ENVIRONMENTAL PARTNERSHIPS: LEVERAGING RESOURCES TO MEET ENVIRONMENTAL CHALLENGES

C. Sink
Office of Technology Development
U.S. Department of Energy
12800 Middlebrook Road
Germantown, Maryland 20874

T. Berg
Martin Marietta Energy Systems
P.O. Box 2009
Oak Ridge, TN 37831

F. Booth and K. Easley
Waste Policy Institute
12850 Middlebrook Road
Germantown, MD 20874

ABSTRACT

Over 40 years of defense production activities have left behind a serious environmental legacy. Federal and State mandates require the remediation of defense production sites. To ensure an appropriate and timely response to these enormous environmental restoration and waste management challenges, the Secretary of Energy, Admiral James D. Watkins, authorized the establishment of the Office of Environmental Restoration and Waste Management (EM). EM is actively seeking collaborative opportunities with other government agencies and the private sector to identify, adapt, and develop new and consistent site restoration and consistent waste management practices, throughout the DOE Complex. The Technology Integration Division (TID) of the EM Office of Technology Development (TD) is charged with promoting the movement of innovative technology and "lessons learned" into, out of, and across the Complex to enhance public, private, domestic, and international cleanup capabilities and bolster U.S. competitiveness.

Secretary Watkins recently set a new course for DOE in technology transfer, and TID is responding to this new mission requirement by expanding and enhancing cooperative work with public and private sector partners. Consistent with this new philosophy of operations, TID acts as a facilitator to ensure other government agencies, industry, and universities work in partnership with EM to find more efficient and cost-effective technological solutions to mutual environmental management problems. In addition, TID leverages the technical and financial resources of public and private participants to share the costs associated with technology research, development, demonstration, testing, and evaluation (RDDT&E). This paper provides an overview of the OTD technology integration effort, the importance of public participation, and a discussion of technology integration models currently being developed in conjunction with TID support and oversight.

INTRODUCTION

In 1989, Secretary of Energy Watkins made a historic commitment to the American public to ensure DOE compliance with all applicable laws and standards aimed at protecting human health and the environment. The Secretary's pledge requires the remediation of the 1989 DOE Complex inventory of chemical, radioactive, and mixed wastes by 2019. Presently, more than 3,700 DOE sites and 26,000 acres are contaminated with radioactive, hazardous, and mixed wastes. In addition, over 500 surplus sites are awaiting decontamination and decommissioning (D&D), and there are approximately 5,000 peripheral properties with contaminated soils (e.g., uranium tailings). These problems exist at both inactive sites, where the primary focus is on environmental restoration, and at active sites, where the emphasis is on improved waste management techniques.

To ensure appropriate and timely response to these enormous environmental restoration and waste management challenges, Secretary Watkins established an Office of Environmental Restoration and Waste Management (EM). The Office of Technology Development (OTD) was concurrently formed within EM and has since instituted an aggressive national program for applied research and development to address major technical issues and progress beyond current remediation and reclamation technologies. Under the aegis of OTD, the Technology Integration Division (TID) promotes the movement of innovative environmental management technology into, out of, and across the Complex to foster enhanced public, private, and international cleanup capabilities.

EM is actively seeking collaborative partnerships with the private sector as part of its effort to identify, adapt, and develop new environmental management technologies to ensure regulatory compliance, DOE site restoration, and consistent waste management practices across the Complex. TID is an essential program interface that enables private sector interactions with the varied environmental restoration, waste operations, and technology development groups within EM. In addition, TID is the ombudsman and real-time problem

solver for the private sector, making it easier for DOE and outside groups to form partnerships to develop generic solutions to common environmental management problems.

EM employs the best available technologies (BATs) developed by industry, universities, other Federal agencies, or other DOE research programs to achieve regulatory compliance, remediate DOE sites, and manage waste streams. However, BATs sometimes do not satisfy regulatory requirements. To overcome these deficiencies, OTD is collaborating with public and private sector groups to develop suites of innovative environmental management technologies. Major elements of the EM strategy include: initiating the treatment and/or disposal of stored wastes; developing and deploying innovative technology solutions to environmental problems; structuring program activities to support regulatory compliance; communicating with stakeholder publics; expanding the human resource base; practicing pollution prevention; training and/or retraining of current staff and new hires; and integrating and institutionalizing EM activities (i.e., environmental restoration, waste management, and technology integration) into current and future Departmental efforts.

