

Environmental Management Science Program

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Science Advancing Solutions



**U.S. Department of Energy
Office of Environmental Management
Office of Science and Technology**

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U.S. Department of Energy
Office of Environmental Management
Office of Science
Office of Science and Technology
Environmental Management Science Program

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We are pleased to provide this third Annual Report for the Environmental Management Science Program. The Program has been successful in establishing new research project awards and communicating the emergence of promising new results for the Department's cleanup program. This year, EMSP sponsored a national workshop where EMSP researchers met one-on-one with environmental technology developers and cleanup project managers. These interactions have brought new ideas and expertise into the Environmental Management Program and have helped to bring the EMSP's scientific results to bear on DOE's cleanup problems. This year EMSP competitively renewed some of the most promising of the projects that were initially funded in FY 1996 and FY 1997. These and other FY 2000 accomplishments are captured in this report, along with additional information on the background, current projects, and future EMSP direction.

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Introduction

The Environmental Management Science Program (EMSP) is a collaborative partnership between the DOE Office of Environmental Management (DOE-EM), Office of Science (DOE-SC), and the Idaho Operations Office (DOE-ID) to sponsor basic environmental and waste management related research. Results are expected to lead to reduction of the costs, schedule, and risks associated with cleaning up the nation's nuclear complex. The EMSP research portfolio addresses the most challenging technical problems of the EM program related to high-level waste, spent nuclear fuel, mixed waste, nuclear materials, subsurface contamination, deactivation and decommissioning, and health, ecology, and risk.

The EMSP was established in response to a mandate from Congress in the Fiscal Year 1996 Energy and Water Development Appropriations Act. Congress directed the Department to "provide sufficient attention and resources to longer-term basic science research which needs to be done to ultimately reduce cleanup costs, ...develop a program that takes advantage of laboratory and university expertise, and ...seek new and innovative cleanup methods to replace current conventional approaches which are often costly and ineffective." This mandate followed similar recommendations from the Galvin Commission to the Secretary of Energy Advisory Board. The EMSP also responds to needs identified by National Academy of Sciences experts, regulators, citizen advisory groups, and other stakeholders.

The mission of the EMSP is to develop and fund a targeted, long-term research program that will result in transformational or breakthrough approaches for solving the Department's environmental problems. The purpose is to provide the basic science knowledge that will lead to reduced remediation cost, schedule, technical uncertainty, or risk. A second priority of the Program is to help alleviate otherwise intractable problems. EMSP research is focused on the Department's cleanup problems and has explicit links to problem holders, including technical staff, managers, and stakeholder advisory groups at the sites. The goal is to support research that will:

- Lead to significantly lower cleanup costs and reduced risks to workers, the public, and the environment over the long term.
- Bridge the gap between broad fundamental research that has wide-ranging applicability, such as that performed in the Office of Science, and needs-driven applied technology development conducted by the EM Office of Science and Technology (OST) Focus Areas.
- Serve as a stimulus for focusing the nation's science infrastructure on critical national environmental management problems.

"... the EMSP should be viewed as an investment that may, in the long term, lead to more effective cleanup. The EMSP alone will not solve all of EM's cleanup problems - but given the sheer magnitude of the cleanup mission and its estimated cost, coupled with the technological challenges, the committee views the investment in EMSP as both prudent and timely."

- National Research Council-Building an Effective Environmental Management Science Program, 1997

Research projects are solicited and awarded according to program needs of the DOE sites and the degree to which those needs can be influenced by scientific findings. Awardees conduct the research and interface with OST Focus Area representatives at multiple points during the projects. Research is integrated into technology development activities of the Focus Areas and site end-users through a number of facilitated interactions, such as topical and site-specific workshops, national workshops, and other EM program meetings. In FY 1999, the first of the EMSP funded projects reached the end of their primary three-year funding period. In FY 2000, the projects funded in FY 1997, reached the end of their primary funding period.

EMSP Organization

Integrating EMSP results with environmental technology development and end-user objectives is accomplished in cooperation and partnership with the Environmental Management's Office of Science and Technology's Office of Basic and Applied Research, DOE-SC, and the DOE-Idaho. The Office of Basic and Applied Research is the lead organization for planning and budgeting. It also provides policy and programmatic guidance, assists in soliciting research needs, ensures research is applicable to DOE cleanup problems, and communicates research results. DOE-SC provides input into Program policy development, manages the solicitation of research applications, oversees the scientific review process, and manages the scientific aspects of the Program. DOE-ID is the lead Field Office for Program execution, which includes: assisting the Office of Basic and Applied Research in analyzing science needs, providing procurement services, integrating research results, and managing project funding. DOE-ID also serves as the interface between the EM Focus Areas, Crosscutting Programs, and other DOE Field Offices.

The EMSP has a number of technical advisory groups providing valuable input on both technical and programmatic matters. In the technical area, EM's Site Technology Coordinating Groups (STCGs) identify technology needs associated with all field sites and cleanup projects. The Focus Areas work with EMSP and the STCGs to evaluate the needs and set basic research directions. The EM Integration team identifies ways to improve efficiencies and cost savings throughout EM and identifies additional science priorities associated with critical waste streams.

Several programmatic advisory groups assist the EMSP with strategic and policy recommendations. The EM Federal Review Board and the EM Advisory Board (EMAB) advise and evaluate overall Program execution. The EMAB Science Committee reviews the processes used to select projects, provides recommendations on Program direction, and advises on EM science policy. DOE's Strategic Laboratory Council also advises the EMSP on planning and execution processes in

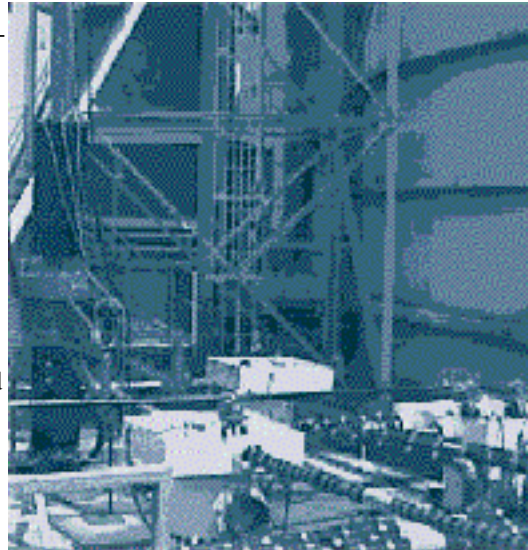
order to ensure programmatic relevance and successful utilization of research results. The National Academy of Sciences/National Research Council (NAS/NRC) provides periodic external peer review and policy recommendations. In FY 2000, the NAS/NRC completed an evaluation of the *Research Needs in Subsurface Science*. Additionally, in FY 2000, the National Academy of Science was commissioned to provide recommendations for long-term science needs in the areas of High-Level Waste (HLW) and Deactivation and Decommissioning (D&D).

EM Problem Areas and Science Needs

DOE field sites have identified key science and technology needs that must be addressed in order to meet cleanup goals set forth in the *Accelerating Cleanup: Paths to Closure* document. Over 460 individual needs have been specified, including 73 associated with basic science research. The Focus Areas assist the EMSP in evaluating these needs and setting research priorities in seven major problem areas, which are described below. Focus Areas also serve as the primary means through which EMSP project results are integrated into EM's technology development and deployment efforts.

High-Level Waste

Within the DOE Complex, 239 underground storage tanks that were used to process and store radioactive and chemical mixed waste, generated from weapons production and manufacturing, still need to be remediated. Collectively, these tanks hold over 100 million gallons of HLW and low-level radioactive waste (LLW) in the form of liquid, sludge, and saltcake, as well as supernate and vapor. Most of the waste is alkaline and contains a diversity of constituents, including nitrate and nitrite salts (approximately half the total volume), hydrated metal oxides, phosphate precipitates, and ferrocyanides. Radionuclides consist primarily of the transuranic (TRU) elements and fission products, specifically strontium-90, cesium-137, and their decay products yttrium-90 and barium-137. Only a small portion of the original tank inventory has been treated and/or disposed of in final form, owing to the significant scientific and technical challenges that must be solved.



Basic research is needed in virtually all aspects of tank characterization and safety, retrieval of tank waste and tank closure, pretreatment and separation processes for tank waste, and waste immobilization and disposal. In 2000, the EMSP requested that the National Academy of Sciences/National Research Council conduct a study of the long-term research needs in the area of HLW. The needs identified in their interim report are given in the box below.

- Long-term issues related to tank closure and characterization of surrounding areas.
- High-efficiency, high-throughput separation methods that would reduce high-level waste program costs over the next few decades.
- Robust, high-loading, immobilization methods and materials that could provide enhancements or alternatives to current immobilization strategies.
- Innovative methods to achieve real-time, and, when practical, in-situ characterization data for HLW and process streams that would be useful for all phases of the waste management program.

Transuranic and Mixed Waste

The term "mixed waste" refers to waste containing both radioactive and hazardous materials. An inventory of over 1,400 different mixed waste streams at 38 DOE sites, amounting to over 160,000 cubic meters, currently awaits treatment and disposal. This inventory will increase with newly-generated mixed waste from DOE's ongoing cleanup activities. However, existing treatment and disposal capacities currently are too limited to achieve significant reduction in the overall inventory.

In FY 2000, DOE realigned the technology development focus area responsible for mixed waste so that it now places increased emphasis on the problems associated with transuranic wastes with particular attention to the technical areas associated with the Waste Isolation Pilot Project near Carlsbad, New Mexico. Because of recent regulatory changes there is particular need for technologies that could replace mixed waste thermal treatment. Research at a fundamental scientific level could lead to innovative processes or technologies, or provide data to permit the advancement of technologies currently under development.



Examples of specific Transuranic and Mixed Waste research and technology needs are:

- Characterization Technologies - Non-destructive evaluation techniques to detect hazardous compounds in containers and facilitate routing of incoming waste streams, and better effluent monitoring to optimize treatment operations and ensure environmental compliance.
- Waste Treatment and Handling - Better information to support high-temperature treatment equipment design and permitting, including hazardous waste thermodynamics, transport, and generation mechanisms; methods for direct removal of radioactive compounds; real-time monitors for heavy metals, dioxins, and volatile organic compounds; and non-thermal treatment processes.
- Toxic Metals Removal - Large-scale techniques for monitoring and removal of mercury and other toxic metals from wastes.
- Radioactive Component Removal - Innovative methods for removing radioactive components, especially small quantities, from solid waste forms, including reprocessing sludges, metals and concrete from D&D, and calcined wastes.
- Hydrogen Generation Control - Methods for controlling hydrogen generation in shipping containers.

