

# **Report to Congress Coordination of Programs That Foster Public and Private Sector Development of Environmental Technologies**

## **1. Introduction**

In the FY 2003 House Appropriations Conference Report 108-10, page 1438, Congress directed the Environmental Protection Agency (EPA) to "*develop a 'one-stop shop' office to coordinate similar programs which foster private and public sector development of new, cost-effective environmental technologies.*" This report describes EPA's response to this directive.

EPA has six primary programs that provide support to the public and private sector for the development of new, cost-effective technologies. These technology development programs, described herein, are all managed and coordinated through a single office, EPA's Office of Research and Development (ORD). Thus, a "one-stop-shop" office already exists to assist outside organizations seeking assistance in developing new technologies. ORD's technology support programs, as described herein, are integrated and complementary, and provide a continuum of support from early stage research to late stage commercialization. EPA technology programs in other program offices are presented in Appendix B.

However, more can be done to communicate these ORD technology development support programs and to provide a visible, single point of access to them for those seeking assistance. In addition, more can be done to guide users to the various other types of technology programs and information at the Agency. This includes information on available technologies to address certain pollutants or certain media, or information on programs in other parts of EPA that encourage technology innovation through voluntary or incentive programs. A plan to provide one-stop-shop access to all of these technology programs is described in Section 4.

## **2. Background**

### **Support for technology development**

There are three types of programs that EPA's Office of Research and Development (ORD) uses to promote and assist public and private sector interests in developing innovative technologies to address a variety of environmental issues. (EPA also conducts independent research in its laboratories, but this research normally does not involve outside organizations seeking EPA support.)

1. **Financial support** for small and medium-sized private companies or for universities or other not-for-profit organizations to develop new technologies. These include the Small Business Innovation Research (SBIR) program, which provides assistance to small businesses; the Science to Achieve Results (STAR) competitive grants program, which provides support to universities and not-for-profit organizations; and the National Environmental Technology Competition (NETC), which recognizes and rewards innovative and cost-effective technology solutions developed by private companies in high-priority areas.
2. **Independent testing and performance verification** of privately developed, commercial-ready technologies through the Environmental Technology Verification (ETV) program and, for site remediation technologies, through the Superfund Innovative Technology Evaluation (SITE) program.
3. **In-kind support** working collaboratively with private companies or other government laboratories to share facilities and/or expertise in technology development under Cooperative Research and Development Agreements (CRADAs).

Each of these programs is described in more detail in and summarized in Table 1.

In addition to these ORD programs that support technology development, a number of other technology-related programs exist in other parts of EPA. These programs, described in Appendix B, are generally informational, or provide encouragement for voluntary actions to use innovative technologies for environmental improvement.

### **3. Management and Coordination of Technology Development Support Programs**

One of the objectives of a "one-stop-shop" office is to ensure that technology support programs are well integrated and coordinated, and that there is no duplication or wasted resources. The Office of Research and Development has accomplished this for its six technology support programs, as described below. Appendix A provides more detail about each of the programs.

#### **Program Integration and Coordination**

The six programs described below are well-integrated and complementary parts of an overall support network that spans the technology development continuum from early-stage development to final commercialization. Each addresses a unique problem or need that has been identified and raised by technology developers over a number of years as inhibiting their ability to develop and successfully commercialize environmental technologies. The complementary nature of each program is described briefly below, beginning with the early stages of development.

**STAR Research Grants.** Research funding under the Science to Achieve Results (STAR) program addresses the need for pre-competitive research to provide a foundation on which

others in the public, and particularly the private sector, can build. Research results are widely publicized and broadly available. Most private companies, especially small and medium-sized businesses, look to the government for this type of research, because they typically lack the resources to take on riskier research. They tend to focus their efforts on more applied research that will have near-term payback. This research is funded through grants to universities and not-for-profit organizations.

**Small Business Innovation Research (SBIR).** While small businesses have historically accounted for over half of the innovation in the U.S., they often have difficulty getting equity capital for the high risk technology development they conduct. This is a particularly acute problem with regard to environmental technologies, where regulatory changes can quickly change market opportunities. The SBIR program starts with early stage (proof-of-concept) research, but unlike STAR research is applied to a particular proprietary technology, and continues, through Phase II funding, to produce a commercial prototype. To better integrate the SBIR and ETV programs, EPA now offers an option to Phase II recipients to receive an additional \$25,000 to be used toward their cost of technology performance verification through the ETV program.