By promoting win-win partnerships with industry, universities, and other Federal and State environmental organizations, TID promotes the transfer of innovative technologies and lessons learned from EM research, development, demonstration, testing, and evaluation (RDDT&E) processes to appropriate points of contact within the user community.

PUBLIC-PRIVATE PARTNERSHIPS ENABLE THE FLOW OF TECHNOLOGY AND INFORMATION

TID is structured to enable the development of collaborative partnerships with U.S. industry, the National laboratories, other Federal agencies, universities, and certain international participants to facilitate timely and effective applications of generic technologies and to satisfy a growing array of Federal, State, and local environmental requirements. TID also supplements the OTD systems approach to developing integrated solutions to EM problems.

Environmental Restoration technology integration activities proceed through various site characterization, assessment, remediation, and monitoring phases, and are designed as full-scale technology evaluation projects. Projects are implemented concurrently so alternative technical solutions to specific environmental restoration problems can be examined and evaluated in parallel. In addition, these activities are planned and executed in a context that considers pertinent factors associated with full-scale environmental restoration (e.g., planning, regulatory permitting, and public acceptance). Waste Operations technology integration activities include the parallel testing of multiple technologies so that the advantages of one technology over another, or the benefits of potential combinations of technologies, can be accurately assessed.

Evaluating Innovative Technologies

Because activities in these Program Areas are conducted via a systems analysis, determinations regarding cost, efficiency, and technical merit can be made regarding a technology's ability to proceed beyond bench-scale tests toward commercial application. Before suites of innovative technologies are demonstrated, they are carefully screened. Those with limited probability for commercial success are typically dropped from further consideration. An exception might involve a technology that appears to have marginal commercial potential but is uniquely capable of addressing specific site problems. Similarly, potential costs and benefits associated with these technologies are analyzed and evaluated. In each case, a determination would be made regarding potential risks to human health and the environment. In addition, relevant commercialization risks would be similarly analyzed and evaluated.

The three primary program area components are operational concerns, technology filtering, and technology integration. Operational concerns are addressed in structuring "end-to-end" systems approaches for technology demonstrations. Technology filtering requires the evaluation and selection of those technologies that survive the RDDT&E process and satisfy relevant environmental management criteria. Technology integration necessitates early and continuing interaction among Federal and State regulatory authorities and affected publics (e.g., neighboring communities around DOE sites) to ensure expedited regulatory and public acceptance of innovative environmental technologies.

Although program areas dealing with generic problems are centrally managed, they are not necessarily centrally located. An advantage to this approach is that it provides a focal point for the development of the technical base to ensure EM goals and objectives are realized within the thirty-year timeframe. In addition, applied research activities with the highest probability for success are coordinated within the Complex to maximize program benefits through regular program interaction. This approach provides a continuing mechanism to focus R&D activities, directing them toward the development of innovative technologies, enabling evaluations of their suitability and applicability to existing or planned technology demonstrations, and expediting the transfer of results to the DT&E phase. Specifically, program areas are coordinated among multiple R&D laboratories and/or participants so potential solutions to common problems are broadly disseminated across the Complex.

As a complement to the systems approach and programmatic framework of the activities described above, OTD engages in joint efforts and cooperative ventures with other government agencies and the private sector to leverage resources and facilitate technology integration. These public-private partnerships are vehicles to increase industrial participation and foster entrepreneurial innovation. TID identifies eligible technologies for testing and evaluation, and communicates, coordinates, and transfers results of OTD activities to interested constituencies. TID also conducts program outreach and communicates with other EM offices, Field Offices, contractor managers, and technology program area coordinators. As a result, the potential for duplication is reduced or eliminated.