Subsurface Contamination



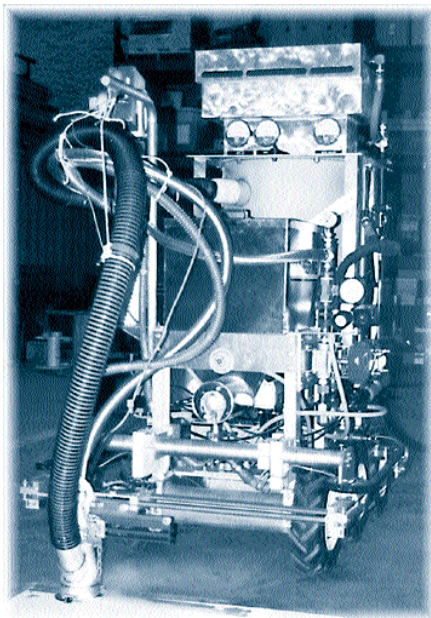
Environmental problems associated with hazardous and radioactive contaminants in soil and groundwater exist at nearly every DOE site. This consists of approximately 40 million cubic meters of contaminated soil and 1.7 trillion liters of contaminated groundwater. In addition, DOE is responsible for remediating numerous landfills, trenches and spill areas with over 3 million cubic meters of leaking waste that are potential sources of further subsurface contamination. Currently available technologies are inadequate or unacceptable due to their high costs, excessive cleanup time, or generation of secondary waste.

Basic scientific research is needed in:

- Subsurface measurements, characterization and transport validation of contaminants in fractured rock and the unsaturated (vadose) zone
- Hydrologic and geochemical processes that affect contaminant migration and immobilization
- Groundwater characterization and contaminant simulation models
- Surface water toxicological cumulative effects
- Contaminant inventory estimates and validation techniques.

"...subsurface contamination is an enormously difficult cleanup problem that represents a potentially large future mortgage for the nation. This mortgage could, however, be reduced significantly through the development and application of new and improved technologies. The development of such technologies will require advances in basic understanding of the complex natural systems at DOE sites and the nature of the contaminants there." (National Research Council, Committee on Subsurface Contamination at DOE Sites, 2000)

Deactivation and Decommissioning



DOE is attempting to solve the problem of deactivating over 4,000 buildings and facilities that have completed their mission. Over 3,300 of these buildings and facilities were used in the nuclear weapons production program. In addition, there are another 10,000 buildings and facilities not yet under the auspices of environmental management. Metal and concrete within those buildings must be decontaminated and nearly 200,000 tons of scrap metal must be disposed of. In FY 1998, EMSP targeted research in the D&D problem area in one of the two calls for proposals. Long-term research needs for D&D problems, identified in an interim report from the NAS/NRC this year, are shown in the box below.

- Characterization
 - Means to locate and quantify difficult-to-measure contaminants, preferably real-time, minimally invasive, and field useable.
 - Biotechnological sensors to detect contaminants of interest.
- Decontamination
 - Research into the interactions among contaminants and the construction material.
 - Biotechnological means to remove or remediate contaminants from surfaces or from porous materials.
- Remote Systems
 - Intelligent remote systems that are adaptable to a variety of tasks including actuators, universal operational software to provide criteria-based decisionmaking, and virtual presence of the worker in hazardous environments.

Spent Nuclear Fuel

DOE is custodian for several thousand tons of spent nuclear reactor fuels, which resulted primarily from weapons fabrication, but also include fuel from research and naval reactors. Long-term containment performance of the fuel under realistic storage and disposal conditions remains an issue and affects the ability to license disposal methods.



Nuclear Materials

DOE is also custodian for large quantities of fissile material which were left in the manufacturing and processing facilities after weapons production was halted. These materials include plutonium solutions, plutonium metals and oxides, plutonium residues and compounds, highly enriched uranium, and other actinides. Research is needed to design processes for safe conversion of various types of fissile materials to optimal forms for safe interim storage, long-term storage, and ultimate disposition.

Specific research needs in this area are:

- Fuel Package Performance - Better understanding of mechanisms that adversely affect fuel packages, including radiolytic effects on surrounding media; corrosion, degradation, and radionuclide release rates; matrix dissolution characteristics; and microbial effects
- Safety Issues - Understanding of pyrophoricity and combustion parameters, gas generation during processing, moisture content measurement and effects, long-term dry storage degradation and kinetics, fissile and radioisotopic content, and segregation behavior of elements
- Additional Characterization - Better and less expensive fission and/or gamma ray nondestructive assay or evaluation for specific fuels, on-line measurement of fissile content and nuclear poisons during stabilization, and more detailed understanding of thermodynamic and kinetic properties of miscellaneous fuel types to facilitate their inclusion in general purpose treatment processes.

Improvements are needed in:

- Thermodynamic redox potentials and heterogeneous electron transfer kinetics of selected actinides and complexes
- Actinide chemical thermodynamics and kinetics
- Behavior of mixed oxidation states of plutonium-containing materials
- Plutonium diffusion and corrosion behavior
- Actinide interactions with organometallics, surfaces, and organic residues
- Characterization of plutonium compound solubility
- Performance of x-ray tomography, digital radiography, acoustic resonance spectroscopy, and actinide self-fluorescence.

Ecology/Health/Risk

There is scientific uncertainty regarding a safe level of risk to human health and the environment for the end state of the Department's cleanup effort. Accurate risk analysis requires thorough knowledge of contaminant characteristics, basic ecological processes and principles, rates at which contaminants move through ecosystems, and other health and ecological effects. Research is needed to define transport dynamics of toxic chemicals and radionuclides and potential effects of long-term exposure to combinations of low levels of radionuclides and other contaminants. Research is also required to improve the understanding of threatened and damaged ecosystems and to develop processes to restore viability and quality to these systems. In FY 1999, the EMSP solicited research proposals addressing the effects of exposure to low-dose radiation.



Specific needs in this area were targeted in this year's Low-Dose Radiation Effects research solicitation, including:

- Better understanding of the differences and similarities between low-dose ionizing radiation and endogenous (normal) oxidative damage to deoxyribose nucleic acid (DNA), including improvements to current measurement techniques
- Better characterization and understanding of real (not extrapolated) differences and similarities in biological changes after low-dose exposures
- Scientifically-defensible tools and methods to model recent molecular-level data on low-dose radiation, induced damage, including new algorithms and approaches to accurately reflect potential risk thresholds
- Investigation of genetic factors that affect individual susceptibility to low-dose radiation.

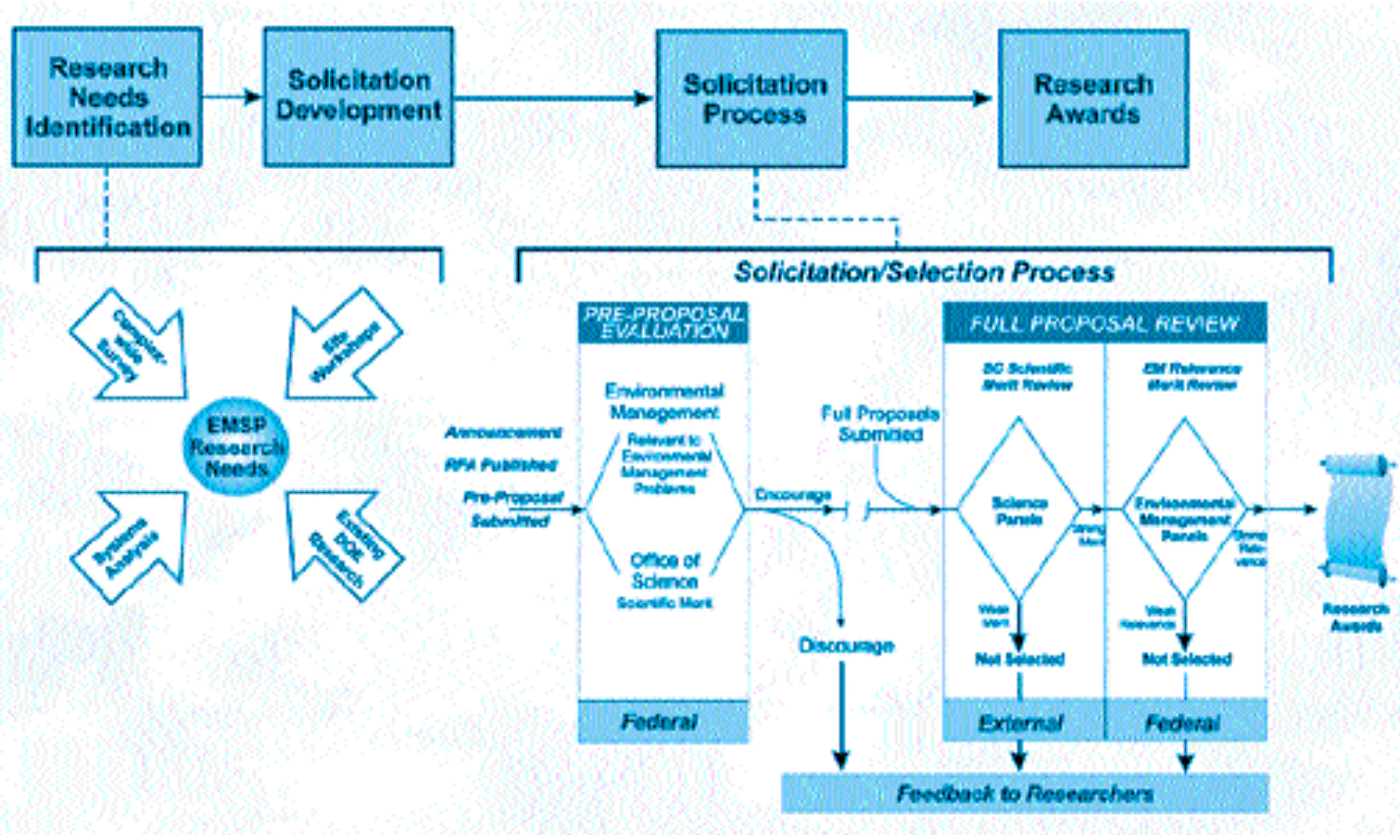
EMSP Project Selection Process

In order to address these basic science needs, the EMSP has developed an innovative process for seeking the broadest possible involvement of government and non-government organizations and researchers. The EMSP process for the submission of proposals and applications for research is illustrated in the schematic. Requests for Applications (RFA) are published in the Federal Register, in addition to direct announcements to universities and laboratories to ensure wide participation by the scientific community. Awards are competitively determined based on applications that best demonstrate both scientific merit and the potential to lead to new and improved solutions to EM's cleanup problems.

EMSP's process for selecting research awards includes optional pre-proposals and mandatory full proposals or grant applications. If the research call is sufficiently broad, the pre-proposals are used to focus proposed research toward more DOE specific topics. Alternatively, when the research topics are well defined, only full proposals are requested. This two-phase process saves both time and effort for researchers, and enhances the quality of full proposals, but does not preclude researchers from submitting full proposals even if discouraged from doing so as a result of the pre-proposal review.

EMSP RFAs clearly communicate research needs and focus researchers on DOE's most intractable cleanup problems or problems needing better solutions. A number of information sources have been used to identify these research needs including site-specific workshops, a complex-wide research needs survey, EM Technology Focus Areas, and the Project Baseline Summary information developed for the *Paths to Closure* document.

