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Site Remediation Technology InfoBase: A Guide to Federal Programs, Information Resources, and Publications on Contaminated Site Cleanup Technologies

Second Edition

Prepared by the Member Agencies of the Federal Remediation Technologies Roundtable:

U.S. Environmental Protection Agency
Department of Defense
- **U.S. Air Force**
- **U.S. Army**
- **U.S. Navy**

Department of Energy
Department of Interior
National Aeronautics and Space Administration
Tennessee Valley Authority
Coast Guard

NOTICE

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DoD Environmental Quality Mission and Challenges

The Department of Defense's Environmental Quality Research, Development, Testing, and Evaluation (EQ RDT&E) program is based on four requirements that constitute the pillars of DoD's environmental security mission. DoD is required to:

(1) **Cleanup** hazardous wastes resulting from past practices at active, formerly used, and to-be-closed military sites;

(2) **Comply** with laws by controlling hazardous emissions from its systems and operations;

(3) **Prevent pollution** through substitutions of materials and processes to significantly reduce or eliminate the generation of pollutants; and

(4) **Conserve** natural and cultural resources through proper stewardship and management.

Cleanup. DoD has identified 17,660 potentially contaminated sites at 1,877 DoD installations and 6,786 formerly used defense sites (FUDS). Of these, about 7,000 will require cleanup. DoD estimates that nearly all sites have been identified and that cleanup of the sites will be completed by 2011. Design and construction work was expected to increase through 1998, and then to moderate until all cleanup is completed. The most common contaminants at DoD sites are: petroleum products, solvents, metals, pesticides, and paints. Some sites also contain more unusual wastes, such as unexploded ordnance or low-level radioactive materials.

Compliance. DoD must meet all regulatory requirements established by law relating to air, water, and land discharges. Many compliance deadlines have been met with best-available but costly technology; some operations continue under temporary waivers. Experience suggests that future regulations will likely be more stringent, and compliance through emission control will continue to be required, since it will not be possible to eliminate all hazardous discharge through pollution prevention strategies.

Pollution Prevention. DoD is required to reduce waste streams through material substitution and redesign of materials and processes that are environmentally superior while continuing to be functionally effective. The primary targets, derived from the Toxic Release Inventory and EPA's list of the 17 most toxic substances, are volatile organic compounds, ozone depleting substances, and hazardous/toxic materials.

Conservation. DoD must balance conflicting demands of more space-intensive training on diminishing military lands. Maintenance of national infrastructure for flood control, navigation, and other Corps of Engineers national civil works often result in competing uses for land resources. Protecting coastal and marine resources while conducting operations for military readiness also presents challenges.

DoD, as "owners" of environmental problems, and with both an interest in safeguarding the public and the legal responsibility for its own contamination, requires more effective and less costly technologies to address environmental security. DoD is interested in accelerating - development and implementation of cost-effective advanced technologies because it must provide timely solutions for its mission-unique technology needs and its other extensive, costly, complex, and risky environmental needs.

DoD recognizes the need for competent in-house people who know how to by smart technology from academia, industry, or other agencies. Such competence can be maintained only through active pursuit of research and development in its laboratories and centers and through simultaneous pursuit of scientific understanding of issues, processes, and continued advances in technology,

DoD Problem Areas and Development Mission Objectives

Problem Definition	Development Objectives
CLEANUP The remediation of soil, sediment, groundwater, surface water, and structures contaminated with hazardous and toxic materials from past military activities.	Provide new or improved cost effective methods to identify, evaluate, treat, control, and mitigate past hazardous and toxic materials disposal practices in three areas: site investigation/characterization; remediation; and environmental contaminant and effects.
COMPLIANCE EQ requirements relating to air, water, and land pollution through the control, treatment, and disposal of solid and hazardous wastes. Primary areas of emphasis are industrial activities, solid and liquid discharges from ships, and environmentally sound disposal of pyrotechnics, explosives, and propellants.	Technologies for advanced end-of-pipe control, treatment, and disposal of wastes to meet air, water, and land requirements. R&D is focused on characterization of pollutant and waste behavior, media-specific control and treatment technologies, and monitoring and assessment tools to meet existing and future national/international regulatory constraints otherwise inhibiting the DoD mission.
POLLUTION PREVENTION Elimination and/or minimization of materials and materials development processes that produce or release hazardous, toxic, or excess wastes into the environment.	Technology in the form of materials, processes, and functional products allowing the eventual elimination of the use of VOC, ODC, and HAZMAT materials and processes in DoD maintenance, overhaul, and remanufacture of new weapons systems.
CONSERVATION Maintaining optimum training, testing, and operational mission effectiveness by stewardship and preservation of the natural and cultural resources on DoD lands.	Enhanced and continued testing and training mission effectiveness through effective management of ecological and cultural resources diversity and productivity. Advanced models and techniques for resource characterization/impact analysis and improved mitigation and rehabilitation measures.

coupled with rigorous testing and evaluation through an integrated research and development program. Integration is provided through existing mechanisms led by Defense laboratories' balance of intramural and extramural activities.

DoD Environmental Quality RDT&E Process

DoD's EQ RD effort is primarily executed by the Services through Civil & Environmental Engineering, Combat Material, and Corporate laboratories. These laboratories provide the technical expertise to enable the Services to be smart buyers and users of new and improved technologies. Each laboratory generally performs the environmental work required by the primary weapon, platform, or installation mission it supports. For example:

- The Air Force Research Laboratory's Airbase and Environmental Technology Division and the Naval Air Warfare Center share the lead on environmental work for aviation and maritime aviation.
- The Naval Surface Warfare Center does environmental RDT&E for ships in support of NAVSEA, the acquisition and life-cycle manager for surface weapons systems.
- The U.S. Army Engineer Waterways Experiment Station (WES), where cleanup RD is conducted, is under the command of Headquarters, U.S. Army Corps of Engineers, which performs the cleanup program for the Army.

In the continuous dialogue between the test and evaluation communities, technology users, and R&D producers, the laboratories and Environmental Field Office help users to separate the R&D requirement from needs that can be addressed through existing and available technology. User-stated requirements are cross-checked for commonality by the Tri-Service Project Reliance Joint Engineers' Panel teams for the four environmental security mission pillars. These pillars are comprised of R&D engineers and scientists from each Service who also sit on parallel teams of the interagency Strategic

Environmental Research and Development Program (SERDP) (see p. 18). The personnel on the teams possess the subject matter expertise to understand the technology, interpret the requirements to create balanced and focused joint projects and evaluate technical program proposals for inclusion in SERDP, the Environmental Security Technology Certification Program (ESTCP) (see p. 15), and other agency programs. The teams provide for DoD inter-laboratory integration and the leveraging of technical concepts, programs, and talents to create projects for innovative dual use technology, while providing for DoD user requirements.

Laboratory personnel and pillar technology teams play a key role in technology-shortfall need identification and assisting field commands to understand and solve urgent problems requiring emerging technologies from *any* source. Laboratory scientists and engineers communicate their R&D accomplishments and DoD technology needs to professional, trade, and academic forums through scientific or technical papers and numerous other exchanges. The research engineers and scientists link their laboratories with field users and external suppliers of science and technology from industry, academia, and other agencies. The communication interaction that underlies the more formal and visible user requirements development and approval processes is the work of people who have ready access to peer organizations, the private sector, and the users who need their advice. They also have access to industry and academia peers to facilitate their understanding of DoD's specific needs and constraints.

Defense Environmental Restoration Program

DoD cleanup policy is determined centrally under the Defense Environmental Restoration Program (DERP). DERP includes two major components: Other Hazardous Waste Operations (OHW) and the Installation Restoration Program (IRP). Under the IRP, DoD performs all required contaminated site cleanups. Although policy direction and oversight of IRP are responsibilities of the Deputy Assistant Secretary of Defense, each Service (Army, Navy, Air Force) is responsible for program implementation.

DERP has specified procedures for evaluating sites and procuring cleanup services under IRP that follow EPA guidelines for site investigations and remediation. These procedures cover all phases of site operations, including preliminary assessment/site inspection (PA/SI), remedial investigation/feasibility study (RI/FS), and remedial design/and remedial action (RD/RA).

Nearly all DoD assessment and remediation work is done through contractors. Generally, there are two types of contractors: those engaged in site assessments and investigations (PA/SI through RI/FS) and those that perform cleanups (RD/RA). Contractors that work on PA/SIs and RI/FSs seldom work on the RD/RA phase.

In selecting and designing remedies, DoD officials coordinate with EPA Regional officials to ensure that cleanup goals meet regulatory requirements. Most contracting is done on an installation-oriented basis, either through centralized contracting service centers or directly by the installation. Although each Service follows general procedures specified by DERP, each procures its own services.