Public-private partnerships that tie RDDT&E activities to DOE site remediation problems are of critical importance because they can provide the necessary foundation for a new U.S. environmental management technology base; one that will be increasingly responsive to both domestic and international environmental restoration and waste management needs. In addition to making OTD successes available to private industry, TID is committed to working with State and local organizations to make DOE-funded environmental management technology available for use in various economic development initiatives that create jobs and increase regional

economic conditions. By focusing the overall RDDT&E effort on generic, user-identified needs, OTD is able to develop innovative technologies that both outperform conventional technologies and can benefit public-private remediation efforts.

Various TID program mechanisms are used to ensure goals and objectives are realized. For example, collaborative efforts are funded as cooperative agreements, grants, interagency agreements (IAGs), subcontracts, DOE "Work for Others" (WFOs), and cooperative research and development agreements (CRADAs). TID works as a broker in matching suppliers with end-users of environmental management technologies, and as a facilitator to streamline government procedures and overcome bureaucratic inertia. In addition, TID is working to jointly determine user/market needs and identify and overcome the following barriers to successful collaboration and commercialization: handling of proprietary data; management of potential conflicts of interest; delays in procurement; and distribution of intellectual property rights (IPR).

DOE investments in the "incubation" of environmental and waste management technologies are expected to generate returns as successful technologies are applied to real-world environmental problems across the DOE complex. These applications will occur in environmental remediation activities under the guidance of EM-40, waste reduction applications under the guidance of EM-30, and within DOE Defense Programs. At this point in the technology development cycle, TID program benefits will become readily apparent. These benefits will be both monetary, in terms of cost savings achieved through the development and use of more efficient technologies, and time savings, as technologies developed in TID-sponsored programs achieve performance objectives more rapidly than conventional technologies. Accelerated environmental remediation activities, site cleanup actions, and the adoption of waste reducing operating practices will continue to yield benefits to DOE and the public for the foreseeable future. Further, the deployment of advanced DOE-sponsored environmental management technologies throughout the private sector will directly contribute to improved competitiveness as domestic environmental management firms compete in both domestic and international environmental cleanup markets.

PUBLIC PARTICIPATION IS INTEGRAL TO SUCCESSFUL TECHNOLOGY INTEGRATION

OTD involves DOE stakeholders in technology program areas through the public participation process. The TID Public Participation Program is managed in conjunction with technology programs, and is responsive to all relevant legal and regulatory requirements. In addition, the Public Participation Program identifies public participation needs and issues, and coordinates DOE Headquarters, Field Office, and related efforts to ensure those needs and issues are addressed.

The various "publics" for the TID Public Participation Program are those individuals and groups affected by the process of demonstrating, testing, and evaluating technologies. They include: State and local government officials responsible for oversight of sites where OTD technology will likely be applied; Indian tribes with technology demonstration sites located on or near their lands; citizen groups and individual citizens concerned about specific issues such as public safety, government expenditures, and environmental quality; citizen groups and individual citizens who are opinion leaders involved in promoting the overall welfare of their respective communities; other Federal agencies involved in the technology development process (e.g., EPA); industry groups supplying or receiving technologies; and colleges and universities involved in technology integration (See Fig. 1).

The TID Public Participation Program is committed to integrating the views of each of these publics into the decision-making process. Public participation in decision-making means that public concerns, needs, objectives, and other input are identified early through two-way communications between DOE and the respective publics prior to making decisions. This interactive process improves not only DOE understanding of public concerns, but also the public's understanding of DOE decisions and subsequent technology development activities. It enables stakeholder publics to view competing issues within a much larger context, in which significant environmental, financial, legal, and technical