Pre-proposals and full proposals are peer reviewed by panels of scientists and engineers from the scientific community to evaluate both scientific merit and relevance to identified EM problems and needs. A two-phase formal review process is used to ensure awards are made to the most meritorious and relevant applications. The initial phase involves evaluations by external peer reviewers who are experts in specific scientific disciplines. The second phase involves review of the scientifically meritorious proposals for relevance to DOE-EM's cleanup needs by DOE Program and Focus Area Managers who are most familiar with EM problems and may be potential users of the research results. Funding is recommended only for those applications that are successful in both reviews.



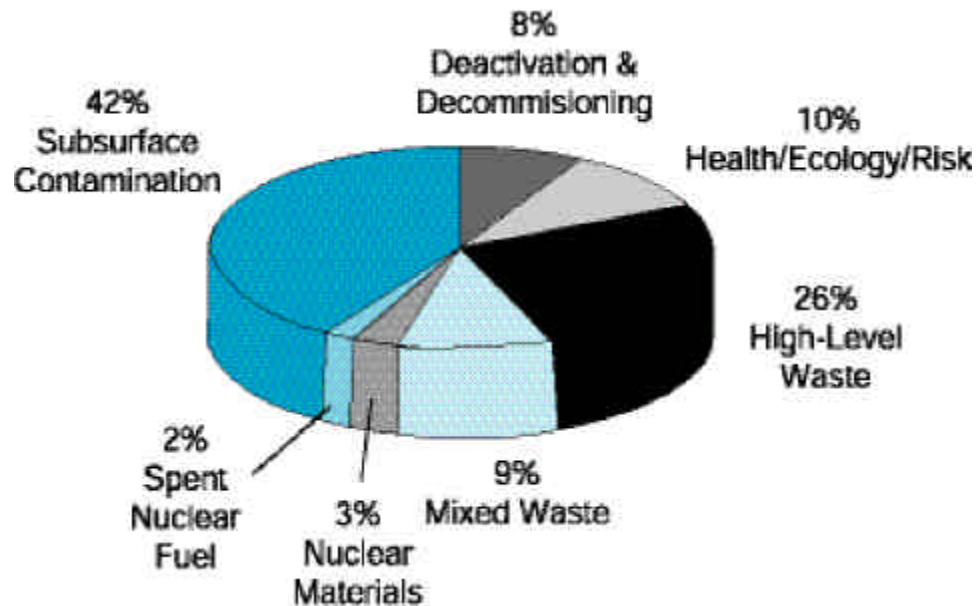
The selection process for the renewal of FY 1996 and FY 1997 projects, conducted this year, used the same overall review process except there was no preproposal phase. This phase was eliminated because the candidates were limited to research projects that were already in the EMSP portfolio and, as such, had already been through a prior screening.

Addressing DOE's environmental management problems and research needs requires the expertise from a variety of scientific disciplines such as chemistry, geology, physics, and biology. From these broad disciplines, 14 science categories have been used in the EMSP's project merit review and selection process. They reflect traditional areas of expertise within the scientific community and facilitate identification of well-qualified technical reviewers. Each science category may represent several sub-categories. For example, engineering science includes such diverse fields as bioengineering, diagnostics, robotics, and design/process modeling. Taken together, the sub-categories reflect the essential scientific underpinning necessary for long-term solutions to EM problems.

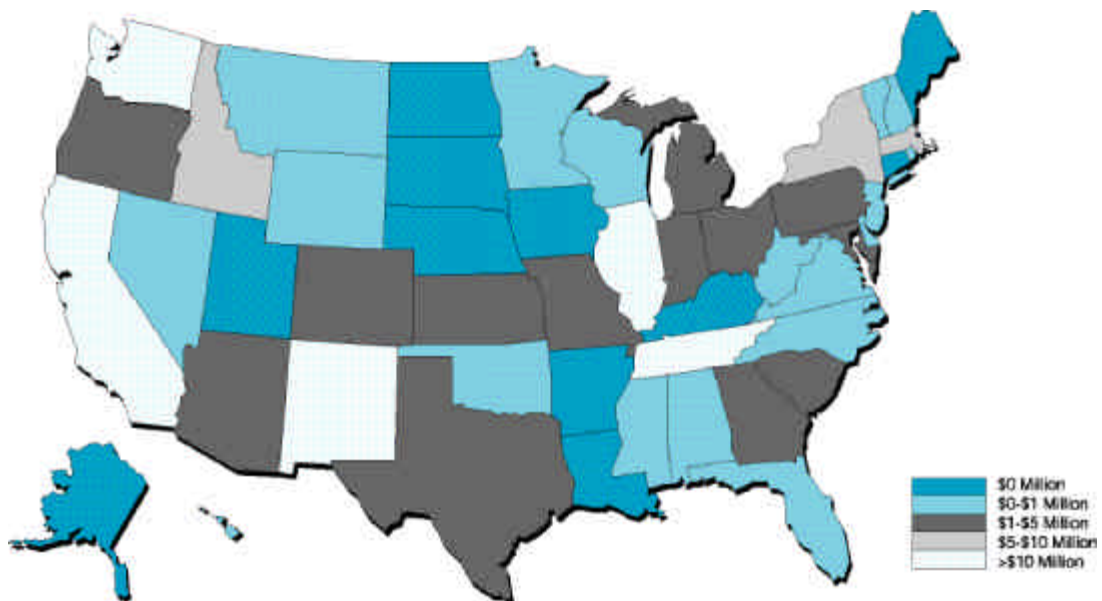
While EMSP research awards address many cleanup needs, they are not generally intended for application at specific sites. In fact, a given research project is likely to address several site-specific problems, or in some cases it may be relevant to more than one EM problem area. The table of EMSP projects provided at the end of this document identifies only the primary EM problem addressed by each research project.

Current Research Portfolio

Since its inception in FY 1996, EMSP has invested over \$254 million in support of 316 research projects. This investment has led to research at 97 universities, 13 national laboratories, and 20 other governmental and private laboratories. Research is being conducted in 40 states and the District of Columbia, two Canadian provinces, Australia, Russia, the United Kingdom, Ireland, Austria, Switzerland, and the Czech Republic. The distribution of the projects by problem area and by location is shown below.



EMSP Funding by Problem Area



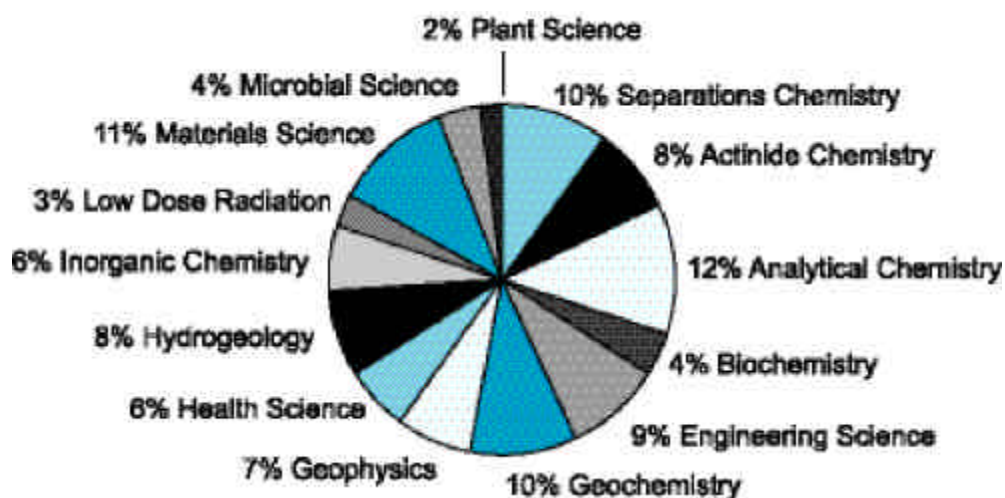
Geographic Distribution of EMSP Projects

During the first year of the program, FY 1996, a single broad RFA was issued, which resulted in 136 project awards. These projects encompassed all of the Department's problem areas. The primary funding period for these projects ended in FY 1999.

In FY 1997 another broad call resulted in the funding of 66 projects. Again, the projects were a cross-section of the Department's problem areas. These projects reached the end of their primary three-year funding period in FY 2000.

In FY 1998, 33 awards were made to respond to needs in the areas of high-level waste and deactivation and decommissioning. Continuing to draw on expertise available from abroad, particularly in high-level waste, the FY 1998 awards also included projects in the Czech Republic and Russia.

Two EMSP solicitations for research were conducted in FY 1999. The first addressed subsurface contaminants and the vadose zone. This solicitation resulted in the selection of 31 projects with a combined funding of over \$25 million. The second solicitation addressed low-dose radiation effects. It resulted in eight project awards with a total funding of \$7.7 million.



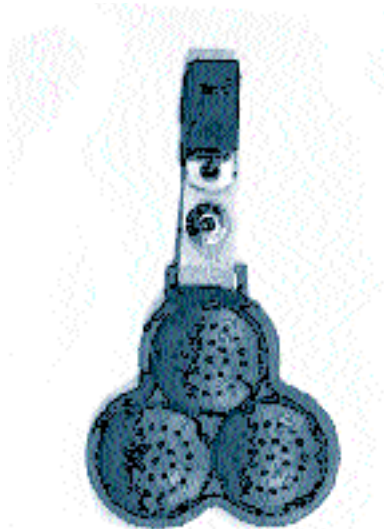
Cumulative EMSP Project Funding by Science Category

In FY 2000, the EMSP conducted a solicitation for the renewal of promising projects initially funded in FY 1996 and FY 1997. The goal of this solicitation was to provide the opportunity to further develop the results of the initial research. This solicitation resulted in the awarding of \$29.6 million for the continuation of research on 42 projects.

EMSP Successes

DOE's technology development effort utilizes a stage-gate model for tracking the movement of projects from basic research through development into full utilization. In this model, the next step for basic research is applied research. Basic research can, however, in many cases provide insight which can be applied to other projects that are at much later stages of development or can, in some cases, provide processes or technology that are ready for immediate use.

An important aspect in the formation of the EMSP was to develop a cadre of scientists focused on the nation's environmental problems. Projects supported by the EMSP have included nearly 550 undergraduate, graduate and post-doctoral researchers and to date has supported 42 theses and dissertations. The research program has led to over 1500 other publications and presentations that serve to stimulate the scientific community.



EMSP projects typically have a three-year term; the first 136 of these projects reached the end of their primary funding in FY 1999 with an additional 66 reaching an end of their primary funding in FY 2000. The research results from these projects have been instrumental in developing new tools for environmental cleanup and in improving the understanding of scientific principles that underlie conventional cleanup methods. While most of these projects will require additional applied research and development to realize their full potential, such as those that were renewed this year, some projects have already had useful impact and others need little additional work to be incorporated into cleanup activities. The following are examples of some early EMSP results that could provide significant benefits to EM's cleanup effort.