DoD spends approximately $15 million annually on RTD&E, primarily to demonstrate promising technologies. Technologies demonstrated include: bioventing, *in situ* aerobic and anaerobic bioremediation, monitored natural attenuation, *in situ* and *ex situ* vapor extraction, *in situ* soil venting, chemical detoxification of chlorinated aromatic compounds, incineration of soil contaminated with explosives, infrared thermal destruction, low temperature thermal stripping, thermal destruction, radio frequency thermal soil decontamination, and composting of explosives-contaminated soil.

U.S. Army Defense Environmental Restoration Program

The Deputy Assistant Secretary of the Army (Environment, Safety and Occupational Health) (DASA(ESOH)) is responsible for overall policy and guidance for the Army's Installation Restoration Program for active installations, the Base Realignment and Closure (BRAC) Environmental Program for closing installations, and is the Executive Agent for the DoD Formerly Used Defense Sites Program (FUDS). The Assistant Chief of Staff for Installation Management (ACSIM) has Army Staff responsibility for all three programs, and programs and budgets resources necessary to support them. The U.S. Army Environmental Center (USAEC) is responsible for program management of the IRP to include program, fiscal and technical oversight. USAEC provides funding guidance and subsequent resources to support the MACOM developed annual and multiyear IRP workplans and monitors and evaluates MACOM performance against the funded requirements. The ACSIM centrally manages the Army BRAC program, with oversight assistance from USAEC. MACOMs are responsible for program execution of the IRP and BRAC programs, but the U.S. Army Corps of Engineers (USACE) performs most phases of project execution on a reimbursable basis. USACE is also responsible for program management and project execution for FUDS, which include formerly used properties from all the DoD components.

U.S. Air Force Major Commands

The Air Force IRP is decentralized. It is executed by the Air Force Major Commands. Each may obtain specialized technical support from contractors in one of three ways: through task-order contracts administered by five contract service centers; through individual contracts issued by the commands themselves; or by individual installations. Much of the Air Force's restoration work is conducted by the Army Corps of Engineers. In the future, the Air Force plans to issue contracts for this work.

U.S. Navy Facilities Engineering Command

The Navy Facilities Engineering Command (NAVFAC) manages the Navy IRP. Day-to-day operations of the IRP are conducted by ten field divisions that operate within distinct geographical boundaries. The majority of the IRP work is conducted by support contractors under two distinct contract mechanisms, each managed by the field divisions:

- Comprehensive Long-Term Environmental Action Navy (CLEAN) contracts for procuring remedial study and design services.
- Remedial Action Contracts (RACs) for procuring remedial cleanup services.

Army Environmental Quality Technology Process

The Army Environmental Quality Technology (EQT) Process was created in 1997 by the Assistant Secretary of the Army (ASA) for Acquisitions, Logistics, and Technology (ALT) and the ASA (IE) as a parallel to the Defense Systems Acquisition Management Process. The Army Environmental Requirements and Technology Assessments (AERTA) process closely parallels the Mission Needs Statement (MNS) Generation Process of the Defense System Acquisition Management System. The four distinct phases of the MNS Process can also apply to the AERTA process: definition, documentation, validation, and approval.

- Definition Phase: This activity defines, describes, and justifies the need for an environmental technology to solve a user problem or satisfy a deficiency.
- Documentation Phase: This phase is the formal preparation and review of the draft user requirements under the AERTA process by Assistant Chief of Staff for Installation Management (ACSIM)/Office of the Director

of Environmental Programs (ODEP)/U.S. Army Environmental Center.

- Validation/Approval Phase: This is the formal review process of the user requirements, with their respective performance criteria and metrics, by the Army user community, including representatives of the MACOMs, and appropriate Army agencies (e.g., DCSOPS, ASA(ALT)) to confirm and prioritize the needs. Review and final recommendation of the draft user requirements rests with the Army MACOMs and other agencies, as appropriate. Validation authority rests with the ACSIM. Approval is a formal sanction that the validation process is complete and the identified user needs described in the documentation are valid. An approved memo is sent by the ACSIM to the ASA(ALT).
- Execution Phase: The Army's laboratories and Technology Teams (TTs) implement and monitor the technology program plans.

The AERTA is the central repository for the Army's identified, quantified, and validated environmental technology requirements, associated potential off-the-shelf technology solutions, and points of contact. Potential off-the-shelf solutions are neither validated nor recommended—only identified.

The AERTA structure allows for maximum summary information, located in the "requirement report" and the "tech assessment" pages, to be viewed on one page with links to more detailed information. Additional detailed information can be obtained from points of contact located in the requirement report and the technology assessment webpages.

The regulatory climate directing the Army's environmental technology program changes every year. This requires monitoring of the laboratories' programs, knowledge of technological advancements inside and outside of the Army, and refocusing of the RDT&E programs from time to time. AERTA provides the framework for documenting current information on the Army's needs, off-the-shelf technologies available, and the RDT&E program.

U.S. Department of Energy Cleanup Programs

Environmental Restoration Program Needs

DOE's Environmental Restoration Program is responsible for cleaning up 110 major installations and other locations. DOE estimates that remediation may be required at about 4,000 of its contaminated areas or sites. Most sites have been used for nuclear weapons research, development, and production. DOE installations tend to be much larger than non-DOE sites. Twenty-three DOE sites are listed on the Superfund National Priorities List.

Key considerations of DOE's Environmental Restoration program include the following:

- Most of the DOE cleanup effort occurs at 64 installations managed under the Remedial Actions Program.
- Some contaminants at DOE installations are unique to nuclear production, while others are common to more typical industrial processes. Mixed waste (containing both radioactive and non-radioactive constituents) is a widespread problem.
- The Decontamination and Decommissioning Program will involve up to 1,000 facilities. This program manages retired government-owned facilities such as reactors, laboratories, buildings, and storage tanks.
- DOE conducts research and development, primarily in the form of demonstrations of technologies such as *in situ* bioremediation, air stripping, vitrification, soil washing, solvent extraction, solar detoxification, and above-ground biological treatment.

Contractors perform virtually all cleanup and restoration work at DOE installations. DOE awards remedial action contracts on a site-by-site basis. These contracts are managed by DOE's Operations Offices. Depending on the site, contractors may be responsible for management tasks, actual cleanup work, waste management duties, or various combinations. For example, contractors are responsible for day-to-day project management under Environmental Restoration Management Contracts (ERMCs) awarded at the Hanford and Fernald sites. ERMC contractors have the option of performing remedial investigation/feasibility studies themselves and are responsible for subcontracting remaining work to companies with specialized expertise and technology.

DOE has begun to implement a number of contract reforms that emphasize performance-based approaches and risk sharing, provide incentives for Managing and Operations (M&O) contractors for cost-reduction and safety measures, and identify tasks that should be undertaken by qualified subcontractors. The first two integrated management contracts awarded under the new system have been multi-year efforts for management and cleanup of the Idaho National Engineering Laboratory and Rocky Flats sites.

Environmental Technology Development Programs and Services

DOE provides a range of programs and services to assist universities, industry, and other private sector organizations and individuals interested in developing or applying environmental technologies. Working with DOE Operations Offices, as well as management and operating contractors, DOE/Environmental Management (EM) employs a number of mechanisms to identify, integrate, develop, and adapt promising emerging technologies. These mechanisms include collaborative arrangements, procurement provisions, licensing of technologies, consulting arrangements, reimbursable work for industry, and special consideration for small business.

EM awards grants and cooperative agreements if 51% or more of the value of the effort is related to a public interest goal. Such goals include

advancement of present/future U.S. capabilities in domestic and international environmental cleanup markets, technology transfer, advancement of scientific knowledge, or education and training of individuals and businesses.

The Industry and University Programs Area (see p. 22) is a primary DOE vehicle for funding research and development partnerships with the public and private sectors to introduce new technologies into the programs managed by DOE's Office of Science and Technology.

DOE uses several mechanisms under the above Programs Area and otherwise to invite the private sector to participate in its technology research and development programs. These include Cooperative Research and Development Agreements (CRADAs) for collaborative R&D with non-federal partners, and procurements for technology development under Program Research and Development Announcements (PRDAs) (see p. 22) and Research Opportunity Announcements (ROAs) (see p. 22). The Small Business Technology Transfer Program (see p. 14) is a special program through which small businesses may participate in the above programs. DOE also is one of 11 federal agencies involved in the Small Business Innovation Research Program, administered by the Small Business Administration (see p. 14).

CRADAs are agreements between a DOE or other federal R&D laboratory and any non-federal source to conduct cooperative R&D that is consistent with the laboratory's mission. The partner may provide funds, facilities, people, or other resources. DOE provides the partner with access to facilities and expertise; external participants receive no federal funds. Rights to inventions and other intellectual property are negotiated between the laboratory and the participant.

PRDAs are program announcements that solicit a broad mix of advanced development and demonstration proposals. A PRDA requests proposals for a wide range of technical solutions to specific EM problem areas. Multiple awards, which may have distinct approaches or concepts, are generally made.