**Environmental Technology Verification (ETV).** For years, technology developers have been stymied in their efforts to sell new, innovative technologies because potential buyers are often unwilling to take the risk that the technology will not perform as claimed by the developer. The ETV program was created to address this need. To be eligible for testing under ETV, technologies must be commercial-ready. While EPA provides no funding to developers, EPA provides roughly 70 percent of total ETV program costs. This includes financially supporting the management of the third-party test centers, providing quality assurance oversight of the testing, reporting results, and providing outreach. The ETV program is currently evaluating appropriate outcome measures for the program to determine impacts to the environment.

**Superfund Innovative Technology Evaluation (SITE).** The SITE program uniquely addresses technologies for monitoring and cleanup of contaminated sites. SITE focuses on commercial-ready technologies and provides for a field test of the technologies at actual sites using contaminated materials from those sites. The testing and documentation of the technologies is similar to that done in the ETV program (which defers to SITE for remediation technologies). Technology developers are not given funding directly, and must bring their equipment to the site for testing. EPA conducts the testing and documents the results.

**National Environmental Technology Competition (NETC).** The NETC is a program designed to competitively seek the best commercially developed new technologies to cost effectively address certain high-priority National environmental problems, particularly

related to sustainability. EPA looks to identify the best developed technologies and to support their broad application in solving problems. The support for "first users" through longer term field demonstrations has been widely recognized in assuring that technologies are broadly accepted. It is often an important step that extends beyond the ETV performance verification and is appropriate for critical needs such as cost-effective removal of arsenic in drinking water.

**Cooperative Research and Development Agreements (CRADAs).** Unlike research grants under STAR and research contracts under SBIR, EPA does not provide funding under CRADAs. Instead, EPA makes available its unique research facilities and expertise. CRADAs can serve many purposes, but usually are intended to transfer intellectual property or cooperate in final development or testing leading to making a technology commercially available. In some cases these are technologies that EPA has developed in its laboratories that are being licensed to a private company. In others, a private company uses EPA's expertise or facilities to complete final testing or development of their technology.

### **Management of Technology Development Programs**

EPA's Office of Research and Development (ORD) manage all of the programs described above. ORD establishes policies for the programs, ensures that they are well coordinated, and handles all external communications. Budget development and program planning is part of ORD's research planning process. Efforts under all of the programs are included as an integral part of research strategies and multi-year plans that support ORD's GPRA goals and measures. This ensures that the technology development support programs are consistently evaluated and measured in the context of all of EPA's research as well as EPA's and ORD's strategic goals.

The programs reside primarily in two ORD organizational units, the National Center for Environmental Research (NCER) and the National Risk Management Research Laboratory (NRMRL), which report to the Assistant Administrator for the Office of Research and Development. NCER manages the STAR and SBIR programs, and co-manages the NETC program with NRMRL. NRMRL manages the ETV and SITE programs. The CRADA program engages all of ORD's laboratories and centers and is managed by ORD's Office of Science Policy (OSP). ORD has established internal communication mechanisms so that all parties involved with the technology development programs communicate regularly and understand the program functions. In addition, the web sites for NCER, NRMRL, and OSP contain links to the descriptions of these programs and opportunities available through them.

#### 4. Additional Steps

In addition to ensuring that the technology development support programs are well integrated and coordinated, it is important that potential users seeking support from EPA for technology development have a clear, simple, and transparent path to the program(s) that may meet their needs. This also extends to other technology programs and information at EPA. Currently, there is no "environmental technology" link on either the EPA or the ORD home pages or other central source to guide users to the environmental technology programs. Therefore, EPA is taking additional steps to ensure potential users have easier access to these programs including:

**Establish an Environmental Technology Internet Portal.** EPA is establishing a new web link on both the ORD and EPA home pages to serve as a "technology portal." This will make "technology" as a topic clearly visible, and will also include a logical and complete guide to technology programs and information available through EPA, including the ORD technology development support programs. Users who enter this portal will be taken to a user-friendly description of all of the available programs, with cross links to the existing web sites for each separate program. Contact information will also be available. Thus, the technology portal will include links to technology-related programs in any of the Agency's Program or Regional Offices making the site a complete road map or one-stop-shop to technology programs and information in the Agency.

**Establish Single Point of Contact.** To further assist users, contacts and phone numbers will be provided for individual technology support programs, and EPA will establish a single point of contact who can guide and further assist customers in reaching the program and people who can best address their needs.

**Create an Environmental Technology Council.** To enhance the communication and coordination of all EPA technology activities, EPA will establish an Environmental Technology Council that will have membership from all Agency technology programs, offices and regions, and that will meet on a regular basis to discuss technology needs and program synergies.