Deployment

The results of research directed to developing state-of-the-art personal and environmental exposure assessment for inhaled radionuclides has yielded two new instruments that have been deployed at Fernald for about one year. Together these instruments permit the air concentrations of the gas, the air-borne particulates, and their particle size distribution to be measured on a continuous basis. The new instruments can have wide application at other DOE sites. The first instrument is a radon, thoron passive alpha track detector that can be worn (see photo at the left) or used as an area detector to obtain research quality measurements for modeling or for personal exposure assessment. The second instrument is a particle size analyzer. Although the inhaled particle size is the major determinant of bronchial dose, Fernald, as the first site to deploy this equipment, is the only site attempting to do particle size distribution measurements. Prior to the development of this instrument, the labor intensive effort needed and the cost, precluded these measurements.

A new antifoam developed by the Illinois Institute of Technology, as the result of EMSP sponsored research, is expected to be deployed at the Defense Waste Processing Facility. This material is also expected to have broad application in waste tank remediation throughout the DOE complex.

Transition to Focus Areas

Focus Areas and Crosscutting Programs have transitioned four basic research projects, started under the EMSP, into their applied research efforts. These projects include the demonstration of "Laboratory-on-a-Chip" (project 64982) by the Deactivation and Decommissioning Focus Area, demonstration of miniature spectrometer (project 60231) for groundwater monitoring by the Subsurface Contaminants Focus Area, and two separate demonstrations of Crown Ethers for Cesium Separation (project 55087) at the Savannah River Site and Oak Ridge National Laboratory. This latter separation process has also been commercialized.

Commercialization

Results of nine other projects sponsored by the EMSP have also been commercialized. The process for growing Graphite Nanofibers developed by Northwestern University (project 54571) has been licensed by two companies. The ability to manipulate the physical structure of the graphite fibers offers a wide range of potential applications including microfiltration. Other commercialized separations or filtration projects include Synthesis of New Water-Soluble Metal Binding Polymers (project 54724), and Novel Ceramic-Polymer Composite Membranes for the Separation of Liquid Waste (project 54926). The use of plants to separate mercury from the environment (project 54837) is another novel separation technique that has been commercialized as the result of research sponsored by EMSP. This project involved the engineering of transgenic plants. The results of the research have been so successful that a new company was formed to capitalize on them. Another area where EMSP-sponsored projects have met with commercial success is characterization and monitoring. Three separate projects (projects 54639, 54751, and 60231) have been commercialized as novel methods that improve on existing sensor or analytical technology. Two projects that investigated methods for removing contaminants from surfaces, such as would need to be done in Deactivation and Decommissioning (projects 54914 and 60283) have also been commercialized. The early acceptance of EMSP sponsored research results in the commercial marketplace demonstrates the high relevance of the research included in the EMSP portfolio.

Field Testing

Twelve field testing projects have resulted or are planned based on the promise shown by 10 EMSP sponsored projects. Most of these can be categorized as process improvement or new remedial methods (60143, 55416, 55388, 55332, 55264, 55036, 54914), while the remainder are in the area of characterization and monitoring (60162, 60158, 60115). These field tests provide the opportunity to test the applicability and efficacy of these processes, methods and technologies in actual use situations, although, in some situations the tests are performed on surrogates for the actual site materials.

Additional information on the projects described here can be found in the table of projects at the end of this report or on the EMSP website.

Planning Studies

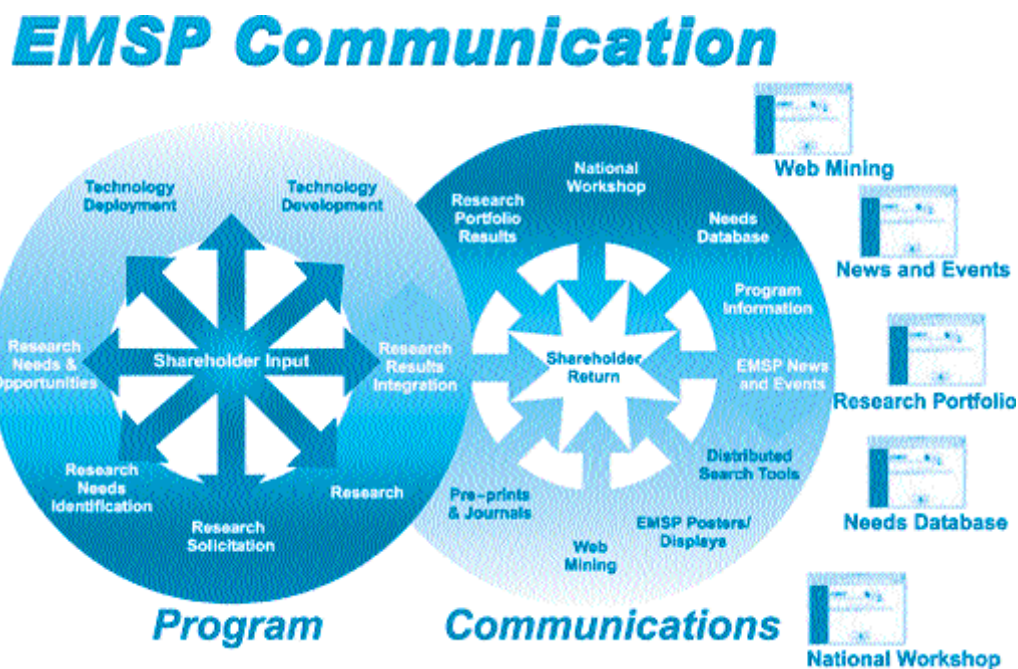
In FY 2000, the NAS/NRC released their final report on *Research Needs in Subsurface Sciences*. The interim report for this study was utilized in formulation of the FY 1999 research solicitation for Subsurface Contaminants and the Vadose Zone. Also in FY 2000, the NAS/NRC initiated studies of the research needs in the areas of Deactivation and Decommissioning and High-Level Waste. These studies are expected to provide insight that will be used in the formulation of the FY 2001 research solicitations.

National Workshop

In April of 2000, the EMSP National Workshop was held in Atlanta, Georgia. This conference brought together over 550 researchers, environmental managers, stakeholders, and regulators. Presentations by the environmental managers, regulators, and stakeholders were included to help the researchers in the formulation of future research direction and the researcher's presentations were to demonstrate to the problemholders, stakeholders and regulators the potential new solutions that are being developed to aid in future cleanup efforts. These interactions were geared to assuring that the EMSP targets the right areas of research, the researchers understand the DOE problem set, and that the problemholders, stakeholders and regulators are aware of the latest developments of the research community. The interactions of the researchers with the user and stakeholder community are an integral part of the EMSP's efforts to move the basic research it sponsors on through the development cycle. The EMSP also sponsored a field trip to the Savannah River Site for the researchers, in order to make them more aware of the types of problems faced by the sites.

Communicating Results

EMSP places high priority on assisting principal investigators in communicating with other researchers, technology developers, and EM cleanup project end-users. A number of documents are available which describe the Program or specific projects. Most recently, a series of *Project Summary Fact Sheets* have been developed to highlight EMSP efforts directed at specific problems. These fact sheets can be found on the EMSP website listed at the end of this report. In addition to these traditional tools, EMSP uses the Internet and a variety of electronic media to disseminate and track information produced by EMSP researchers throughout the technical community. DOE's Office of Scientific and Technical Information and the DOE-Idaho work together to implement these state-of-the-art tools.



Direct interaction between researchers and end-users still provides the most effective means of integrating new talent and ideas into the EM mission. National and site-specific workshops, as well as conferences, allow researchers to meet EM project managers and visit sites with specific science needs.

Because of the success of the April, 2000 EMSP's National Workshop held in Atlanta, GA, another workshop is already in the planning phases.

Additionally, in order to increase awareness of the program among potential end-users and researchers, EMSP's management and staff made presentations or displayed posters at a number of meetings, symposia, and conferences. A few of the events in which EMSP has participated include:

- Waste Management 2000
- The Strategic Environmental Research and Development Program Colloquium
- Technical Information Exchange
- Albuquerque Needs Workshop
- Weapons Complex Monitor's Applied Research Development and Deployment Cleanup Technology Colloquium
- Focus Area Mid-Year Reviews

- Technology Transfer Sessions of the Historically Black Colleges and Universities and Other Minority Institutions Annual Symposium
- Interstate Technology Regulatory Cooperation Workgroup Leadership Team Meeting.

Looking to the Future

The projects initiated in FY 1996 reached the end of their primary funding in FY 1999. The 66 EMSP funded research projects initiated in FY 1997 reached the end of their initial three years of funding in FY 2000. A limited number of these projects have been continued, at no additional cost, beyond their initial funding period. Additionally, because the EMSP is a targeted, long-term research program, funding for 42 of these FY 1996 and FY 1997 projects was renewed for FY 2000. The ultimate goal will be to transfer the scientific and engineering knowledge from these projects to EM stakeholders, including EM/OST Focus Areas and the site problem holders. To assure that future research solicitations are targeted at the right aspects of the Department's problem set, EMSP plans to again enlist the assistance of the National Academy of Sciences to investigate the research needs in the area of TRU and mixed waste and possibly in nuclear materials and spent nuclear fuel. National Academy investigations, conducted in FY 2000, into the research needs in HLW and D&D, are expected to provide the foundation for new research solicitations in these areas in FY 2001. The interim findings of these studies are presented in the discussions of these problem areas in this report. In FY 2001, it is anticipated that the NAS/NRC will be requested to undertake similar studies into the research needs in transuranic and mixed waste that will, in turn, be an integral part of the basis for research solicitations in FY 2002.



"I am challenging the site managers, project managers, industry, regulators, and others involved in our cleanup activities to engage with the scientific community to utilize this valuable resource."

Dr. Carolyn Huntoon - From her keynote address to the EMSP National Workshop

EMSP Project Table

The EMSP Project Table includes all research funded to date, according to scientific category, year of award, EM problem area, and primary research institution. Project titles are abbreviated; however, proposal numbers are consistent with abstracts found in other EMSP publications and web site descriptions. The funding level for the projects has been rounded to the nearest thousand. The award year is shown in bold for the Fiscal Years 1996 and 1997 projects that have been completed, or are expected to be completed, in FY 2000. Projects with a no-cost extension that have not reached their extended end date are denoted by the award year being shown in italics. New FY 2000 projects that resulted from the renewal of existing projects are shown as new entries with the new project number followed by the original project number with an asterisk.