The ROA seeks advanced research and technologies for a broad scope of cleanup needs and supports applied research ranging from concept feasibility to full-scale testing. Each ROA is open continuously for a full year following the date of issue and includes a partial procurement set-aside for small businesses.

Developers and vendors of innovative technologies interested in more information about DOE's technology development efforts should contact the DOE's Center for Environmental Management Information, toll-free, at 800-736-3282.

Technology Focus Areas

DOE recognizes that DOE cleanups provide an opportunity for developers of innovative technologies. DOE's technology-related research and development activities target five focus areas that represent key remediation and waste management problems within the DOE complex. Five areas for the development of cross-cutting technologies also have been established.

Each focus area includes specific categories of technologies that require research and development. These are:

Subsurface Contaminants Focus Area, which is developing technologies to address environmental problems associated with hazardous and radioactive contaminants in soil and groundwater that exist throughout the DOE complex, including radionuclides, heavy metals, and dense, nonaqueous phase liquids. Numerous contaminant plumes have contaminated soil and groundwater. Some of these contaminants have migrated from the numerous landfills at DOE facilities, and SCFA is responsible for supplying technologies for the remediation of radioactive and hazardous buried waste, as well as for developing new or alternative technologies for *in situ* stabilization and nonintrusive characterization of these sites. Technology developed within this specialty area will provide

effective methods to contain contaminant plumes and innovative technologies for remediating contaminated soils and groundwater, with emphasis on *in situ* technologies to minimize waste disposal costs and potential worker exposure.

Mixed Waste Characterization, Treatment, and Disposal Focus Area, which planned to conduct a minimum of three pilot-scale demonstrations of mixed waste treatment systems, using actual mixed waste, by 1997.

Radioactive Tank Waste Remediation Focus Area, which has concentrated on four DOE installations where most DOE underground storage tanks are located.

Facility Deactivation, Decontamination and Material Disposal Focus Area, which is in the process of selecting a site for a full-scale demonstration of facility decommissioning technology with an emphasis on the recycling of contaminated building materials for reuse within the DOE complex.

Cross-cutting technologies are defined as those which overlap the boundaries of focus areas, and technologies developed in these areas will be used in focus area testing and evaluation programs wherever they are applicable. These areas are: Characterization, Monitoring, and Sensor Technology; Efficient Separations and Processing; Robotics; Innovative Investment; and Pollution Prevention.

U.S. Environmental Protection Agency Cleanup Programs

Hazardous Waste Cleanup Sites

The Superfund program for the cleanup of closed or abandoned hazardous waste sites is administered by EPA under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Since 1980, the primary responsibility for site cleanups has shifted from EPA to responsible parties. Currently, nearly 75% of all cleanups are implemented by responsible parties, with EPA or state oversight.

Superfund emphasizes remedies that include the use of hazardous waste treatment technologies. The use of innovative technologies for Superfund cleanup has been increasing. Innovative treatment technologies currently account for more than half of the treatment technologies selected for controlling waste sources.

EPA has an active research and demonstration program for innovative cleanup technologies. EPA's primary mechanisms for promotion of innovative technologies for site remediation are testing/verification programs, including the Superfund Innovative Technology Evaluation (SITE) Program (see p. 27) and the Environmental Technology Verification (ETV) Program (see p. 25). EPA sponsors other interagency technology development programs and initiatives.

Remedies have not yet been selected for hundreds of sites on the NPL. In addition, EPA estimates that 80% of future sites—including those on the National Priorities List (NPL) and others—will require remediation of contaminated ground water, 74% will require soil remediation, 15% sediments remediation, and 10% sludge treatment. The data available on these sites indicate the types and extent of treatment technology applications needed in the future:

- Volatile organic compounds (VOCs) are the most common contaminants, followed by metals and semi-volatile organic compounds.
- Chlorinated VOCs are the most common organic contaminant, followed by other VOCs, PCBs, PAHs, and phenols.
- The most common metal is lead, followed by chromium, arsenic, and cadmium.

Based on contaminant occurrence and historical technology trends, some general observations can be made about the potential Superfund market for specific technologies. These observations do not necessarily consider several other important factors in remedy selection, such as federal and state cleanup standards, competing technologies, other site characteristics, and public acceptance.

- Based on current trends, at least 30% of the Superfund sites will implement innovative technologies for some degree of source control. Innovative technology use should grow as more cost and performance data become available.
- The use of soil vapor extraction (SVE) technologies for all types of VOCs is expected to continue at current levels, and may even increase.
- Thermal desorption for the treatment of VOCs and PCBs may increase.
- The selection of bioremediation at Superfund sites may increase.
- Alternatives to incineration for the treatment of semi-volatile organic compounds (SVOCs) are in demand.
- Treatment of metals in soil represents a potentially large, but untapped market for innovative treatment.
- New *in situ* ground water treatment technologies are in great demand. Pump-and-treat technologies often cannot achieve desired cleanup goals.

RCRA Corrective Action Sites

Approximately 5,100 hazardous waste treatment, storage, and disposal facilities (TSDFs) may be subject to corrective action under the Resource Conservation and Recovery Act (RCRA). Facility owners or operators are responsible for the necessary corrective action, with oversight by EPA or a state.

Between 1,500 and 3,500 of the regulated TSDFs will require corrective action. A wide variety of wastes, many of which are similar to those found at Superfund sites, will require corrective action. Some of the most prevalent wastes include corrosive and ignitable wastes, heavy metals, organic solvents, electroplating waste, and waste oil.

About half of all RCRA corrective action facilities use off-site disposal remedies and half use innovative treatment. Of the innovative technologies, about one-third are SVE; one-third *in situ* bioremediation; and one-third above-ground treatment, primarily bioremediation.

Underground Storage Tank Sites

Underground storage tanks (USTs) containing petroleum products or hazardous chemicals are also regulated under RCRA. Tank owners are responsible for remediation under state UST programs. Major factors concerning UST site remediation include the following:

- As of 1995, approximately 306,000 UST sites require cleanup. Of these, 131,000 sites have completed cleanups, leaving approximately 170,000 sites requiring some level of cleanup. An additional 100,000 releases were expected by 2000. There is an average of almost three tanks per site. Per site cleanup costs range from $10,000 to $125,000 for soil remediation and $100,000 to $1 million for ground water remediation. At an average cost of $125,000, the potential UST market could reach $34 billion.

- Approximately 98% of USTs contain petroleum products and 2% contain hazardous materials.

- About 68% of UST cleanups use innovative technology. For sites contaminated with petroleum, landfilling is used most frequently at sites (one-third), followed by natural attenuation, biopiles, soil vacuum extraction, landfarming, and thermal desorption. For sites with ground water contamination, natural attenuation is the most common remedy, followed by pump-and-treat, air sparging, and *in situ* bioremediation.

FEDERAL SITE REMEDIATION TECHNOLOGY DEVELOPMENT ASSISTANCE PROGRAMS

Interagency R&D Assistance Programs

Rapid Commercialization Initiative

Coordinating Agency: U.S. Department of Commerce

Participating Agencies: U.S. Department of Defense, U.S. Department of Energy, U.S. Environmental Protection Agency, California EPA, Western Governors' Association, Southern States Energy Board

The Rapid Commercialization Initiative (RCI), an interagency effort coordinated by the U.S. Department of Commerce, fosters cooperative interaction of the private sector, states, and Federal agencies to help bring environmental technologies to market more rapidly and efficiently. RCI acts as a gateway to other federal agency programs that provide opportunities for environmental technology demonstration, verification, and transfer. RCI provides in-kind assistance for selected companies with commercially ready environmental technologies in four categories: avoidance, control, monitoring and assessment, and remediation and restoration.

The primary goal of RCI is to provide services to industry that help lower three key barriers to commercialization:

(1) finding sites for full-scale technology demonstrations;
(2) evaluating and verifying technical performance and the cost of performance of technologies; and,
(3) promoting regulatory acceptance of verified data and expediting the permitting process.

The selection of technologies for participation in RCI programs centers on two criteria:

- The technology addresses environmental and market needs, with a focus on solutions to private sector needs and added consideration for application to public sector environmental problems.

- There is a clear path to commercialization and the technology is only a few, final steps from commercialization, such that testing, evaluation, and verification will complete the process.

Marketing, financing, or production assistance are not available under RCI. Exemptions from federal laws and regulations also are not available. Participants in RCI are selected through program announcements and an intensive peer-review process that examines both technical and business soundness.

Contact: Stanley Chanesman
U.S. Department of Commerce
H4418
Washington, DC 20230
202-482-08250

Website: http://rci.gnet.org/

Small Business Innovative Research Program/Small Business Technology Transfer Research Program

Coordinating Agency: U.S. Small Business Administration

Participating Agencies: U.S. Environmental Protection Agency, U.S. Department of Energy, U.S. Department of Defense, others

The Small Business Innovative Research (SBIR) Program is a multi-media assistance program designed to assist and promote U.S.-owned high technology companies with 500 or fewer employees. SBIR activities are overseen by the Small Business Administration. Funding is provided to companies through grants and contracts awarded by SBIR program offices in 11 Federal agencies. Each agency offers at least one SBIR program solicitation annually that specifies the types of research to be funded.