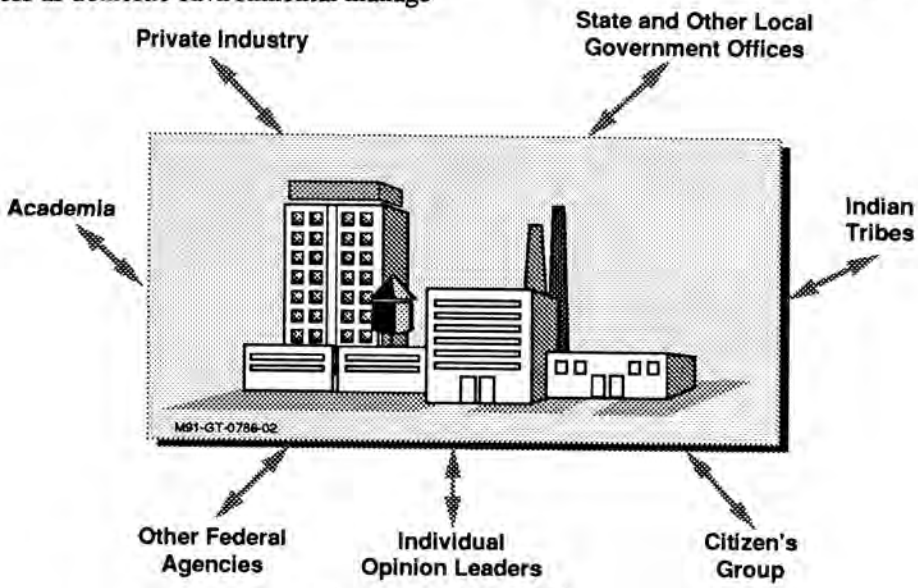

Fig. 1. Key DOE policies.

considerations must be analyzed concurrently, as opposed to simply examining them individually.

Active public participation is a positive step towards creating a culture of openness within DOE. As envisioned by Secretary Watkins in SEN-11-89, this new culture "will emphasize an open door philosophy and demand professional excellence in both government and contractor performance, and it will be a culture wherein constructive criticism from any source, external as well as internal, is encouraged and rewarded." In addition, technology development and demonstration activities are governed by environmental regulations, many of which require public participation and dictate specific public involvement activities. Therefore, the goal of the TID Public Participation Program is to enable the public to directly influence and provide input into the decision process. (See Fig. 2). If the available alternatives are to be comprehensively evaluated, the public must be adequately informed of the various options and their associated consequences.

As a result of this two-way communication, technologies subsequently delivered to the EM Offices of Waste Operations and Environmental Restoration will have already been screened to ensure that public acceptance criteria are met. Otherwise, the technologies may prove impractical for field implementation.

Increased public participation can also improve DOE oversight and reduce frequently encountered delays and legal challenges. Without effective two-way communication between DOE and the stakeholder publics, accomplishing the thirty-year EM mission in full or in part will be extremely difficult if not impossible.

Consistent with the overall EM public participation effort, TID has established the following goals and objectives for its Public Participation Program: ensuring the letter and spirit of the public participation requirements embodied in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the National Environmental Policy Act (NEPA), and the Resource Conservation and Recovery Act (RCRA) are met; securing public input to identify EM problems and issues that should be addressed; identifying alternative solutions to those problems and issues; comprehending the importance of environmental, social, economic, and cultural conditions and values to be promoted and protected; addressing conflicts among competing objectives; building consensus toward EM actions and decisions in the best overall public interest; and increasing public understanding of the problems and issues that EM must address. In pursuing these goals and objectives, EM seeks to achieve and maintain legitimacy in accomplishing its mission through a visible and credible process that involves the public in making decisions. Although public participation is unable to eliminate all controversy or satisfy all concerned parties (i.e., stakeholder publics), the process will provide citizens with the requisite information and means to influence DOE plans and decisions.

TECHNOLOGY INTEGRATION AND TRANSFER MODELS

Presently, TID is supporting several technology integration models to assess their strengths, weaknesses, and overall contribution to the EM program. For example, at the Ames Laboratory, technologists are working in conjunction with TID to develop a technology adaptation model. The first application of the Ames Technology Adaptation Model will conduct real-time heavy metals sampling, screening, and analysis at field sites. The system is designed to also provide environmental remediation QA/QC when deployed