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
Actinide(Heavy Element) Chemistry					
1996	54595	f-Element Ion Chelation in Highly Basic Media	University of New Mexico	HLW	500
1996	54621	Chemical Speciation of Strontium, Americium, and Curium in High-Level Waste	Pacific Northwest National Laboratory	HLW	1,051
1996	54679	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents	Pacific Northwest National Laboratory	TMW	1,800
1996	54683	Speciation and Structural Characterization of Actinide-Organic Complexes in Surface and Groundwaters	Woods Hole Oceanographic Institute	SC	823
1996	54893	Research to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu	Florida State University	SC	875
1997	59977	Templated Ion Exchange Resins Synthesis and Characterization for Selective Actinide Ions Complexation	Johns Hopkins University Applied Physics Lab	HLW	302
1997	60370	Rational Design of Metal Ion Sequestering Agents	Lawrence Berkeley National Laboratory	TMW	405
1997	59967	Aqueous Electrochemical Mechanisms in Actinide Residue Processing	Los Alamos National Laboratory	NM	750
1997	60319	Thermodynamics of Actinide Metals Volatilization in the High-Temperature Treatment of Radioactive Wastes	Lawrence Livermore National Laboratory	NM	900
1997	59996	Plutonium Speciation, Solubilization, and Migration in Soils	Los Alamos National Laboratory	SC	750
1998	65318	Actinide-Aluminate Speciation in Alkaline Radioactive Waste	Los Alamos National Laboratory	HLW	1,334
1998	65352	The Effect of Temperature and Electrolyte Concentrations on Actinide Speciation in HLW	Washington State University	HLW	865
1998	65370	Actinide-Specific Interfacial Chemistry of Monolayer Coated Mesoporous Ceramics	Pacific Northwest National Laboratory	HLW	1,200
1998	65398	Characterization of Actinides in Simulated Alkaline Tank Waste Sludges and Leach Solutions	Argonne National Laboratory	HLW	930
1999	70035	DNAPL Surface Chemistry: Its Impact on DNAPL Distribution in the Vadose Zone and Its Manipulation to Enhance Remediation	Clarkson University	SC	805
1999	70050	Novel Optical Detection Schemes for In-Situ Mapping of Volatile Organochlorides in the Vadose Zone	University of South Carolina	SC	825
1999	70126	Collaboration: Interfacial Soil Chemistry of Radionuclides in the Unsaturated Zone	Pennsylvania State University	SC	747
1999	70132	Speciation, Mobility and Fate of Actinides in Groundwater at the Hanford Site	Woods Hole Oceanographic Institute	SC	1,000
1999	70176	Transuranic Interfacial Reaction Studies on Manganese Oxide Hydroxide Mineral Surfaces	Lawrence Berkeley National Laboratory	SC	750
2000	73749 54621*	Chemical Speciation of Strontium, Americium, and Curium in High-Level Waste: Predictive Modeling of Phase Partitioning During Tank Processing	Pacific Northwest National Laboratory	HLW	990
2000	73759 54679*	Computational Design of Metal Ion Sequestering Agents	Pacific Northwest National laboratory	TMW	700
2000	73819 59996*	Plutonium Speciation, Solublization, and Migration in Soils	Los Alamos National Laboratory	SC	859
Analytical Chemistry and Instrumentation					
1996	54674	Design and Development of a New Hybrid Spectroelectrochemical Sensor	University of Cincinnati	HLW	850

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1996	55318	Improved Analytical Characterization of Solid Waste Forms by Development of Laser Ablation Technology	Lawrence Berkeley National Laboratory	HLW	1,229
1996	54751	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste	Los Alamos National Laboratory	TMW	745
1996	54864	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance	University of Kansas	TMW	775
1996	55146	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation	University of Washington	TMW	610
1996	55171	Advanced In-Situ Techniques for Chemistry Monitoring and Corrosion Mitigation in SCWO Environments	Pennsylvania State University	TMW	696
1996	55247	Ion and Molecule Sensors Using Molecular Recognition in Luminescent, Conductive Polymers	Argonne National Laboratory	TMW	1,500
1996	54639	In-Situ Microsensor Development for Measurements of Cr and Ur in Groundwater	New Mexico State University	SC	690
1996	54698	Rapid Mass Spectrometric DNA Diagnostics for Assessing Microbial Activity	Lawrence Berkeley National Laboratory	SC	675
1996	54800	Construction of Bending Magnet Beamline at the APS for Environmental Studies	University of Washington	SC	810
1996	55108	Monitoring Genetic & Metabolic Potential for In-Situ Bioremediation	Oak Ridge National Laboratory	SC	1,080
1996	55205	Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals	University of South Carolina	SC	630
1996	55328	Novel Analytical Techniques Based on an Enhanced Electron Attachment Process	University of Tennessee at Knoxville	SC	540
1997	60163	Investigation of Techniques to Improve Continuous Air Monitors Under Conditions of High Dust Loading	New Mexico Institute of Mining & Technology	H/E/R	310
1997	60218	Novel Mass Spectrometry Mutation Screening for Contaminant Impact Analysis	Oak Ridge National Laboratory	H/E/R	600
1997	60474	Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-term Monitoring and Monitoring Air	Georgia Institute of Technology	H/E/R	609
1997	59978	Thermospray Mass Spectrometry Ionization Processes	Oak Ridge National Laboratory	HLW	590
1997	60075	Particle Generation by Laser Ablation in Support of HLW Chemical Analysis	Washington State University	HLW	544
1997	60217	Optically-Based Array Sensors for Selective In-Situ Analysis of Tank Waste	Oak Ridge National Laboratory	HLW	600
1997	60219	Development of Advanced Electrochemical Emission Spectroscopy for Monitoring Corrosion	Pennsylvania State University	HLW	350
1997	60424	High Temperature Condensed Phase Mass Spectrometric Analysis	Idaho National Engineering and Environmental Laboratory	HLW	680
1997	59981	Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry	Los Alamos National Laboratory	TMW	655
1997	60070	Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals	Mississippi State University	TMW	538
1997	60231	Novel Miniature Spectrometer for Remote Chemical Detection	National Institute of Standards & Technology	TMW	549

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1997	60247	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring	University of Illinois at Chicago	NM	482
1997	60197	Microsensors for In-Situ Chemical, Physical, and Radiological Characterization of MW	Oak Ridge National Laboratory	SC	615
1997	60141	Gamma Ray Imaging for Environmental Remediation	Naval Research Laboratory	SNF	780
1998	64982	Metal Ion Analysis Using Near-Infrared Dyes	Naval Research	D&D	471
1998	65001	Development of Novel, Simple Multianalyte Sensors for Remote Environmental Analysis	University of Pittsburgh	D&D	650
1998	65004	Real-Time Identification and Characterization of Asbestos and Concrete Materials with Radioactive Contamination	Rensselaer Polytechnic Institute	D&D	600
1998	65340	Detection and Characterization of Chemicals Present in Tank Waste	Oak Ridge National Laboratory	HLW	1,005
1998	65421	Correlation of Chemisorption and Electronic Effects for Metal/Oxide Interfaces	National Institute of Standards & Technology-Maryland	HLW	1,070
1998	65425	Mass Spectrometric Fingerprinting of Tank Waste Using Tunable, Ultrafast Infrared Lasers	Vanderbilt University	HLW	760
1998	65435	Millimeter-Wave Measurements of High Level and Low Activity Glass Melts	Massachusetts Institute of Technology	HLW	1,429
1999	70010	Spectroelectrochemical Sensor for Technetium Applicable to the Vadose Zone	University of Cincinnati	SC	1,050
1999	70179	Radionuclide Sensors for Water Monitoring	Pacific Northwest National Laboratory	SC	825
2000	73807 60218*	Rapid Nucleic Acid Analysis for Contaminant Evaluation	Oak Ridge National Laboratory	H/E/R	690
2000	73844 60231*	Miniature Chemical Sensor Combining Molecular Recognition Evanescent-Wave Cavity Ring-Down Spectroscopy	National Institute of Standards and Technology	TMW	950
2000	73839 60141*	Gamma Ray Imaging for Environmental Remediation (GRIER)	Naval Research Laboratory	SNF	850
2000	73808 60197*	Microsensors for In-Situ Chemical, Physical, & Radiological Characterization of Mixed Waste	Oak Ridge National Laboratory	SC	630
Biogeochemistry					
1996	54790	Microbial Mineral Transformations at the Fe(II)/Fe(III) Redox Boundary	University of Toronto	SC	502
1996	55071	Reduction and Immobilization of Radionuclides and Toxic Metal Ions Using Combined Zero Valent Iron and Anaerobic Bacteria	Tennessee Technological University	SC	356
1996	55164	Advanced Experimental Analysis of Controls on Microbial Fe(III) Oxide Reduction	University of Alabama	SC	427
1996	55267	Containment of Toxic Metals and Radionuclides in Porous and Fractured Media	Oak Ridge National Laboratory	SC	1,235
1996	55388	Stable Isotopic Investigations of In-Situ Bioremediation of Chlorinated Organic Solvents	Argonne National Laboratory	SC	825
1997	60015	Long-term Risk from Actinides in the Environment: Modes of Mobility	Los Alamos National Laboratory	H/E/R	900
1998	64907	“Green” Biopolymers for Improved Decontamination of Metals from Surfaces	Oak Ridge National Laboratory	D&D	900
1998	64931	Microbially Promoted Solubilization of Steel Corrosion Products and Fate of Actinides	Pacific Northwest National Laboratory	D&D	1,406

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1999	70063	Biodegradation of Chlorinated solvents: Reactions Near DNAPL and Enzyme Function	Stanford University	SC	750
1999	70165	Integrated Field, Laboratory, and modeling Studies to Determine the Effects of Linked Microbial and Physical Spatial Heterogeneity of Engineered Vadose Zone Bioremediation	Pacific Northwest National laboratory	SC	1,050
2000	72784 55267*	Microbially Mediated Immobilization of Contaminants through In-Situ Biostimulation: Scale Up of EMSP Project 55267	Oak Ridge National Laboratory	SC	1205
2000	73914 55164*	Reductive Immobilization of U(VI) in Fe(III) Oxide- Reducing Subsurface Sediments	University of Alabama	SC	720
Engineering Science					
1996	55052	Advanced Sensing and Control Techniques to Facilitate Semi-Autonomous Decommissioning	Clemson University	D&D	871
1996	54656	Mixing Processes in HLW Tanks	University of California at Berkeley	HLW	417
1996	54890	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool	University of California at Davis	HLW	691
1996	55179	Acoustic Probe for Solid-Gas-Liquid Suspensions	Syracuse University	HLW	751
1996	55294	Superconducting Open-Gradient Magnetic Separation for Pretreatment of Waste Vitrification Feeds	Argonne National Laboratory	HLW	1,500
1996	54973	Novel Energy-Efficient Plasma Chemical Process for Volatile Toxic Compounds Destruction	Oak Ridge National Laboratory	TMW	980
1996	55211	Cavitation Hydrothermal Oxidation: A New Remediation Process	University of Illinois at Urbana-Champaign	TMW	478
1996	54857	Surface Nuclear Magnetic Resonance Imaging of Subsurface Water Content Distribution	New Mexico Institute of Mining & Technology	SC	638
1996	55013	Biofiltration of Volatile Pollutants	Oak Ridge National Laboratory	SC	950
1996	55374	Use of Sonication for In-Well Softening of Semivolatile Organic Compounds	Argonne National Laboratory	SC	1,470
1997	60040	Development of Monitoring and Diagnostic Methods for Robots Used in Remediation of Waste Sites	Foster Miller Technologies	D&D	403
1997	60143	Foaming in Radioactive Waste Treatment and Immobilization Processes	Illinois Institute of Technology	HLW	360
1997	60451	Mechanics of Bubbles in Sludges and Slurries	Pacific Northwest National Laboratory	HLW	1,132
1997	60155	Measurements and Models for Hazardous Chemical and MWs	National Institute of Standards & Technology-Boulder	TMW	500
1997	60326	Isolation of Metals from Liquid Wastes: Reactive Scavenging in Turbulent Thermal Reactors	University of Arizona	TMW	1,075
1997	60077	Development of Nuclear Analysis Capabilities for DOE Waste Management Activities	Oak Ridge National Laboratory	NM	600
1997	60144	Flow Visualization of Forced and Natural Convection in Internal Cavities	University of Idaho	SNF	1,077
1998	64947	Contaminant-Organic Complexes; Structure and Energetics in Surface Decontamination Processes	Pacific Northwest National Laboratory	D&D	1,242
1998	64979	PCB D&D of Sites: Extraction, Electrokinetics, and Hydrothermal Oxidation	South Carolina University Research an Education	D&D	980