SBIR is a three-step grant and contract program. Phase I grants and contracts are awarded in amounts of $60,000 to $100,000 each for technology feasibility studies that can last up to six months. Only Phase I recipients are eligible for Phase II awards. Phase II grants and contracts can last from one to two years of principal research and development, and range from $150,000 to $750,000. Phase III funding assistance is provided either through commercial application with additional funding from the private sector, or through non-SBIR funding provided by the participating agency for research and development in areas of particular interest to the agency.

The Small Business Technology Transfer Program (STTR) expands funding opportunities in the federal innovation research and development arena. Under STTR, a specific percentage of federal R&D funding for five agencies (including DoD and DOE) is reserved for awards to small business and nonprofit research institution partners. These agencies designate R&D topics and accept proposals. Small businesses must meet certain eligibility criteria (similar to SBIR) to participate in the STTR Program.

Following submission of proposals, agencies make STTR awards based on small business/nonprofit research institution qualification, degree of innovation, and future market potential. Small businesses that receive awards or grants then begin a three-phase program. Phase I is the start-up phase, with awards of up to $100,000 for approximately one year fund the exploration of the scientific, technical, and commercial feasibility of an idea or technology. Phase II awards of up to $500,000 are awarded for as long as two years, for projects that expand on Phase I results. During this period, the R&D work is performed and the developer begins to consider commercial potential. Only Phase I award winners are considered for Phase II. Phase III is the period during which Phase II innovation moves from the laboratory into the marketplace. No STTR funds support this phase. The small business must find funding in the private sector or other non-STTR federal agency funding.

Contact: U.S. Small Business Administration
Office of Technology
409 Third Street, SW
Washington, DC 20416
202-205-6450

Website: http://www.sba.gov/SBIR/

U.S. Department of Defense R&D Assistance Programs

Air Force Center for Environmental Excellence

The Air Force Center for Environmental Excellence (AFCEE) has an Innovative Technology Program that identifies and field tests innovative site characterization, remediation, and pollution prevention technologies, with an emphasis on technologies that save time and money and facilitate compliance with air, soil, and water regulations.

Special areas of interest within the Innovative Technology Program include:

- remediation technologies to treat fuels, chlorinated solvents, pesticides, PCBs, and heavy metals;
- vapor phase capture and treatment;
- cost effective site characterization;
- stripping and removal of protective coatings;
- parts cleaning and degreasing; and
- industrial process sludge treatment.

Successful projects have been based on sound scientific principles and offer widespread applicability to Air Force sites and significant cost savings.

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Environmental Security Technology Certification Program

ESTCP's goal is to demonstrate and validate promising, innovative technologies that target the Department of Defense's (DoD's) most urgent environmental needs. These technologies provide a return on investment through cost savings and improved efficiency. ESTCP's strategy is to select lab-proven technologies with broad DoD and market application. These projects are aggressively moved to the field for rigorous trials that document their cost, performance, and market potential. To ensure that the demonstrated technologies have a real impact, ESTCP incorporates these players in the development and execution of each technology. ESTCP demonstrations—

- address real DoD environmental needs.
- significantly reduce costs and risks and expedite implementation.
- document and validate the cost and performance of new technologies for DoD end-users and the regulatory community.

The ESTCP Process (below) ensures approved technologies meet DoD environmental challenges:

- DoD environmental requirements are specified.
- ESTCP requests proposals.
- Rigorous and expert scientific reviews are made.
- ESTCP projects are selected in cleanup, compliance, and pollution prevention.
- Technologies are demonstrated and evaluated at DoD sites.
- Cost and performance data are validated.
- Effective and affordable technologies are transferred across DoD.

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National Environmental Technology Test Sites (NETTS) Program

The National Environmental Technology Test Sites (NETTS) Program sponsored by the Strategic Environmental Research and Development Program (SERDP), is an environmental technology testing and evaluation program that provides locations, facilities, and support for applied research demonstration, and evaluation of innovative cleanup and characterization technologies that are candidates for Installation Restoration efforts at DoD facilities. NETTS, which is managed under the SERDP Cleanup Program, promotes technology transfer from research to proof-of principle demonstration and facilitates expeditious transfer of technologies between government agencies and the private sector.

There are currently four DoD SERDP NETTS test sites and one NETTS technology support center that primarily focus on the proof-of-principle demonstrations of cleanup technologies. They consist of:

- Dover NETTS Test Site: The Dover National Test Site (DNTS) at Dover AFB provides sites where research can be conducted on the transport, detection, monitoring, and cleanup of solvent and fuel contaminants in the subsurface. DNTS provides a unique opportunity for conducting experimental, contained releases of dense nonaqueous phase liquids (DNAPLs). DNTS also provides other well-characterized contaminated plume sites and support services.

- McClellan NETTS Test Site: The Air Force also manages a Chlorinated Hydrocarbon Remedial Demonstration Site at McClellan AFB, which provides areas to evaluate investigative technologies and remediation technologies for chlorinated hydrocarbon contamination in soil and groundwater.

- Naval Facilities Engineering Service Center NETTS Test Site: The Environmental Technology Demonstration Site at Port Hueneme, California, provides *in situ* and *ex situ* locations to demonstrate advanced fuel hydrocarbon remediation technologies for treatment of Navy specific fuels contamination in soil and groundwater. Areas include a soil stockpile facility

contaminated with fuels; underground storage tank and spill areas; an 11-acre gasoline station plume; and a 43-acre MTBE plume associated with the gasoline station site.

- Former Wurtsmith AFB NETTS Test Site: The National Center for Integrated Bioremediation Research and Development at Wurtsmith AFB, Michigan, co-sponsored by EPA and the University of Michigan, operates a controlled field test-bed facility for investigations to support the design and engineering of integrated bioremediation systems. This project focuses on *in situ* bioremediation of surface soils, subsoils, surface water, and groundwater contaminated by fuels, solvents and other organic substances.

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Individual Test Locations:

Dover National Test Site
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909 Arnold Drive Extension
Dover AFB, DE 19902-6600
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McClellan AFB National Test Site
Lim Lu
SM-ALC/EMR
5050 Dudley Blvd., Suite 3
McClellan AFB, CA 95652-1389
PHONE: 916-643-0830 ext. 466
FAX: 916-643-0827/5880
E-MAIL: jim.lu@mclellan.af.mil

Navy Port Hueneme National Test Site
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Website: http://www.serdp.org

Naval Environmental Leadership Program

The Naval Environmental Leadership Program (NELP) seeks to expedite cleanup and compliance at the Naval Air Station North Island, San Diego, California, and Naval Station Mayport, Jacksonville, Florida, using innovative technologies and focused management. The two NELP bases serve as prototypes for identification, development, testing, implementation, evaluation, and refinement of new initiatives and export of successful applications for implementation as part of the Navy's Environmental Management Program.

Interested public or private sector parties with innovative technologies that may be implemented at full-scale to address environmental problems at the two NELP bases and that address problems of concern in the Navy-wide environmental management program may be eligible to participate in NELP. Innovative technologies are selected and included in the program through a variety of mechanisms. The NELP Initiative solicits proposals for innovative technologies via the *Commerce Business Daily*.

NELP emphasizes full-scale technology implementation to solve an environmental problem at one of the NELP bases. It is not an R&D program; however, the NELP Initiative may serve as a host for technology demonstrations if the developer requires a demonstration site, once the NELP base meets the requirements for a successful demonstration, and funding is provided by the developer or other source. Successful demonstrations will lead to full-scale implementation at the NELP base and within the execution of the Navy's Installation Restoration Program.

Contact: Naval Facilities Engineering Command
Washington Navy Yard
Building 33
901 M Street SE
Washington, DC 20374

Website: http://www.nasni.navy.mil/nelp/

Strategic Environmental Research and Development Program

Coordinating Agency: U.S. Department of Defense

Participating Agencies: U.S. Department of Energy, U.S. Environmental Protection Agency

The Strategic Environmental Research and Development Program (SERDP) is a multiagency program funded through the Department of Defense. SERDP responds to environmental needs of DoD, along with those it shares with the Department of Energy, the Environmental Protection Agency, and other federal government agencies.

SERDP seeks to identify, develop, demonstrate, and transition technology for four thrust areas. The four thrust areas correspond to the four pillars of DoD's Environmental Quality Program: including environmental cleanup technology. The cleanup technology thrust area focuses on conducting research and development to achieve more effective and efficient environmental characterization, assessment, monitoring, and cleanup of soil, sediment, groundwater, surface water, and structures contaminated by past defense practices with hazardous materials (including unexploded ordnance), and toxic substances. The cleanup technology area also seeks to:

- develop cost-effective methods to determine fate, transport, and effects of contaminants related to defense activities;

- develop risk-based modeling methods for establishing cleanup priorities; and

- facilitate transfer of technology to field use by means of the proof-of-principle demonstration of R&D projects, particularly at the SERDP National Environmental Technology Test Sites.