**Develop a One-Stop-Shop Brochure.** ORD is developing a brochure that will parallel the information in the web site described above for its technology support programs. It will be handed out at conferences and meetings and be available for general distribution.

#### 5. Summary and Schedule

EPA has already consolidated its technology development support programs under a single "one-stop-shop" office—the Office of Research and Development. Each of the six existing programs is unique, and together they are well-integrated, complementary efforts that address specific needs related to technology developers in both the public and private sectors. However, ORD will do more to communicate this information in a way that the programs are transparent to users so that the function of each and the relationships between them can be readily accessed and understood by users. Likewise, users do not now

have an easy way of learning about the other EPA programs and information related to technology. As a result of the Congressional directive, EPA is developing a new web portal on the EPA home page to serve as a one-stop-shop for technology, and is reorganizing all of its technology information under that portal. This will enable any interested party to quickly see the full range of programs, understand which program fits their need, and to get further information and contacts for that program. EPA is developing a brochure for general distribution describing these programs. EPA is also enhancing its coordination across the Agency by establishing an Environmental Technology Council. These efforts will be completed by the end of calendar year 2003.

**Table 1– ORD Technology Development Support Programs**

<b>Program</b>	<b>Type of Assistance</b>	<b>Development Stage</b>	<b>Eligible Entities</b>	<b>Responsible ORD Organization</b>
STAR	Financial support – grants	Pre-competitive	Universities and not-for-profits	NCER
SBIR	Financial support – contracts	Proof of concept to commercial prototype	Small businesses	NCER
ETV	Verification centers and test protocols <sup>1</sup>	Commercial ready	Public or private organizations	NRMRL
SITE	Field performance tests <sup>1</sup>	Commercial ready	Public or private organizations – remediation only	NRMRL
NETC	Demonstrations <sup>1</sup>	Commercialization	Public or private organizations	NCER and NRMRL
CRADA	In-kind	Various	Public or private organizations	Office of Science Policy

<sup>1</sup> Indirect support of performance testing. No direct funding to the entity.

## **Appendix A**

### **EPA Technology Development Support Programs**

#### **Science to Achieve Results (STAR) Research Grants Program**

The Science to Achieve Results (STAR) grants program is EPA's primary program to fund extramural research in environmental science and engineering. Through competitive application and independent peer review processes, STAR funds high-quality scientific research by universities and not-for-profit organizations. Part of the STAR research focus is innovative environmental technologies. Research typically focuses on new, cutting-edge concepts and approaches that provide a foundation—in the form of pre-competitive technology advances—for further support by other Federal agencies, or development by private companies.

The primary innovative technology emphasis of STAR research has been environmentally benign processing and synthesis, often called Green Chemistry and Engineering. For the past seven years, EPA has engaged in a partnership with the National Science Foundation for research in this area under a joint solicitation called Technology for a Sustainable Environment. EPA and NSF have together funded 164 research grants since the partnership began in 1995. These research projects have included replacing hazardous solvents, making chemical reactions occur faster and more efficiently, converting waste biomass into useful products, and carrying out recycling and reuse in production processes. The aim of this research is to minimize or eliminate pollution from industrial processes.

Additional areas under STAR addressing innovative technologies include the Hazardous Substances Research Centers (HSRCs) and the Exploratory Research Grants program. HSRCs conduct research on remediation technologies, including bioremediation. A variety of innovative technology research has been funded under exploratory research and a recent focus has been nanotechnology. These new capabilities can serve many purposes, including improved environmental management. EPA has funded over 30 nanotechnology research projects to date that address monitoring, treatment, remediation, and pollution prevention.

#### **Small Business Innovation Research (SBIR) Program**

EPA is one of ten federal agencies that participate in the SBIR program, which was first mandated by Congress in 1983 under the Small Business Innovation Development Act. A small business is defined as a for-profit organization with no more than 500 employees. EPA's highly competitive SBIR program offers critical financial support to small businesses to develop the best, new, innovative technologies, to address a wide range of environmental problems.

EPA's SBIR program focuses on important areas related to environmental protection including clean air and water, hazardous and solid waste, pollution prevention, remediation, and monitoring. Recent issues addressed include: bio-terrorism, arsenic in drinking water, diesel emissions, and storm water runoff. The SBIR program's technology priorities are generated by the special needs of EPA's regional offices, as well as EPA and state regulatory and compliance needs.