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1998	65015	Three-Dimensional Positron-Sensitive Germanium Detectors	Lawrence Berkeley National Laboratory	D&D	750
1998	65328	Electrically Driven Technologies for Radioactive Aerosol Abatement	Oak Ridge National Laboratory	HLW	830
1998	65371	Numerical Modeling of Mixing of Chemically Reacting, Non-Newtonian Slurry for Tank Waste Retrieval	University of Minnesota	HLW	658
1999	70045	Investigation of Pore-Scale Processes which Affect Soil Vapor Extraction	University of Illinois at Urbana - Champaign	SC	600
1999	70088	Interfacial Reduction-Oxidation Mechanisms Governing Fate and Transport of Contaminants in the Vadose Zone	New Mexico Institute of Mining and Technology	SC	840
2000	73827 54890*	Non-Invasive Diagnostics for Measuring Physical Properties and Processes in High-Level Waste	University of California - Davis	HLW	655
2000	73896 55179*	Acoustic Monitor for Liquid-Solid Slurries Measurement at Low Weight Fractions	Syracuse University	HLW	500
2000	73793 55013*	Biofiltration of Volatile Pollutants: Solubility Effects	Oak Ridge National Laboratory	SC	840
Geochemistry					
1996	55042	Quantifying Silica Reactivity in Subsurface Environments	Georgia Institute of Technology	HLW	359
1996	54548	Efficacy of Oxidative Coupling for Promoting In-Situ Immobilization in Contaminated Soil and Sediment Systems	University of Michigan	SC	557
1996	54585	Permanganate Treatment of DNAPLs in Reactive Barriers and Source Zone Flooding Schemes	Ohio State University	SC	351
1996	54635	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides	Pacific Northwest National Laboratory	SC	1,450
1996	54741	Characterization of Contaminant Transport Using Naturally-Occurring U-Series Disequilibria	Los Alamos National Laboratory	SC	900
1996	54823	Modeling of Cation Binding in Hydrated 2:1 Clay Minerals	New Mexico State University	SC	359
1996	54860	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in Presence of Organic Co-Contaminants	Stanford University	SC	784
1996	55014	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil	Alabama A&M University	SC	362
1996	55148	Hydrologic and Geochemical Controls on Radionuclides as Determined by Accelerator Mass Spectrometry	Lawrence Livermore National Laboratory	SC	1,563
1996	55249	Determination of Contaminant Metal Mobility as a Function of Temperature, Time, and Solution Chemistry	Lawrence Livermore National Laboratory	SC	1,130
1996	55284	Aquifer Transport of Th, U, Ra, and Rn in Solution and on Colloids	California Institute of Technology	SC	500
1996	55351	Isotopic Diagnostics Evaluation for Subsurface Characterization and Monitoring	Lawrence Berkeley National Laboratory	SC	763
1996	55396	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces	Lawrence Berkeley National Laboratory	SC	1,387
1997	60403	Phase Chemistry of Tank Sludge Residual Components	Sandia National Laboratories-Albuquerque	HLW	1,157

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1997	60355	Mineral Surface Processes Responsible for the Decreased Retardation of ¹³⁷ Cs from HLW Tank Discharges	Pacific Northwest National Laboratory	SC	1,250
1997	59849	Radionuclide Immobilization in the Phases Formed by Corrosion of SNF	University of Michigan	SNF	481
1997	59960	Direct Investigations of Radionuclides Immobilization in SNF Alteration Phases	University of Notre Dame	SNF	782
1999	70070	Reactivity of Primary Soil Minerals and Secondary Precipitates Beneath Leaking Hanford Tanks	University of Colorado	SC	720
1999	70081	Immobilization of Radionuclides in the Hanford Vadose Zone by Incorporation in Solid Phases	Ohio State University	SC	1,139
1999	70121	The Influence of Calcium Carbonate Grain Coatings On Contaminant Reactivity in Vadose Zone	Pacific Northwest National Laboratory	SC	1,300
1999	70146	Spectroscopic and Microscopic Characterization of Contaminant Uptake and Retention by Carbonates in Soils and Vadose Zone Sediments	State University of New York at Stony Brook	SC	767
1999	70163	The Aqueous Thermodynamics and Complexation Reactions of Anionic Silica Species to High Concentration: Effects on Neutralization of Leaked Tank Wastes and Migration of Radionuclides	Pacific Northwest National Laboratory	SC	974
1999	70177	Technetium Attenuation on the Vadose Zone: Role of Mineral Interactions	Pacific Northwest National laboratory	SC	945
1999	70206	Calcite Precipitation and Trace Metal Partitioning in Groundwater and the Vadose Zone: Remediation of Sr-90 and Other Divalent Metals and Radionuclides in Arid Western Environments	Idaho National Engineering and Environmental Laboratory	SC	908
2000	73859 55042*	Quantify Silica Reactivity in Subsurface Environments: An Integrated Study of Quartz and Amorphous Silica to Establish a Baseline for Glass Durability	Virginia Polytechnic Institute and State University	HLW	500
2000	73745 54585*	Permanganate Treatment of DNAPLs in Reactive Barriers and Source Zone Flooding Schemes	Ohio State University	SC	380
2000	73758 60355*	Fixation Mechanisms and Desorption Rates of Sorbed Cesium in HLW Contaminated Subsurface Sediments: Implications of Future Behavior and In-Ground Stability	Pacific Northwest National Laboratory	SC	830
2000	73773 55351*	Isotopic Tracers for Waste Fluid Tracking and Fluid-Soil Interactions: Hanford, Washington	Lawrence Berkeley National Laboratory	SC	720
2000	73775 55396*	Colloid Genesis/Transport and Flow Pathway Alterations Resulting From Interactions of Highly Reactive Waste Solutions and Sediments in the Vadose Zone	Lawrence Berkeley National Laboratory	SC	600
2000	73751 59849*	Corrosion of Spent Nuclear Fuel: The Long Term Assessment	The University of Michigan	SNF	445
2000	73691 59960*	Direct Investigations of the Immobilization of Radionuclides in the Alteration Products of Spent Nuclear Fuel	University of Notre Dame	SNF	1,026
Geophysics					
1996	55141	Imaging and Characterizing Underground Storage Tank Waste Materials Using Seismic Normal Modes	Massachusetts Institute of Technology	HLW	576
1996	54655	Hydrogeological-Geophysical Methods for Subsurface Site Characterization	University of California at Berkeley	SC	921
1996	54699	Dielectric and NMR Measurements to Determine the Pore-Scale Location of Organic Contaminants	University of British Columbia	SC	486

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1996	55011	Surface and Borehole Electromagnetic Imaging of Conducting Contaminant Plumes	Lawrence Livermore National Laboratory	SC	1,088
1996	55218	Seismic Surface-Wave Tomography of Waste Sites	Georgia Institute of Technology	SC	358
1996	55300	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes	Massachusetts Institute of Technology	SC	710
1996	55332	Hybrid Hydrologic-Geophysical Inverse Technique for the Vadose Zone Leachates Assessment and Monitoring	Sandia National Laboratories-Albuquerque	SC	2,024
1996	55411	Joint Inversion of Geophysical Data for Site Characterization and Restoration Monitoring	Lawrence Livermore National Laboratory	SC	1,272
1997	60115	Advanced High Resolution Seismic Imaging	Rice University	SC	550
1997	60162	Very Early Time Electromagnetic (VETEM) Prototype Instrument Enhancements & Characterization	U.S. Geological Survey	SC	820
1997	60199	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization	University of Kansas	SC	630
1997	60328	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts	Lawrence Berkeley National Laboratory	SC	816
1999	70012	Complex Electrical Resistivity for Monitoring DNAPL Contamination	New England Research, Inc.	SC	510
1999	70052	Material Property Estimation for Direct Detection of DNAPL Using Integrated Ground-Penetrating Radar Velocity, Imaging, and Attribute Analysis	University of Wyoming	SC	648
1999	70108	Effects of Fluid Distribution on Measured Geophysical Properties for Partially Saturated, Shallow Subsurface Conditions	Lawrence Livermore National Laboratory	SC	750
1999	70115	The Use of Radar Methods to Determine Moisture Content in the Vadose Zone	University of British Columbia	SC	372
1999	70220	High Frequency Electromagnetic Impedance Imaging for Vadose Zone and Groundwater Characterization	Sandia National Laboratories-Albuquerque	SC	656
1999	70267	A Hydrologic-Geophysical Method for Characterizing Flow and Transport Processes within the Vadose Zone	University of Wisconsin- Madison	SC	1,005
2000	73731 60199*	Automated Shallow Seismic Imaging	University of Kansas	SC	792
2000	73776 60328*	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts	Lawrence Berkeley National Laboratory	SC	870
2000	73830 55218*	Seismic Surface Wave Tomography of Waste Sites	Georgia Institute of Technology	SC	97
2000	73836 55300*	Induced Polarization with Electromagnetic Coupling: 3D Spectral Imaging Theory and Field Tests	Massachusetts Institute of Technology	SC	712
2000	73962 60115*	Advanced High Resolution Seismic Imaging, Material Properties Estimation and Full Wavefield Inversion for the Shallow Subsurface	Rice University	SC	216
Health Science					
1996	54546	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons	University of California at Berkeley	H/E/R	891
1996	54684	Mechanism Involved in Trichloroethylene-Induced Liver Cancer	Pacific Northwest National Laboratory	H/E/R	1,800