On an annual basis, SERDP solicits proposals from the federal and private sector in the areas of site characterization, monitoring, remediation, and risk assessment. Each year, specific statements of needs are issued. For current topics of interest and information on how to become involved, please see the SERDP web site.

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Unexploded Ordnance Technology Demonstration Program

The Congressionally funded Unexploded Ordnance (UXO) Technology Demonstration Program has established technology performance baselines by demonstrating and highlighting the strengths and capabilities of numerous UXO technologies.

The U.S. Army Environmental Center, in partnership with the Naval Explosive Ordnance Disposal Technology Division, has conducted over 76 demonstrations of UXO detection and remediation technology. Phase I, Phase II and Phase III were conducted in 1994, 1995 and 1996 at the U.S. Army Jefferson Proving Ground in Madison, Indiana. These demonstrations were performed on a controlled test site containing a known baseline of emplaced, inert ordnance.

Additional technology demonstrations were conducted during 1995 at five sites throughout the United States that contained live ordnance. JPG Phase IV demonstrations, which focused on discrimination technologies, were conducted in FY98/99. The JPG Program has been structured to demonstrate and evaluate systems, which are used for detection, identification and remediation of UXO.

The primary objective of te UXO demonstration program is to evaluate, establish, and advance UXO technology performance. Prior to this, no broad technology performance baseline existed. A framework has been established to better understand and assess UXO technology. Additionally, program demonstrators have benefitted from target data feedback that has enabled them to better undertake or continue system improvements—and successful performance at JPG has been an effective marketing tool. The primary focus of the Phase IV effort was to document state-of-the-art for discrimination and classification techniques.

Results of the Phase III demonstrations show that overall technology detection rates have improved since the initial Phase I Demonstration Program (1994) and that state-of-the-art prototype technology is capable of detecting over 95% of emplaced ordnance. However, significant technology limitations still exist.

The Phase IV efforts have documented the baseline capabilities and limitations of current technologies for target discrimination. Current technologies have limited capabilities to efficiently discriminate ordnance from non-ordnance. However, the groundwork has been laid to develop this capability in the future. The combined capabilities to detect, discriminate, and remediate will significantly reduce the overall cost of UXO clearance by reducing the number of anomalies, which must be dug.

Details of the multi-phase demonstration programs can be found in published reports. The most recent document is entitled, *UXO Technology Demonstration Program at Jefferson proving Ground, Phase III*, April 1997. The Phase IV report will be available Spring 2000. These reports and additional information can be obtained by contacting USAEC's hotline, or by e-mail.

Contact: U.S. Army Environmental Hotline
(800) USA-3845, DSN 585-1699

Website: http://aec.army.mil/prod/usaec/et/uxo/jpgfs.htm

U.S. Army Environmental Center

The U.S. Army Environmental Center (USAEC) is a field operating agency of the Department of the Army Headquarters. USAEC provides the tools and programs that prepare soldiers, installation, major commands and Army Headquarters to protect readiness and quality of life through sound environmental stewardship. USAEC's skilled team includes professionals in engineering, physical science, technology, chemistry, biology, geology, archeology, history, safety, health, law, resource management, information systems and public affairs. USAEC also works with Army, government, public and private-sector experts to provide cost-effective support for military environmental programs.

The U.S. Army Environmental Center's commitment to stewardship contributes directly to the Army's ability to achieve its mission goals—whether it is devising innovative ways to sustain training areas, helping installations prevent pollution or developing cost-effective strategies for meeting environmental compliance requirements. USAEC's pollution prevention programs help major commands and installation invest in new ways to protect resources, meet environmental requirements and maintain readiness.

USAEC's environmental technology demonstration and transfer programs provide the innovative tools of tomorrow to the hands of today's Army. These initiatives enable the Army to test and implement cost-effective technologies in pollution prevention, conservation, compliance and restoration. To support these efforts, USAEC maintains the database for environmental technologies requirements and is responsible for the transfer of emerging technologies to meet Army installations' requirements. USAEC administers technical demonstrations of technologies resulting from research in Army laboratories and the private sector.

The focus of Army technology investments and the technology transfer efforts of USAEC is on Army- or military-unique research requirements. For example, Army restoration research and development and technology transfer efforts currently focus primarily on unexploded ordnance and explosives compounds technologies.

USAEC looks closely at range activities and devises ways we can be better stewards of this land so the Army can continue to use these valuable areas well into the 21st century. Partnerships between the Army's environmental, training and materiel-development communities apply the latest pollution prevention, compliance and conversation techniques to range operations.

USAEC's restoration oversight managers work with major commands and installations to find practical and cost-effective solutions to cleanup challenges—devising ways to protect people and the environment while saving resources and ensuring Army readiness.

Contact

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Website: http://aec.army.mil

U.S. Department of Energy R&D Assistance Programs

Industry and University Programs Area

The mission of the Industry and University Programs Area is to identify and provide development support for technologies that show promise in addressing DOE's Environmental Management (EM) needs, but require proof-of-principle experimentation and already proven technologies in other fields that require critical path experimentation to demonstrate feasibility for adaptation to specific EM needs.

The underlying objective is to ensure that private industry, other Federal agencies, and universities are major participants in developing and deploying new and emerging technologies. Tools used to achieve this objective include Program Research and Development Announcements (PRDAs, see p. 22), Research Opportunity Announcements (ROAs, see p. 22), Cooperative Research and Development Agreements (CRADAs), other grants, and inter-agency agreements (IAGs).

Contact: Jeffrey Walker
U.S. Department of Energy
19901 Germantown Road
Germantown, MD 20874-1290
301-903-7966
301-903-7457 fax

Program Research & Development Announcements/Research Opportunity Announcements

Program R&D Announcements (PRDAs) and Research Opportunity Announcements (ROAs) are DOE's major assistance vehicles for developing technologies. PRDAs solicit a broad mix of proposals where R&D, including demonstration, testing, and evaluation, is required within broadly defined areas of interest. DOE may issue a PRDA in response to an individual program need, such as the cleanup of a particular contaminant at a specific site. Multiple awards for proposals, which may have varied approaches or concepts, generally are made. Numerous PRDAs may be issued each year.

ROAs solicit industry and academic proposals throughout the year ("rolling admissions") for potential contracts in applied research. ROAs support research efforts for the development of technologies with potential application in the EM program. A proposed technology should improve DOE's capabilities in areas such as *in situ* remediation; detection, characterization, and monitoring; efficient separations technology for radioactive waste; and robotics. ROAs are published in the *Commerce Business Daily*. The program includes some set-asides for small businesses. DOE anticipates making 25-30 awards through an active ROA at its Morgantown facility.

For information on the full range of DOE/EM assistance programs, contact the EM Central Point of Contact (CPOC). The CPOC is a referral service that expedites and monitors private sector interaction with EM. The CPOC can identify links between technologies and program needs and connect potential partners with an extensive network of Headquarters and field program contacts.

Developers can gain more information on DOE's business and research opportunities by obtaining the *U.S. Department of Energy Environmental Cleanup Technology Development Program Business and Research Opportunities Guide* (DOE/EM-0115P). The *Guide* can be obtained from the National Technical Informa-

tion Service (NTIS, see p. 31).

Contact: EM Central Point of Contact
U.S. Department of Energy
19901 Germantown Road
Germantown, MD 20874-1290
800-845-2096
301-903-7238 fax

For information on ROA awards through the Morgantown Energy Technology Center:

Contact: Thomas Martin
304-291-4087

TechCon

TechCon is a DOE program developed to increase the use of commercially available technologies at DOE cleanup sites with an emphasis on technologies that have shown superior performance characteristics. TechCon's mission is to identify, screen, and support the implementation of available environmental technologies from both the private and public sector in the U.S., as well as from international sources.

The TechCon Program works with sites to identify clean-up needs, finds commercially available technologies and services that have proven performance capabilities, matches technologies to needs at DOE sites, and delivers information on these technologies to site personnel. By connecting representatives of technology companies with those at remediation sites, TechCon promotes the use of available technologies and resolves barriers to their field application.

A key to TechCon's success is improving communication among companies, site representatives, and regulators. To that end, TechCon has instituted an e-mail discussion list that is hosted at the Argonne National Laboratory. With over 60 members, including DOE, EPA, and site-contractor and technology-company personnel, this e-mail list facilitates dissemination of information and can expedite the matching of technology needs with commercially available technologies.

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P.O. Box 999
Mail Stop K8-04
Richland, WA 99352
509-372-4278
509-372-4394 fax

Website: http://www.ead.anl.gov/~techcon/index.html

Technology Development Initiative

DOE's Technology Deployment Initiative (TDI) seeks to:

- achieve multiple deployments of cleanup technologies and processes that expedite DOE's environmental management effort,
- obtain third-party validation of cost savings,
- facilitate the reinvestment of cost savings to increase participation in the program, and
- break down barriers to the implementation of new technologies.