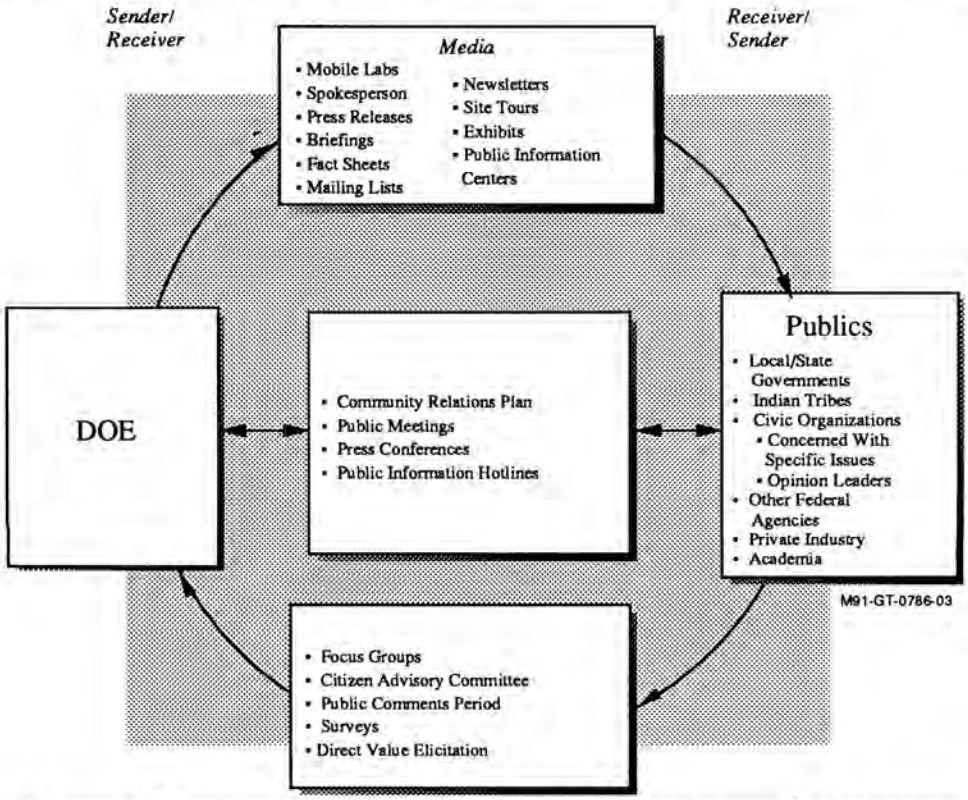

Fig. 2. Integrated demonstration public involvement is a two-way communication process.

immediately following cleanup. Each mobile system can analyze up to 5,000 samples a year, and dollar savings per sample are estimated to exceed $3,500. In addition, the total time required per sample is reduced from about 90 days to 15 minutes. With a cumulative investment of $5 to $7 million during the next 5 to 10 years, estimated cost savings could exceed $100 million.

Another TID approach involves the Technology and Software Licensing model, a tool that is fundamentally proven and becoming part of the business and industry integration task within TID. Its major advantage is Martin Marietta Energy Systems' experience and skill in implementing business mechanisms and intellectual property provisions. Since 1986, 59 licenses for ORNL, Y-12, and K-25 have been issued for Oak Ridge developed technologies with the resultant commercial product sales valued at $50 million. Royalties earned total $1.7 million with the following distribution: 25% to employees, 25% for outreach and communications materials, and 50% returned to originating divisions for technology maturation. Complex business mechanisms and intellectual property terms and conditions are potential obstacles for several M&O contractors who lack mature technology transfer programs. However, the model can address this gap for other M&O contractor capabilities (especially nonlaboratory facilities) and facilitate the acquisition and adoption of international technology sources.

A third model, the ANL/ARCH ASSESSTEK new business development model, fosters enhanced public/private sector interactions through the establishment of new business ventures. Argonne National Laboratory and ARCH, the University of Chicago nonprofit, adjunct organization established in 1986, are presently investigating approaches for hazardous waste assessment corporations to leverage the technology expertise resident in Federal R&D laboratories with their own to perform high quality, low cost site assessments. By FY 1993, it is anticipated that a competitive selection process will lead to the selection of a private sector partner. ANL/ARCH organizational conflict of interest provisions will also be in place, making possible the first technology implementation efforts.