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1996	54856	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins	University of Pennsylvania	H/E/R	980
1996	54931	A Novel Biomarker for Beryllium Sensitization in Humans	University of Vermont	H/E/R	649
1996	54940	Improved Risk Estimates for Carbon Tetrachloride	Lovelace Biomedical & Environmental Research Institute	H/E/R	1,000
1996	55032	Environmental Analysis of Endocrine Disrupting Effects from Hydrocarbon Contaminants in the Ecosystem	Tulane University	H/E/R	620
1996	55100	Human Genetic Marker for Resistance to Radiations and Chemicals	Columbia University	H/E/R	751
1996	55356	An In-Vivo Model to Evaluate the Health Impact of MW Chemicals	University of California at San Francisco	H/E/R	970
1996	55410	Determining Significant Endpoints for Ecological Risk Analysis	Savannah River Ecology Laboratory	H/E/R	898
1996	54584	Comparison of Elemental Waste Laden Soils Bioavailability Using In-Vivo and In-Vitro Analytical Methodology	University of Medicine & Dentistry of NJ	SC	506
1996	55033	Characterization of Chemically Modified Hyperthermophilic Enzymes	Oak Ridge National Laboratory	SC	1,393
1996	55185	Strategies for Designing Inexpensive but Selective Bioadsorbents for Environmental Pollutants	University of Texas at Austin	SC	749
1996	55343	Enzyme Engineering for Biodegradation of Chlorinated Organic Pollutants	Lawrence Berkeley National Laboratory	SC	550
1997	59828	Bioavailability of Organic Solvents in Soils: Biologically Based Models for Human Risk Assessments	University of California at San Francisco	H/E/R	1,105
1997	59882	Measurements of Radon, Thoron, Isotopic Uranium and Thorium to Determine Exposure & Risk	New York University School of Medicine	H/E/R	630
1997	59918	Improved Radiation Dosimetry/Risk Estimates	Lovelace Biomedical & Environmental Research Institute	H/E/R	863
1997	60037	Estimation of Potential Population Level Effects of Contaminants on Wildlife	Oak Ridge National Laboratory	H/E/R	619
2000	74050 59882*	Measurement of Radon, Thoron, Isotopic Uranium and Thorium to Determine Occupational and Environmental Exposure	New York University School of Medicine	H/E/R	400
2000	73942 59918*	Improved Radiation Dosimetry Risk Estimates to Facilitate Environmental Management of Plutonium Contaminated Soils	Lovelace Biomedical & Environmental Research Institute	H/E/R	1,000
Hydrogeology					
1996	54576	Inclusion of Interfacial Area Between Phases in the Physical and Mathematical Subsurface Multiphase Flow Description	University of Notre Dame	SC	845
1996	54680	Migration and Entrapment of DNAPLs in Heterogeneous Porous Media	University of Michigan	SC	582
1996	54793	Establishing a Quantitative Functional Relationship Between Capillary Pressure, Saturation and Interfacial Area	Cornell University	SC	962
1996	54888	Manipulating Subsurface Colloids to Enhance Cleanups of DOE Waste Sites	Massachusetts Institute of Technology	SC	451

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1996	54908	Partitioning Tracers for In-Situ Detection and Quantification of DNAPLs in Groundwater Systems	University of Arizona	SC	777
1996	54950	Characterization of Contaminant Transport in Heterogeneous Vadose Regimes	Lawrence Livermore National Laboratory	SC	1,200
1996	55036	Colloid Transport and Retention in Fractured Deposits	Oak Ridge National Laboratory	SC	1,100
1996	55083	Behavior of Dense, Immiscible Solvents in Fractured Clay-Rich Soils	University of Tennessee at Knoxville	SC	600
1996	55109	New Permeameters for In-Situ Characterization of Unsaturated Heterogeneous Permeability	New Mexico Institute of Mining & Technology	SC	612
1996	55196	In Situ, Field Scale Evaluation of Surfactant Enhanced DNAPL Recovery	Oregon State University	SC	617
1996	55216	In-Situ Characterization of DNAPLs Using Partitioning Tracers	University of Texas at Austin	SC	600
1996	55359	Chaotic-Dynamical Conceptual Model to Describe Fluid Flow and Contaminant Transport in a Fractured Vadose Zone	Lawrence Berkeley National Laboratory	SC	1,440
1996	55395	Physics of DNAPL Migration and Remediation in the Presence of Heterogeneities	Sandia National Laboratories-Albuquerque	SC	1,245
1997	60069	Least-Cost Ground water Remediation Design Using Uncertain Hydrogeological Information	University of Vermont	SC	377
1997	60158	Development of Radon-222 as a Natural Tracer for Monitoring NAPL Contamination Remediation	Oregon State University	SC	404
1998	65410	Study of Rapid Migration of Radionuclides Leaked from HLW Tanks	Pacific Northwest National Laboratory	HLW	905
1999	70069	Fast flow in Unsaturated Coarse Sediments	Lawrence Berkeley National Laboratory	SC	450
1999	70135	Colloid-Facilitated Transport of Radionuclides Through the Vadose Zone	Washington State University	SC	700
1999	70149	Dynamics of Vadose Zone Transport: A Field and Modeling Study Using the Vadose Zone Observatory	Lawrence Livermore National Laboratory	SC	600
1999	70187	Quantifying Vadose Zone Flow and Transport Uncertainties Using a Hierarchical Approach	Pacific Northwest National Laboratory	SC	600
1999	70193	Influence of Clastic Dikes on Vertical Migration of Contaminants on the Vadose Zone at Hanford	Pacific Northwest National Laboratory	SC	850
1999	70219	Fate and Transport of Radionuclides Beneath the Hanford Tank-Farms: Unraveling Coupled Geochemical and Hydrologic Processes in the Vadose Zone	Oak Ridge National Laboratory	SC	1,210
2000	73732 54680*	Migration and Entrapment of DNAPLs in Heterogeneous Systems: Impact of Waste and Porous Media Composition	The University of Michigan	SC	675
2000	73812 55395*	Physics of DNAPL Migration and Remediation in the Presence of Heterogeneities	Sandia National Laboratory	SC	900
Inorganic Chemistry					
1996	54724	Synthesis of New Water-Soluble Metal-Binding Polymers	Los Alamos National Laboratory	D&D	1,120
1996	54628	Colloidal Agglomerates in Tank Sludge: Impact on Waste Processing	Pacific Northwest National Laboratory	HLW	1,788
1996	54646	Interfacial Radiolysis Effects in Tank Waste Speciation	Pacific Northwest National Laboratory	HLW	871
1996	54765	Enhanced HLW Sludge Processing: Hydrothermal Oxidation of Cr, Te, and Complexants by Nitrate	Los Alamos National Laboratory	HLW	1,020

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1996	54807	Studies Related to Chemical Mechanisms of HLW Gas Formation	Georgia Institute of Technology	HLW	320
1996	55137	Novel Electrode Materials for Electrochemically-Based Remediation of MWs	California Institute of Technology	HLW	650
1996	55229	The NO _x System in Nuclear Waste	University of Notre Dame	HLW	1,201
1996	54506	Acid-Base a Behavior in Hydrothermal Processing of Wastes	University of Texas at Austin	TMW	380
1996	54828	HLW Processing: Spectroscopic Characterization of Redox Reactions in Supercritical Water	Furman University	TMW	112
1996	54897	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation	University of Washington	TMW	770
1996	55115	The Adsorption and Reaction of Halogenated Volatile Organic Compounds on Metal Oxides	Texas A&M University	TMW	390
1996	55276	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes	Oak Ridge National Laboratory	TMW	1,220
1996	54834	Investigation of Homogeneous and Heterogeneous Sonochemistry for Hazardous Waste Destruction	Purdue University	SC	290
1996	55061	Contaminants Removal from Ground and Waste Waters via Reduction by Zero-Valent Metals	University of California at Riverside	SC	380
1996	55119	Phase Equilibria Modification by Electric Fields	Oak Ridge National Laboratory	SC	1,202
1997	60296	Research Program to Investigate the Fundamental Chemistry of Technetium	Lawrence Berkeley National Laboratory	HLW	900
1997	59934	Hazardous Gas Production by Alpha Particles in Solid Organic Transuranic Waste Matrices	University of Notre Dame	TMW	400
1998	65411	Precipitation and Deposition of Aluminum-Containing Phases in Tank Wastes	Pacific Northwest National Laboratory	HLW	1,120
2000	73778 60296*	Research Program to Investigate the Fundamental Chemistry of Technetium	Lawrence Berkeley National Laboratory	HLW	600
2000	73832 55229*	The NO _x System in Homogeneous and Heterogeneous Nuclear Waste	University of Notre Dame	HLW	780
Low Dose Radiation					
1999	69848	Adaptive Response Against Spontaneous Neoplastic Transformation In-Vitro Induced by Ionizing Radiation	University of California at Irvine	H/E/R	565
1999	69904	Low-Dose Risk, Decisions, and Risk Communication	Decision Science Research Institute	H/E/R	1,230
1999	69906	Markers of the Low-Dose Radiation Response	Medical College of Georgia	H/E/R	930
1999	69938	Biological Effects of LLIR and Normal Oxidative Damage: The Same or Different?	Los Alamos National Laboratory	H/E/R	1,125
1999	69939	Sensitivity to Radiation-Induced Cancer in Hemochromatosis	Pacific Northwest National Laboratory	H/E/R	414
1999	69941	Linking Molecular Event to Cellular Responses at Low-Dose Exposures	Pacific Northwest National Laboratory	H/E/R	1,216
1999	69980	Low-Dose Studies with Focused X-rays in Cell and Tissue Models: Mechanisms of Bystander and Genomic Instability Responses	Gray Laboratory Cancer Research Trust	H/E/R	1,169
1999	69981	Mechanisms of Enhanced Cell Killing at Low Doses: Implications for Radiation Risk	Gray Laboratory Cancer Research Trust	H/E/R	1,065
Materials Science					
1996	54914	Atmospheric-Pressure Plasma Cleaning of Contaminated Surfaces	University of California at Los Angeles	D&D	1,212

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1996	55380	In-Situ Spectro-Electrochemical Studies of Radionuclide Contaminated Surface Films on Metals	Argonne National Laboratory	D&D	1,005
1996	54672	Radiation Effects in Nuclear Waste Materials	Pacific Northwest National Laboratory	HLW	2,880
1996	54691	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository	University of Michigan	HLW	408
1996	54773	Microstructural Properties of HLW Concentrates and Gels with Raman and Infrared Spectroscopies	Los Alamos National Laboratory	HLW	465
1996	54982	Analysis of Surface Leaching Processes in Vitrified HLWs Using In-Situ Raman Imaging and Atomistic Modeling	University of Florida	HLW	559
1996	55188	Chemical Decomposition of High-Level Nuclear Waste Storage/Disposal Glasses Under Irradiation	Naval Research Laboratory	HLW	489
1996	55367	Investigation of Microscopic Radiation Damage in Waste Forms Using ODNMR and AEM Techniques	Argonne National Laboratory	HLW	698
1996	55110	Alternative Host Matrix for the Vitrification of Specialized Nuclear Waste Forms	University of Missouri at Rolla	TMW	625
1996	55387	Photo-oxidation of Organic Waste Using Semiconductor Nanoclusters	Sandia National Laboratories-Albuquerque	TMW	1,251
1996	55094	Chemical and Ceramic Methods Toward Safe Storage of Actinides Using Monazite	Rockwell International Corporation	NM	1,287
1996	55382	Determination of Transmutation Effects in Crystalline Waste Forms	Argonne National Laboratory	NM	913
1997	59925	Modeling of Diffusion of Pu in Other Metals and of Gaseous Species in Plutonium-Based Systems	West Virginia University	D&D	435
1997	60363	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Radionuclides Partitioning during Melt Decontamination	Sandia National Laboratories-Albuquerque	D&D	1,200
1997	59827	Influence of Radiation and Multivalent Cation Additions on Phase Separation and Glass Crystallization	University of Arizona	HLW	723
1997	60020	Stability of HLW Forms	Oak Ridge National Laboratory	HLW	762
1997	60345	New Silicotitanate Waste Forms: Development and Characterization	Pacific Northwest National Laboratory	HLW	1,200
1997	60362	Ion-Exchange Processes and Mechanisms in Glasses	Pacific Northwest National Laboratory	HLW	901
1997	60401	Mechanism of Pitting Corrosion Prevention By Nitrite in Carbon Steel Exposed to Dilute Salt Solutions	Savannah River Technology Center	HLW	650
1997	60118	Fundamental Thermodynamics of Actinide-Bearing Mineral Waste Forms	Los Alamos National Laboratory	NM	1,150
1997	60387	Distribution & Solubility of Radionuclides & Neutron Absorbers in Waste Forms	Pacific Northwest National Laboratory	NM	1,800
1998	64896	Decontamination of Radionuclides from Concrete During and After Thermal Treatment	Oak Ridge National Laboratory	D&D	816
1998	64946	Mechanisms of Radionuclide-Hydroxycarboxylic Acid Interactions for Decontaminant of Metallic Surfaces	Brookhaven National Laboratory	D&D	1,150
1998	65366	Physical, Chemical and Structural Evolution of Zeolite-Containing Waste Forms	Pennsylvania State University	HLW	510
1998	65408	Mechanisms and Kinetics of Organic Aging in High-Level Nuclear Wastes	Pacific Northwest National Laboratory	HLW	900