Under TDI, technologies selected for participation and deployment support DOE's environmental management mission and provide for multiple applications. Applications include a pricing proposal that compares an estimated cost with that of a baseline technology—the technology should accelerate or reduce the cost of that referenced baseline, or both. Applications must also include a commitment from the proposing DOE site manager. TDI funding is for deployment of commercially ready technologies rather than demonstrations.

Ranking criteria for applicants are divided into four areas: impact/technical approach; business management approach; stakeholder/regulatory management approach; and cost. Incentives for developers to participate in TDI include the availability of funds to accelerate deployment and cleanup, increased visibility for the technologies through deployment and the generation of validated cost savings, multiple state acceptance of the technology, and the opportunity for reinvestment of cost savings.

Contacts:

TDI Team
Jeff Walker - DOE-HQ
Kurt Gerdes - DOE-HQ
Jihad Aljayoushi - DOE-ID
Julie Conner - DOE-ID
Susan Prestwich - DOE-ID

To send regular mail to the TDI program:

(TDI Team Contact Name)
TDI Support Office
502 South Woodruff
Idaho Falls, ID 83401

Fax**:** 208-528-2401
E-MAIL: tdi@wpi.org

Website: http://wastenot.inel.gov/tdi

U.S. Environmental Protection Agency R&D Assistance Programs

Environmental Technology Verification Program

Over the years, EPA has evaluated technologies to determine their effectiveness in preventing, controlling, and cleaning up pollution. EPA has expanded these efforts by instituting the Environmental Technology Verification (ETV) Program to verify the performance of a larger universe of innovative technical solutions to problems that threaten human health or the environment. ETV accelerates the entrance of new environmental technologies into the marketplace by supplying technology buyers and developers, consulting engineers, states, and EPA Regions with high-quality data on the performance of new technologies.

ETV expands past verification efforts, such as the SITE program (see p. 27) for remediation technologies, into multiple pilot areas. In these pilot areas, EPA utilizes the expertise of partner "verification organizations" to design efficient processes for conducting performance tests of innovative technologies. EPA selects its partners from both the public and private sectors including Federal laboratories, States, universities, and private sector facilities. Verification organizations will oversee and report verification activities based on testing and quality assurance protocols developed with input from major stakeholders/ customer groups associated with the technology area.

Verification under ETV means confirmation of the performance characteristics of a commercial-ready environmental technologies through the evaluation of objective and quality assured data. ETV's targeted customers are:

- Technology users and purchasers
- Technology enablers
  - permitters, regulators
  - consulting engineers
- Technology developers and vendors

Each pilot will announce its intention to begin accepting technologies for verification in the *Commerce Business Daily* and in the trade press. The pilot areas include the Consortium for Site Characterization Technology (see NETTS program p. 16). By the year 2000, EPA envisions that the ETV program will be comprised of numerous public and private testing entities covering all major classes of environmental technology.

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1200 Pennsylvania Avenue N.W.
Washington, DC 20460
202-260-2600

Website: http://www.epa.gov/etv/

National Center for Environmental Research

The EPA National Center for Environmental Research (NCER), administered by the EPA Office of Research and Development, has primary responsibility to issue and manage research grant and fellowship programs designed to expand EPA's science and technology base and the pool of qualified environmental professionals. NCER also serves as EPA's focal point on quality assurance and peer review. NCER is comprised of four divisions:

- Environmental Engineering Research
- Environmental Sciences Research
- Quality Assurance
- Peer Review

The Environmental Engineering Research Division (EERD) is responsible for planning, administering, and managing the following programs:

- grants for research projects and centers in the engineering disciplines relevant to public health and ecosystem protection;
- EPA's participation in the Small Business Innovation Research Program (see p. 14) and the Strategic Environmental Research and Development Program (see p. 18); and
- coordination of ORD efforts in support of the EPA-wide Common Sense Initiative.

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Website: http://es.inel.gov/ncerqa/

Remediation Technologies Development Forum

The Remediation Technologies Development Forum (RTDF) was established in 1992 by EPA to identify ways of working together with industry to solve complex hazardous waste remediation problems. The RTDF is open to all interested parties and has grown into a consortium of partners from private industry, government agencies, and academia who share the common goal of developing more effective, less costly hazardous waste characterization and treatment technologies. RTDF partnerships undertake research, development, demonstration, testing, and evaluation efforts to achieve common cleanup goals.

The RTDF advances the development of cost-effective technologies for the remediation of hazardous wastes, and works to achieve these goals by:

- identifying priority remediation technology development needs;

- establishing and overseeing action teams to plan and implement collaborative research projects to address these needs; and
- addressing scientific, institutional, and regulatory barriers to innovative treatment technologies.

RTDF members establish self-managed action teams that bring members together to work on their highest priority problems. These teams define technology research needs, develop and implement research project plans, and produce and disseminate scientifically credible results to facilitate broad acceptance of the technology.

EPA facilitates the operation of the Action Teams and the RTDF Steering Committee, and contributes its research efforts to the jointly-led projects. EPA provides funding for RTDF research activities and Action Team meetings. Other federal agencies, industry, and academic participants also provide funding, laboratory, and field support for Action Team projects. Participants in each Action Team provide funding and/or in-kind support for the Team's research efforts.

RTDF is currently made up of seven Action Teams:

Bioremediation Consortium
IINERT Soils-Metals Action Team
In Situ Flushing Action Team
Lasagna™ Consortium
Permeable Barriers Action Team
Phytoremediation of Organics
Sediments Remediation Action Team

Contacts:

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Dr. Walter W. Kovalick, Jr.
Technology Innovation Office (5102G)
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue N.W.
Washington, DC 20460
703-603-9910

Website: http://www.rtdf.org

Superfund Innovative Technology Evaluation Program

The Superfund Innovative Technology Evaluation Program was established by EPA's Offices of Research and Development (ORD) and Solid Waste and Emergency Response (OSWER) to promote the development and use of innovative technologies to remediate Superfund sites. The SITE Program places a special emphasis on demonstrating technologies, including support for bench-scale through pilot-scale and field-scale demonstrations, and includes reports of cost and performance data. The SITE Program consists of three major components to achieve these goals: a Demonstration Program; an Emerging Technology Program; and a Monitoring and Measurement Technologies Program.

The Demonstration Program generates performance, engineering, and cost data through innovative technology demonstrations. EPA publishes an annual solicitation for proposals from developers to demonstrate their technologies. Typical demonstrations take place at Superfund sites. Under the Program, the cost of the demonstration is split between the vendor and EPA. The vendor pays for the operation of the demonstration, while EPA pays for all planning, sampling, and analysis. EPA also reports the results of the demonstration.

The Emerging Technology Program supports bench-scale and pilot-scale development and testing of innovative treatment technologies. EPA publishes an annual solicitation for proposals from developers.

The Monitoring and Measurement Technologies Program supports the development and demonstration of innovative field technologies that monitor or measure hazardous substances.

Over the years, the SITE Program has completed demonstrations and issued reports for over 100 technologies. The advent of environmental technology development and commercialization as national priorities in the last few years, along with the initiation of other EPA environmental technology programs, has led EPA to review and reconsider the future role of the SITE Program in the overall federal environmental technology strategy. For this reason, participation in the SITE Program by new partners has been temporarily suspended.

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FEDERAL SITE REMEDIATION TECHNOLOGY DEVELOPMENT ELECTRONIC DATA BASES

U.S. Department of Commerce

National Technical Information Service (NTIS) Bibliographic Data Base

The National Technical Information Service (NTIS) Bibliographic Data Base is a self-supporting agency of the U.S. Department of Commerce and is the largest single source for public access to federally produced information. NTIS is the federal agency charged with collecting and distributing federal scientific, technical, and engineering information. The NTIS collection covers current technologies, business and management studies, foreign and domestic trade, environment and energy, health, social sciences, general statistics, and hundreds of other areas. When federal agencies and their contractors forward reports and other items to NTIS, these items are entered into the NTIS computerized bibliographic data base and become part of the NTIS archive.

The NTIS bibliographic data base contains data about federal data and software files, U.S. government inventions available for licensing, reports on new technologies developed by federal agencies, federally generated translations, and reports prepared by non-U.S. government agencies. An increasing proportion of the data base consists of unpublished material originating outside the U.S. Most NTIS records include an abstract.

Contact: National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
703-487-4650
703-321-8547 (fax)

Website: http://www.ntis.gov

U.S. Department of Energy

DOE R&D Project Summaries Web Data Base

Access to over 12,000 R&D projects currently ongoing within the DOE can be found within this application. Projects pertaining to Departmental activities in energy research, fossil energy, environmental management, and energy efficiency and renewable energy, are some of the R&D disciplines found in the database.