ARCH is recognized nationally for its diverse capabilities and technology transfer potential. Since its inception, ARCH has licensed over 80 patents and has formed seven new private sector corporations. Once ASSESSTEK becomes operational, it is expected to provide the following program benefits: early involvement of private sector firms with strong environmental capabilities; emphasis on near-term techniques requiring limited preparation or enhancement of existing technology for improved assessment processes; integration of technology and software developed by other organizations; transfer of capabilities and "lessons learned" across additional technology evaluation sites for testing under different conditions; and empowering new business ventures with viable commercial mechanisms and techniques for site environmental assessment with major participation of private sector and venture capital organizations.

A fourth model is being evaluated in cooperation with the EPA's National Environmental Technology Applications Corporation (NETAC). This Private Capital model evaluates the effectiveness of using private sector investment funds in cost-shared arrangements to support evaluation and accelerated development of high-potential environmental restoration technologies. The feasibility of long-term venture capital commitments will be evaluated. By promoting the direct involvement of EPA's Office of Research and Development (ORD), TID can leverage its program resources with EPA/ORD's to foster implementation and ultimately technology permitting.

Another major technology integration activity involves Savannah River Laboratory's (SRL) VOCs in Nonarid Soils Integrated Demonstration (ID). The SRL model technology integration program continues to collaborate with other government agencies to apply waste remediation technologies that have emerged from its ID. In addition, the program locates industrial partners as well as emerging technologies for ID technology evaluation, provides liaison with universities for ID participation, and facilitates timely invention management. Program benefits to date include: increased emphasis on patents within SRL resulting in substantial increases in invention disclosures (seven-fold since 1989) and equally successful conversion of such disclosures into patent applications; development of four nonexclusive licenses for horizontal well technology under the auspices of the ID that were subsequently issued to a number of companies, both large and small; and transferred horizontal well technology to the U.S. Air Force to enhance cleanup operations at Tinker Air Force Base in Oklahoma and Williams Air Force Base in Arizona.

The TID program recognizes many of the problems which confront small firms attempting to gain a market foothold in the development of advanced environmental remediation and waste management technologies. Representative problems addressed in the TID program include: special considerations including procurements limited to small businesses; workshops focused on developing effective technical proposals; and conscious efforts to simplify contractual requirements so that less experienced small businesses can compete with larger firms on a more level playing field.

SUMMARY

TID is working with other government agencies, universities, U.S. industry, and international participants to convert DOE policies and procedures into cooperative collaborative partnerships to enable new and creative business arrangements that promote the development of innovative environmental management technologies. Specifically, TID catalyzes a breadth of public-private capabilities to overcome financial, societal, technical, and regulatory barriers to technology and its commercialization. TID also serves as a mechanism for accessing and applying federally developed environmental management technologies, creating new jobs and raising economic and environmental conditions. Not only does TID support Administration efforts to provide for a cleaner environment to improve human health and safety, TID also has the potential to contribute to improved U.S. economic competitiveness. In particular, by employing DOE-developed technology to minimize waste generation, U.S. industry mitigates its waste disposal problems.

The driving force behind TID is the domestic and international need for advanced innovative environmental management technology. For TID to be successful, U.S. industry must be an active participant in R&D as well as site demonstration, testing, and evaluation activities. Through the DOE Enhanced Technology Transfer Program, public-private

collaborations are encouraged and cooperation is enhanced. This cooperation enables applications of technologies from other DOE research programs and other Federal agencies and has the distinct benefit of promoting regulatory acceptance of innovative technologies. This interaction also enhances information exchange and external awareness of DOE cleanup efforts. Such two-way communication is vital to the success of the EM mission, and TID is proactively combining forces with other DOE programs, other government agencies, and the private sector to leverage its program resources and ensure successful technology integration.

REFERENCES

1. Secretary of Energy James D. Watkins, SEN-11-89 (1989).
2. Secretary of Energy James D. Watkins, SEN-30-91 (1991).
3. Long Range Plan for Technology Integration Programs Office of Technology Development, U.S. Department of Energy, DOE/EM-0011P-DE91012191, May 1991.
4. The National Energy Strategy, Chapter 23, U.S. Department of Energy, DOE-061-00-00754-7, February 1991.