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1998	65422	Modeling of Spinel Settling in Waste Glass Melter	Pacific Northwest National Laboratory	HLW	875
2000	73835 54914*	Atmospheric-Pressure Plasma Cleaning of Contaminated Surfaces	University of California - Los Angeles	D&D	1,100
2000	73748 60345*	New Metal Niobate and Silicotitanate Ion Exchangers: Development and Characterization	Pacific Northwest National Laboratory	HLW	900
2000	73750 54672*	Radiation Effects in Nuclear Waste Materials	Pacific Northwest National Laboratory	HLW	940
2000	73762 54691*	Radiation Effects on Sorption and Mobilization of Radionuclides during Transport through the Geosphere	University of Michigan	HLW	600
2000	73976 55110*	Iron Phosphate Glasses: An Alternative for Vitrifying Certain Nuclear Wastes	University of Missouri- Rolla	HLW	520
Microbial Science					
1996	54666	Mechanisms, Chemistry, and Kinetics of Anaerobic Biodegradation of cDCE and Vinyl Chloride	Stanford University	SC	686
1996	54681	Dynamics of Coupled Contaminant and Microbial Transport in Heterogeneous Porous Media	Pacific Northwest National Laboratory	SC	2,036
1996	55031	Genetic Analysis of Stress Responses in Soil Bacteria for Mixed Contaminants Enhanced Bioremediation	Pacific Northwest National Laboratory	SC	1,022
1996	55105	Complete Detoxification of Short Chain Chlorinated Aliphatics	Michigan State University	SC	196
1996	55152	Molecular Profiling of Microbial Communities from Contaminated Sources	University of Maryland at Baltimore	SC	607
1996	55264	High Resolution Definition of Subsurface Heterogeneity for Understanding Natural Field Systems Biodynamics	Lawrence Berkeley National Laboratory	SC	1,525
1996	55416	Control of Biologically Active Degradation Zones by Vertical Heterogeneity	Idaho National Engineering and Environmental Laboratory	SC	2,000
1997	60150	Genetic Engineering of a Radiation-Resistant Bacterium for Mixed Wastes Biodegradation	University of Washington	TMW	422
1997	59786	Design and Construction of <i>Deinococcus radiodurans</i> for Biodegradation of Organic Toxins	Uniformed Services University of the Health Sciences	SC	800
2000	73833 60150*	Genetic Engineering of a Radiation Resistant Bacterium for Biodegradation of Mixed Wastes	University of Washington	TMW	480
Plant Science					
1996	54837	Phytoremediation of Ionic and Methyl Mercury Pollution	University of Georgia	SC	825
1996	54889	Using Trees to Remediate Groundwaters Contaminated with Chlorinated Hydrocarbons	University of Washington	SC	651
1996	54898	Molecular Dissection of the Cellular Mechanisms Involved in Nickel Hyperaccumulation in Plants	Northern Arizona University	SC	496
1996	55041	Molecular Characterization of a Novel Heavy Metal Uptake Transporter from Higher Plants	University of California at San Diego	SC	483
1996	55097	Heavy Metal Pumps in Plants	Scripps Research Institute	SC	325
1996	55118	Plant Rhizosphere Effects on Metal Mobilization and Transport	University of California at Davis	SC	455

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1996	55278	Molecular Genetics of Metal Detoxification: Prospects for Phytoremediation	U.S. Department of Agriculture	SC	578
1997	60271	Characterization of a New Family of Metal Transport Proteins	Dartmouth College	SC	600
1999	70054	Phytoremediation of Ionic and Methyl Mercury Pollution	University of Georgia	SC	750
2000	73843 55118*	Mechanisms of Heavy Metal Sequestration in Soils: Plant-Microbe Interactions and Organic Matter Aging	California Department of Land, Air, and Water Resources	SC	450
2000	73858 54889*	Chlorinated Hydrocarbon Degradation in Plants: Mechanisms and Enhancement of Phytoremediation of Groundwater Contamination	University of Washington	SC	700
Separations Chemistry					
1996	55103	Utilization of Kinetic Isotope Effects for the Concentration of Tritium	Oak Ridge National Laboratory	TMW	1,354
1996	54716	Polyoxometalates for Radioactive Waste Treatment	Georgetown University	HLW	333
1996	54735	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation	Texas A&M University	HLW	600
1996	54996	Ionizing Radiation Induced Catalysis on Metal Oxide Particles	Pacific Northwest National Laboratory	HLW	1,110
1996	55087	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations	Oak Ridge National Laboratory	HLW	1,920
1996	54571	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods	Northeastern University	TMW	330
1996	54770	New Anion-Exchange Resins for Improved Separations of NM	Los Alamos National Laboratory	TMW	1,212
1996	54791	Managing Tight-binding Receptors for New Separations Technologies	University of Kansas	TMW	350
1996	54847	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide	National Renewable Energy Laboratory	TMW	660
1996	54942	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO ₂	University of Notre Dame	TMW	300
1996	55012	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams	Colorado State University	TMW	333
1996	55223	De Novo Design of Ligands for Metal Separation	Washington University	TMW	380
1996	54122	Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation	Pennsylvania State University	SC	327
1996	54661	Electrochemical Processes for In-Situ Treatment of Contaminated Soils	University of Delaware	SC	317
1996	54926	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste	University of California at Los Angeles	SC	360
1997	60041	Removal of Radioactive Cations and Anions Using Ligand-Modified Colloid-Enhanced Ultrafiltration	University of Oklahoma	D&D	539
1997	60283	Waste Volume Reduction Using Surface Laser Ablation Characterization and Decontamination	Argonne National Laboratory	D&D	790
1997	59982	Reactivity of Peroxynitrite: Implications for Hanford Waste Management and Remediation	Brookhaven National Laboratory	HLW	700
1997	59990	Fundamental Chemistry, Characterization, and Separation of Technetium in Hanford Waste	Los Alamos National Laboratory	HLW	730
1997	59993	Dynamic Effects of Tank Waste Aging on Radionuclide-Complexant Interactions	Los Alamos National Laboratory	HLW	559

Year	Proposal No.	Title	Primary Research Institution	Problem Area	Funding (\$000)
1997	60017	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties	Pennsylvania State University	HLW	390
1997	60050	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions	University of Washington	HLW	850
1997	60123	Potential-Modulated Intercalation of Alkali Cations into Metal Hexacyanoferrate Coated Electrodes	University of Washington	HLW	300
1997	60313	Radiation Effects on Transport and Bubble Formation in Silicate Glasses	Argonne National Laboratory	HLW	750
1997	60096	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation	University of Tennessee at Knoxville	TMW	450
1997	60392	Radiolytic and Thermal Process Relevant to Dry Storage of SNFs	Pacific Northwest National Laboratory	SNF	891
1998	64865	Micelle Formation and Surface Interactions in Supercritical CO ₂ Fundamental Studies for Actinides Extraction	Los Alamos National Laboratory	D&D	960
1998	64912	Interfacial, Transport, and Chemical Properties of Aqueous Surfactant Cleaners	Oak Ridge National Laboratory	D&D	570
1998	64965	Supercritical Carbon Dioxide-Soluble Ligands for Extracting Actinide Metal Ions from Porous Solids	Argonne National Laboratory	D&D	926
1998	65339	Ion Recognition Approach to Volume Reduction of Alkaline Tank Waste	Oak Ridge National Laboratory	HLW	900
1998	65351	Solution Effects on Cesium Complexation with Calixarene Crown Ethers	University of Idaho	HLW	296
1998	65368	Speciation, Dissolution, and Redox Reactions of Chromium Relevant to HLW Pretreatment and Separation	Lawrence Berkeley National Laboratory	HLW	899
1998	65378	Complexants for Actinide Element Coordination and Immobilization	Argonne National Laboratory	HLW	830
1998	65409	Electroactive Materials for Anion Separation-Technetium from Nitrate	Pacific Northwest National Laboratory	HLW	1,567
2000	73824 59982*	Reactivity of Peroxynitrite: Implications for Hanford Waste Management and Remediation Reactivity of Peroxynitrite: Implications for Hanford Waste Management and Remediation	Brookhaven National Laboratory	TMW	735
2000	73850 54791*	Managing Tight Binding Receptors For New Separations Technologies	University of Kansas	HLW	225
2000	74019 54864*	The Supramolecular Chemistry of Anion Recognition for Anions of Environmental Relevance	University of Kansas	HLW	750
2000	73803 55087*	Next Generation Extractants for Cesium Separation from High-Level Waste: From Fundamental Concepts to Site Implementation	Oak Ridge National Laboratory	HLW	660

Acronyms and Abbreviations

D&D	Deactivation and Decommissioning
DNA	Deoxyribose Nucleic Acid
DNAPL	Dense Non-Aqueous Phase Liquid
DOE-SC	Department of Energy Office of Science
DOE-ID	Department of Energy Idaho Operations Office
EMAB	Environmental Management Advisory Board
EMSP	Environmental Management Science Program
EM	Office of Environmental Management
H/E/R	Health, Ecology, and Risk
HLW	High-Level Waste
LLW	Low-Level Waste
NAS/NRC	National Academy of Sciences/National Research Council
NM	Nuclear Materials
OST	Office of Science and Technology
RFA	Request for Applications
SC	Subsurface Contamination
SCWO	Supercritical Water Oxidation
SNF	Spent Nuclear Fuel
STCG	Site Technology Coordinating Group
TRU	Transuranic
TMW	Transuranic and Mixed Waste

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