Each year, EPA's SBIR program makes approximately 40 new awards for "proof of concept" (Phase I) and about 15 awards to further develop technologies (Phase II). EPA encourages new firms to take advantage of these opportunities and, in 2000 alone, nearly half of EPA's Phase I contracts were awarded to first-time participants. Dozens of small businesses have successfully developed new technologies and products under the Agency's SBIR program.

Under SBIR EPA issues annual solicitations for Phase I and Phase II research proposals from private science and technology-based firms with fewer than 500 employees. EPA issues Phase I contracts of up to \$70,000 with a period of performance of 6 months and Phase II contracts of up to \$295,000 over 2 years. Available funding from the statutorily required 2.5 percent allocation of extramural research funds usually ranges from \$6–7 million per year.

The selection of SBIR recipients includes a rigorous review to ensure that the projects meet EPA's needs and program priorities, have significant environmental benefits, and have broad application and impact. Review begins with a technical external peer review of the proposal by panels of experts not employed by the Agency. The care taken in the screening process has paid off in strong projects. Numerous SBIR-funded technologies have been successfully commercialized and are making significant contributions to cost-effective environmental protection.

### **Environmental Technology Verification (ETV) Program**

The Environmental Technology Verification program was initiated in 1995 to evaluate the performance of new commercially available environmental technologies so that purchasers, users, and permit writers have the information to make better environmental decisions. Six ETV Centers and one pilot now verify technologies for air, drinking water and water treatment; monitoring in all environmental media; greenhouse gas reduction; building decontamination; and cleaner coatings processes. ETV is a market-grounded verification program, working with over 800 stakeholders in 21 groups who represent a variety of interests, including state and local governments; technology buyers, sellers, and users; professional and trade associations; and the academic, research, and consulting communities. ETV does not rank technologies, compare technology performance, label or list technologies as acceptable or unacceptable, seek to determine "best available technology" or approve or certify technologies.



Working together, stakeholders, technology developers, and ETV partners, develop testing protocols and project specific test plans. Tests are conducted by independent third parties. Appropriate quality assurance procedures are incorporated into all aspects of the process and all reports are subjected to peer review. Verification statements of three to five pages, based on the performance data in the reports, are signed by EPA and the ETV partner, and are posted on the ETV web site. EPA and ETV partners announce verification activities in relevant publications, and on the ETV Web site and ETV LISTSERV. By May 2003, ETV had verified 203 technologies and developed 73 testing protocols across the range of environmental technology categories. EPA believes that the information developed through ETV on new commercially available technologies will aid vendors in selling and making improvements in their products, and help states and purchasers in permitting and purchasing decisions. Technology vendors and other private and public supporters share the program costs. The ETV program is currently evaluating appropriate outcome measures for the program to determine impacts to the environment. The program is also determining whether verifications have increased sales of ETV-verified technologies

### **Superfund Innovative Technology Evaluation (SITE) Program**

EPA's Superfund Innovative Technology Evaluation (SITE) program was established by EPA's Office of Solid Waste and Emergency Response and ORD in response to the 1986 Superfund Amendments and Reauthorization Act, which recognized a need for an "Alternative or Innovative Treatment Technology Research and Demonstration Program." The SITE demonstration program encourages the development and implementation of innovative treatment technologies for hazardous waste site remediation, and monitoring and measurement.

The SITE program has successfully promoted the development, commercialization, and implementation of innovative hazardous waste treatment technologies. The Program offers a mechanism for conducting joint technology demonstration and evaluation projects involving private sector, EPA, and other federal and state agencies. There are currently 192 technology vendors participating in the program. Technology vendors have reported over 3,200 remediation and treatability contract awards after completing the program. In addition, since the inception of the SITE program, cleanup of contaminated sites through the use of innovative technologies has resulted in a total cost savings of over \$2.6 billion.

The SITE program focuses on the remediation needs of the hazardous waste remediation community through program planning; matching priority sites with innovative cleanup solutions; technology field demonstrations; and information dissemination. Engineering and cost data are gathered on the innovative technology so that potential users can assess the technology's applicability to a particular site. Data collected during the field demonstration are used to assess the performance of the technology, the potential need for pre- and

post-processing of the waste, applicable types of wastes and waste matrices, potential operating problems, and approximate capital and operating costs.

At the conclusion of a SITE demonstration, EPA prepares an Innovative Technology Evaluation Report, a Technology Capsule, and a Demonstration Bulletin. These reports evaluate all available information on the technology and analyze its overall applicability to other site characteristics, waste types, and waste matrices. Testing procedures, performance and cost data, and quality assurance and quality standards are also presented. In addition, a report to congress on the SITE program is submitted each year.