The DOE R&D Project Summaries application, developed by the Office of Scientific & Technical Information, contains a subset of the Department's FY 1995/1996 R&D holdings. Only projects contained in the DOE R&D Tracking Database System with a Funding Mechanism of Managing and Operations (M&O), Grant, Contract, Cooperative Agreements (Non-CRADA), or Small Business Innovative Research (SBIR) are now available through this application. Additional R&D information such as Work For Others, Lab Directed R&D, or the remaining DOE Only R&D information is accessible to Department of Energy entities through the R&D Client/Server interface with the appropriate security levels.

Over 75% of the total Department's R&D holdings are available through this Web based application. Project descriptions and other information about the projects may be viewed after performing a quick search, topical search, or an advanced search.

Website: http://www.doe.gov/rnd/dbhome.html

New Technology from DOE

New Technology from DOE (NTD) contains brief descriptions of Department of Energy research results that have potential for commercialization by U.S. industries. This data base is the centralized source of online information on DOE technical innovations and advancements.

Each NTD record includes a technology description, patent status, secondary or spinoff applications, literature citations, DOE laboratory and sponsoring information, subject descriptors, and a contact for further information. The NTD currently contains 1200 records from 1986 to the present. It is anticipated that older records dating from 1983 will be added to the data base.

Contact: Integrated Technical Information System
U.S. DOE Office of Science and Technical Information
P.O. Box 62
Oak Ridge, TN 37831
615-576-1222

The data base is available to DOE and its contractors through the Integrated Technical Information System (ITIS). Public access is provided through the National Technical Information Service's Technology Transfer Program (see p. 31) .

ReOpt: Electronic Encyclopedia of Remedial Action Options

ReOpt provides information about remedial technologies drawn from DOE, EPA, and industry sources. ReOpt provides descriptions of over 100 technologies, breaking the information into categories, including application and regulatory information for nearly 850 contaminants. ReOpt was developed as part of DOE's Remedial Action Assessment System project.

For each technology, ReOpt contains information for the following categories:

Flow diagram
Description
Engineering or Design Parameters
Contaminant Applicability
Data Requirements
Associated Technologies
Technical Constraints
Regulatory Constraints
References
Previous Applications

ReOpt allows users to search by media, contaminant, and the functional manner in which the user wants to restore the site (such as, *in situ* treatment) to focus the analysis of those technologies potentially applicable to the scenario.

The system is available on diskette for Federal staff and contractors under a Limited Government License from the Energy Science and Technology Software Center (ESTSC). Others may purchase ReOpt through Sierra Geophysics in Kirkland, Washington, (1-800-826-7644, ext. 120).

Contact: Energy Science and Technology Software Center
615-576-2606

or

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Pacific Northwest National Laboratory
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Richland, WA 99352
Phone: (509) 375-3765
Fax: (509) 375-6417
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ReOpt FAX Hotline:
509-375-6417

U.S. Environmental Protection Agency

Bioremediation in the Field Search System

The Bioremediation in the Field Search System (BFSS) provides information on waste sites across the country where bioremediation is being tested or implemented or has been completed. BFSS users can search the database electronically, view data on specific types of bioremediation sites, and print reports of selected information. Registered users also receive EPA's quarterly *Bioremediation in the Field* bulletin.

BFSS currently provides information on *ex situ* and *in situ* technologies at more than 160 bioremediation sites nationwide. The database includes full-scale remediation efforts and treatability and feasibility studies that cover sites under EPA's CERCLA, RCRA, TSCA, and UST authority. Data for sites include location, media, contaminants, and cost and performance. BFSS is available online through the ATTIC (see p. 39) and CLU-IN (see p. 39).

RREL Treatability Data Base

The Treatability Data Base provides a thorough review of the effectiveness of proven treatment technologies in the removal or destruction of chemicals from media such as municipal and industrial wastewater, drinking water, groundwater, soil, debris, sludge, and sediment. The data base includes only those technologies that are commercially available. The data base is distributed to federal, state, and local governments, foreign governments, academia, industry, and many other groups.

The data base is organized by chemical. For each compound, the data base includes:

Physical/Chemical Properties
Freundlich Isotherm Data
Aqueous and Solid Treatability Data
Scale (Bench, Pilot, or Field)

Average Concentration of Contaminants in Influent and Effluent
Average Percentage of Removal
Reference Citations with a Reference Abstract

The RREL Treatability Data Base is searchable online through ATTIC (see page 39) and downloadable from CLU-IN (see page 39).

Vendor Information System for Innovative Treatment Technologies/Vendor Field Analytical Characterization Technology System

The Vendor Information System for Innovative Treatment Technologies (VISITT) contains technical information submitted by vendors of innovative treatment technology equipment and services. The Vendor Field Analytical Characterization Technology System (VendorFACTS) contains similar information on field analytical characterization technologies. These systems are designed for use by hazardous waste cleanup professionals wishing to learn about the application and performance of these technologies.

VISITT and VendorFACTS contain data on vendors of innovative remediation technologies to characterize and treat ground water *in situ*, soils, sludges, and sediments. The systems do not include established technologies, such as incineration and *ex situ* groundwater treatment. Technologies may be at the bench-, pilot-, or full-scale. Each profile includes company information, technology description, and applicable media, wastes, and contaminants. Other information may include unit costs, performance, waste limitations, hardware and capacity, project names and contacts, treatability study capabilities, and references.

VISITT and VendorFACTS are free and available through ATTIC (see p. 39) and CLU-IN (see p. 39). The systems are also available on diskette from EPA's National Center for Environmental Publications and Information (NCEPI, see p. 40).

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FEDERAL ELECTRONIC RESOURCES FOR SITE REMEDIATION TECHNOLOGY INFORMATION

Federal Remediation Technologies Roundtable

The Federal Remediation Technologies Roundtable (FRTR) is an interagency executive committee made up of Federal agencies with hazardous waste cleanup responsibilities. The Roundtable was created to facilitate the exchange of information and provide a forum for joint action regarding the development and demonstration of innovative technologies for hazardous waste remediation. Roundtable member agencies expect to complete many site remediation projects in the near future, and recognize the importance of providing expedited access to Federal resources for technology developers and others interested in innovative technology development. As part of this effort, FRTR has established a website to provide access to FRTR products and publications.

Resources available on the FRTR website:

- Information on cost and performance data reporting, including the Guide to Documenting Cost and Performance for Remediation Projects and Case Study Abstracts.
- Remediation Technologies Screening Matrix and Reference Guide, Version 3.0, an online "yellow pages" of remediation technologies that screens and evaluates candidate cleanup technologies to assist remedial project managers (RPMs) in selecting among remedial alternatives.
- Completed North American Innovative Remediation Technology Demonstration Projects Data Base.

Website: http://www.frtr.gov.

U.S. Department of Defense

Defense Environmental Network and Information Exchange

The Defense Environmental Network and Information Exchange (DENIX) serves as a centralized communication platform for disseminating environmental information pertaining to DoD's environmental security mission area. It fosters online communications and technology transfer among DoD components. DENIX contains a messaging component as well as the capability for file transfers. DENIX includes information on cleanup technologies, policies, and regulatory information.

Website: The public may access DENIX at http://denix.cecer.army.mil/denix/Public/public.html.

Fielding Environmental Solutions

Fielding Environmental Solutions is a monthly electronic newsletter provided by the U.S. Army Environmental Center. This free service highlights technology information, new publications, and events of interest to environmental users. On the first of each month, messages are disseminated that provide information on environmental technologies, the availability of publications, and the status of upcoming events. These short messages not only give a synopsis of the information, but also inform the reader about how to obtain further information.

Fielding Environmental Solutions serves as an effective technology transfer tool to bridge the gap between the developers, regulators, and users of innovative technologies. The information exchanged cuts across all pillars and activity areas.

USAEC projects and programs are not the only items highlighted by Fielding Environmental Solutions. Often different services, major commands, organizations, or installations provide stories or serve as guest editors. Fielding Environmental Solutions is a forum for users to share success stories and problems with others in the environmental community.

Website: For subscription information or to submit articles for publication, contact: http://aec.army.mil/prod/usaec/et/listweb.htm or the newsletter administrator at t2hotline@aec.apgea.army.mil.

Technology Summary Sheets

The Air Force Research Laboratory Airbase and Environmental Technology Division (AFRL/MLQ) has developed Technology Summary Sheets (TSSs) to publicize its research and development programs. The TSSs describe capabilities, facilities (both laboratory and test sites), research interests, collaborative efforts, and the major research projects and programs completed or underway in the Division. These summary sheets identify new technologies, provide information on how technologies are applied, and give results of completed projects or the status of on-going projects. They also provide the name and telephone number of project managers if additional information is needed.

Website: The TSSs, along with software, technical reports, protocols, and manuals can be accessed through the AFRL/MLQ web page at: http:\\www.ml.afrl.af.mil/divisions/mlq/mlq.htm.