### **National Environmental Technology Competition (NETC)**

The National Environmental Technology Competition (NETC) is a new program funded for the first time in the Agency's FY 2003 appropriation. The NETC recognizes and awards innovative and cost-effective technology solutions in high-priority areas that are national in scope where innovation is needed to provide cost-effective solutions (e.g., water quality/water infrastructure, arsenic treatment). The objective of the NETC is to encourage and support the movement of technologies developed by the private sector into actual commercial use. Although several approaches may be employed, the initial focus of this program is to conduct field demonstrations of the best innovative technologies, and to facilitate regulatory acceptance.

The first priority under NETC in FY 2003 is demonstration of technologies for removing arsenic from drinking water supplies serving small communities. Several innovative technologies have been developed to a point of commercial readiness, but will not be accepted by public water authorities and states unless they are proven in the field to meet EPA regulatory requirements and to be reliable. EPA has conducted a competition through a national solicitation to identify the most suitable innovative arsenic treatment technologies for use at seventeen specific potential demonstration sites. The technologies that qualified through an external peer review are in final stages of selection by EPA. Demonstrations covering a full year of operation will lead to the information needed to support wider scale use of the successful technologies. EPA plans to issue a second solicitation for technologies for arsenic removal in drinking water before the end of this fiscal year.

### **Cooperative Research and Development Agreements (CRADAs)**

The Federal Technology Transfer Act (FTTA) provides a mechanism for cooperative research and development partnerships with outside parties such as industry consortia, academia, trade associations, and state and local agencies. Large, medium, and small-sized firms engaged in environmental research have entered into FTTA cooperative research and development agreements (CRADAs) with EPA and continue to leverage EPA's technical

resources to conduct joint research and technology commercialization. These partnerships include:

**Access to EPA laboratory facilities.** By entering into CRADAs, private sector entities can avail themselves of the benefits of conducting research in EPA's scientific facilities, such as hazardous waste test and evaluation facilities, an indoor air chamber facility, and automated test equipment.

**Collaboration with EPA scientists and engineers.** EPA research laboratories employ outstanding scientists and engineers, studying a wide range of environmental issues and potentially beneficial technologies.

**Opportunities for licensing of patented technologies.** Under some CRADAs, companies are given the exclusive right to market and commercialize new technologies that result from the collaboration with EPA.

CRADAs are negotiated agreements between specific laboratories and private sector organizations that outline the terms and conditions under which work will be performed. CRADAs set out the resources to be provided by each party and often contain provisions regarding licensing, commercialization, and patent development. Under CRADAs, EPA laboratories cannot transfer funds to the cooperating partner, but are permitted to exchange personnel, equipment, or services. A CRADA is flexible and can be adapted to fit the goals of a variety of organizations.

EPA typically enters into approximately ten to twenty CRADAs per year. These partnerships have enabled the commercialization and licensing of EPA-developed technologies ranging from a process that measures more than 130 species of toxic molds and fungi in indoor air, to a new software that designs solvents and mixtures using technological and environmental performance measures. EPA is currently evaluating how CRADAs enable commercialization of technologies. EPA is also considering the percentage cost share of CRADA partners as an efficiency measure.

## **Appendix B**

### **Other EPA Technology Programs**

#### **Recognition and Incentive Programs**

**Energy Star** is a government-backed program helping businesses and individuals protect the environment through superior energy efficiency. (Office of Air and Radiation)

**Design for the Environment** partnership projects promote integrating cleaner, cheaper and smarter solutions into everyday business practices. (Office of Prevention, Pesticides and Toxic Substances)

**Green Chemistry Challenge** promotes innovative chemical technologies that reduce or eliminate the use or generation of hazardous substances in the design, manufacture, and use of chemical products. (Office of Prevention, Pesticides and Toxic Substances)

#### **Advocate and Information Programs**

**Technology Innovation Program** provides information about characterization and treatment technologies for hazardous waste remediation, including a database *EPA REACH IT* on available technologies. (Office of Solid Waste and Emergency Response)

**Clean Air Technology Center** serves as a resource on all areas of emerging and existing air pollution prevention and control technologies, and provides data and information on their use, effectiveness and cost. (Office of Air and Radiation)

**Center for Environmental Industry and Technology** provides information, outreach and assistance in Region 1 (New England) on innovative environmental technologies. (Region 1)

**Municipal Technology Assessment Program** encourages development and use of innovative and alternative technologies for wastewater and storm water treatment, biosolids management, and related topics. (Office of Water)