U.S. Department of Energy

Environmental Technologies Remedial Actions Data Exchange (EnviroTRADE)

The Environmental Technologies Remedial Actions Data Exchange (EnviroTRADE) is an international information system that matches environmental problems with potential technological solutions by combining information management techniques, graphical interfaces, and the Geographical Information System (GIS). EnviroTRADE was developed to identify domestic and international environmental technology market opportunities.

EnviroTRADE contains both foreign and domestic technologies and needs profiles. Users can identify possible matches between worldwide environmental restoration and waste management needs and technologies. EnviroTRADE will also provide general information on international environmental restoration and waste management organizations, sites, activities, funding, and contracts. The system is user friendly, providing visually oriented information such as photographs, graphics, maps, and diagrams of technologies and sites. The system has expanded into a fully functional GIS.

Website: http://em-50.em.doe.gov/et/et.html

U.S. Environmental Protection Agency

Alternative Treatment Technology Information Center

The Alternative Treatment Technology Information Center (ATTIC) is a free computer bulletin board and data base system providing up-to-date information on innovative treatment technologies. ATTIC provides access to several independent databases as well as a mechanism for retrieving full-text documents of key literature. The bulletin board features news items, bulletins, computer files, and a messaging system that enables users to communicate and request advice from another users and to seek help from the system operator. ATTIC can be accessed with a personal computer and modem.

Data bases available through ATTIC include:

ATTIC Treatment Technology Database
RREL Treatability Database (see p. 33)
Bioremediation in the Field Search System (BFSS) (see p. 32)
Vendor Information System for Innovative Treatment Technologies (VISITT) (see p. 34)
Underground Storage Tank (UST) Database
Oil/Chemical Spill Database

The dial-in number for ATTIC is (513) 569-7610. The FTP and Telnet address is cinbbs.cin.epa.gov.

ATTIC support line:
(513) 569-7272

Website: http://www.epa.gov/attic/index.html

Hazardous Waste Cleanup Information System

The Hazardous Waste Cleanup Information (CLU-IN) site is a comprehensive information resource designed to assist hazardous waste cleanup professionals in finding the latest information on innovative hazardous waste treatment technologies, including information on programs, organizations, publications, and access to data bases and other tools for cleanups. CLU-IN users include EPA staff, other federal and state personnel, consulting engineers, technology vendors, remediation contractors, researchers, community groups, and the public.

CLU-IN features include the following:

Data bases that can be searched or downloaded, including:
Bioremediation in the Field Search System (BFSS) (see p. 32)
RREL Treatability Database (see p. 33)
Vendor Information System for Innovative Treatment Technologies (VISITT) (see p. 34)
Vendor Field Analytical Characterization Technology System (VendorFACTS) (see p. 34)

TechDirect, an information service that highlights new publications and events of interest to site remediation and site assessment professionals.

Publications for downloading on a wide variety of subjects related to hazardous waste cleanup, including remediation technologies, site characterization technologies, supply and demand of technologies, partnerships and consortia, and regulatory and policy issues.

CLU-IN System Operator
301-589-8368
301-589-8487 (fax)

Website: http://clu-in.com.

National Center for Environmental Publications and Information

The National Center for Environmental Publications and Information (NCEPI) is a central repository for all EPA documents with over 5500 titles in paper and/or electronic format, available for distribution. Titles may be searched and ordered via the Internet. Publications may also be ordered by calling 1-800-490-9198.

Website: http://cioma40.cin/epa.gov:6003.

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OTHER ELECTRONIC RESOURCES FOR SITE REMEDIATION TECHNOLOGY INFORMATION

Global Network for Environmental Technology

The Global Network of Environment & Technology (GNET) utilizes the latest communications technology to bring together the people, processes, and policies that shape environmental business. GNET provides services to enhance efforts to communicate, exchange information, and conduct business. GNET was developed by the Global Environment & Technology Foundation (GETF), a not-for-profit organization sponsored in part by DOE's Global Environmental Technology Enterprise initiative. GNET was created to promote the commercialization of innovative environmental technologies to achieve environmentally sustainable development. GNET provided an interactive communications service for the White House's Technology for a Sustainable Future Initiative, bringing together high-level environmental decision-makers and facilitating development of the national environmental technology strategy, "Bridge to a Sustainable Future." GNET services are used by the Interagency Environmental Technologies Office, governmental agencies, businesses, and individuals in the environmental technology field. Membership in and information from GNET and GETF are free.

The GNET website has the following features:

TechKnow™ Data Base—TechKnow™ provides environmental technology information using a targeted search capability that combines multiple category schemes, including contaminant groups, affected media and other keywords.

Environment & Technology NewsBriefs—Environment & Technology NewsBriefs is a round-up of summaries of the top stories in the environmental business field culled from over 750 published sources.

Environment & Technology Business Forum—GNET members can interact on-line with top policy makers and executives through the monthly Environment & Technology Business Forum.

Contact: Global Environment & Technology Foundation
7010 Little River Turnpike, Suite 300
Annandale, Virginia 22003
703-750-6401
703-750-6506 (fax)
Email: GETF@gnet.org

Website: http://www.gnet.org

Groundwater Remediation Technologies Analysis Center

The Groundwater Remediation Technologies Analysis Center (GWRTAC), established in 1995, is a specialized national environmental technology transfer center that provides current information concerning innovative groundwater remediation technologies. GWRTAC is operated by the National Environmental Technologies Applications Center (NETAC), in association with the University of Pittsburgh's Environmental Engineering Program, under a Cooperative Agreement with the U.S. EPA Technology Innovation Office (TIO). GWRTAC compiles, analyzes, and disseminates information on innovative groundwater remediation technologies and offers a wide range of information on the state of development of all emerging groundwater remediation activities through a website that provides access to searchable case study databases and pertinent technical documents. Information resources include:

Technology Database—Searchable database that contains case study information on groundwater remediation technologies including project location, target contaminants, site characterization, and project contacts.

Vendor Information Database—Database that allows interested parties to locate remediation technology developers and service providers. Links to vendors are included in the Vendor Information database portion of the website. Potential vendors can request submittal through on-line forms.

Technology Evaluation Reports—Peer-reviewed reports, prepared by experts, that provide state-of-the-art reviews of selected remediation technologies.

Information Reports—A variety of reports that review trends in technology utilization, regulatory issues and perspectives, state policies, and sources of information.

Technology Overview Reports—GWRTAC authored reports that provide a general overview and brief introduction of specific groundwater remediation technologies.

Status Reports—A snapshot of the status and current development efforts of emerging technologies, prepared by GWRTAC, EPA-TIO, and others.

Contact: GWRTAC
615 William Pitt Way
Pittsburgh, PA 15238
800-373-1973
412-826-5512 ext. 215
E-mail: gwrtac@netac.org

Website: http://www.gwrtac.org

National Technology Transfer Center

The National Technology Transfer Center (NTTC) at Wheeling Jesuit University works with federal entities like NASA, EPA, Department of Defense, Department of Energy, Department of Justice, Department of Commerce, universities, entrepreneurs and Fortune 500 companies in presenting effective ways to help U.S. corporations and taxpayers access and use federally-financed technologies. NTTC's task is to take technologies off laboratory shelves and put them to work in U.S. businesses and industries. The NTTC website provides a large number of links to electronic technology resources.

Contact: National Technology Transfer Center
Wheeling Jesuit University
316 Washington Avenue
Wheeling, WV 26003
800-678-6882

Website: http://www.nttc.edu/

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EPA 540-R-96-500

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EPA 540-R-95-533

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EPA 540-F-95-506B

Bioremediation Field Initiative Site Profile: Hill Air Force Base Superfund Site, UT
EPA 540-F-95-506C

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EPA 540-F-95-506D

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APPENDIX

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U.S. Department of Defense

U.S. AIR FORCE

GENERAL INFORMATION:
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U.S. NAVY

DEMONSTRATION PROGRAMS:
Ted Zagrobelny
Naval Environmental Leadership Program
703-325-8176

U.S. Department of Energy

RESEARCH PROGRAMS:
Office of Technology Development
301-903-7911

DEMONSTRATION PROGRAMS:
Office of Technology Development
301-903-7917

SMALL BUSINESS TECHNOLOGY INTEGRATION:
Office of Technology Development
301-903-7449

COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS:
Office of Technology Development
301-903-7900

U.S. Environmental Protection Agency

GENERAL INFORMATION:

Site Cleanup Technologies:
Technology Innovation Office
703-603-9910

Cleanup Technologies for Sites Contaminated with Radioactive Material:
Office of Radiation Programs
202-654-9350

RESEARCH PROGRAMS:

General Information:
National Risk Management Research Laboratory
513-569-7418

Grants Information:
National Center for Environmental Research and Quality Assurance (NCERQA)
202-260-4073

COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS:
National Risk Management Research Laboratory
513-569-7960