



Testimony

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NUCLEAR WASTE CLEANUP

Progress Made but DOE Management Attention Needed to Increase Use of Innovative Technologies

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Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to discuss the Department of Energy's (DOE) progress in using the innovative technologies it has developed for cleaning up the hazardous and radioactive contaminants at its sites. These sites present environmental and human health concerns as a result of 50 years of nuclear weapons research, testing, and production activities. Since 1990, DOE has received about \$2.7 billion for developing innovative cleanup technologies and has initiated over 800 projects. According to DOE's data, 179 of the technologies have been deployed at DOE's sites, 100 of which have been used only once.¹ Our September 1998 report to this Committee made several recommendations to address DOE management problems that presented obstacles to selecting and using innovative technologies.² The potential benefits of innovative technologies to reduce costs or speed cleanups cannot be realized unless these obstacles are overcome.

Our testimony is primarily based on our 1998 report and on DOE's actions in response to our recommendations. For this hearing, you asked us to follow up on DOE's responses to our 1998 findings and recommendations on (1) coordination between technology developers and users, (2) modifying completed technologies to meet site-specific needs, (3) technical assistance to sites concerning innovative technologies, and (4) the quality of data on deployment. In addition, you asked us to determine what information is maintained and made available to sites on the vendor companies for the cleanup technologies that DOE has developed. In summary, we found the following:

- As we reported in 1998, a key obstacle to deploying innovative technologies has been the lack of coordination between the technology developers in DOE's Office of Science and Technology (OST) and the end users of technologies at DOE's cleanup sites. As a result, some technologies have not met users' requirements. Since our report, OST has begun several actions to improve coordination between technology developers and users, such as setting its priorities according to the users' stated technology needs. However, OST is still not using the decision-making system it developed that requires user involvement during development and user commitment before investing in demonstrating a technology. Rather, OST is using elements of this system in its annual project reviews. Although these reviews have benefits, they are being implemented

¹Figures are from DOE's data as of May 1999, some of which has not been verified.

²Nuclear Waste: Further Actions Needed to Increase the Use of Innovative Cleanup Technologies (GAO/RCED-98-249, Sept. 25, 1998).

inconsistently and they may not provide enough management attention to developer and user cooperation as a technology progresses through development phases. More assurance may be needed that users will ultimately deploy the technologies being pursued and that a specific “go/no-go” decision is made before substantial investments are made.

- Our 1998 report noted that some OST-developed technologies were too generic to be readily implemented at sites and that responsibilities and funding sources for modifying technologies to meet site-specific needs were unclear. DOE cites its Accelerated Site Technology Deployment program as addressing these concerns. This program provides funding to DOE sites for their first use of an innovative technology developed by OST or other organizations. However, the program funds only a limited number of projects and funding does not necessarily have to be used for modifications. More could be done to proactively promote OST’s technologies by identifying potential applications and alternative DOE funding for modifications, if needed.
- We found that the technical expertise of OST’s focus areas varied and that site officials were sometimes reluctant to consult with them.³ As a result, cleanup sites were not consistently getting technical assistance to identify alternative solutions to cleanup problems. OST is currently establishing lead national laboratories for each of its focus areas to increase its level of expertise. Since OST is still defining the role of the lead laboratories, it is too early to assess the impact of this change on improving expertise. Furthermore, without requiring that an OST representative participate in technology selection, as we recommended, it is unclear whether improving focus areas’ expertise alone will result in more consultations with sites.
- In our 1998 report, we found that OST’s data on the deployment of its technologies were of poor quality. Specifically, we found that, in deployment instances claimed from the start of the program through January 1998, 38 percent should not have been counted as deployments. The most common type of error we found was counting technology demonstrations that did not result in cleanup progress as deployments. OST has since conducted a study that verified the deployments reported for fiscal years 1997 and 1998 and has taken several steps to improve the quality of data input such as issuing a definition of deployment. However, the data being entered into OST’s database continue to have a high degree of errors with only about half of the deployments being correct as listed in

³OST has five focus areas that manage technology development projects for the major cleanup problems that DOE faces, such as radioactive tank waste remediation.

the database. OST plans to hire consultants to help identify the causes of poor data quality and recommend improved approaches. If, as a result of its study, OST develops and systematically implements an approach for ensuring the accuracy of its data, the quality of deployment data needed to manage the program may improve.

- Finally, OST's database, which is available to end users at sites, generally contains information to allow sites to identify and contact vendors. However, these data can become out of date because companies move, merge, sell their patents, or make other changes. OST plans to improve the information on vendors in its database by, for example, linking information in the database with credit for deployment.

Background

The Office of Science and Technology, which is within DOE's Office of Environmental Management (EM), develops new technologies that could accelerate cleanup, reduce costs, reduce risks to cleanup workers, or enable cleanup activities for which no cost-effective technologies exist. For fiscal years 1990 through 1999, the Congress provided a total of approximately \$2.7 billion for the development of innovative cleanup technologies, and OST has initiated over 800 development projects.

OST is currently organized into five focus areas for specific remediation activities: mixed waste characterization, treatment, and disposal; radioactive tank waste remediation; subsurface contaminants; deactivation and decommissioning; and nuclear materials. The focus areas were established in 1994 to concentrate OST's resources on each of the major cleanup problems that DOE faces. A field office that is responsible for the day-to-day management of technology development projects leads each focus area. For example, the Savannah River Operations Office manages the subsurface contaminants focus area, and the Richland Operations Office manages the radioactive tank waste remediation focus area. The focus areas use DOE's national laboratories, private companies under contract to OST, and universities to conduct technology research and development projects.

Although OST is responsible for technology development, DOE's waste sites are responsible for selecting the technologies they will use, with the review and approval of the U.S. Environmental Protection Agency and state agencies that regulate DOE's cleanups and with input from the public

involved with the site.⁴ Each DOE field office has established site technology coordination groups to identify sites' technology needs, provide OST and its focus areas with information, and communicate information about OST's technology development projects to the cleanup sites.

Actions Needed to Increase Coordination Between Technology Developers and End Users

In our 1998 report, we found that OST was not sufficiently involving end users during the development of new technologies. As a result, no customers have been identified for some of the technologies that OST has sponsored. Of the 171 technologies that OST had completed as of March 1999, 59 technologies, costing about \$76 million to develop, have not been used by DOE cleanup sites.⁵ Although OST developed a decision-making system in 1997 that would provide for users' involvement in projects during the development process, the agency was not consistently using this system, known as the gates system. The gates system identifies seven stages of the technology development process: basic research, applied research, exploratory development, advanced development, engineering development, demonstration, and implementation. The gates are decision points preceding each stage. The gates system includes requirements such as identifying specific user needs, defining users' performance requirements, and before investing in a demonstration, obtaining users' commitments to deploy the technology if it meets the performance requirements. OST designed the gates system to provide its focus areas with a process and criteria for making "go/no-go" decisions at various points during a project's development. One reason why the gates system has not been extensively used was that it would lead to the termination of some technology projects, an outcome resisted by the focus areas and national laboratories. We recommended that OST rigorously and consistently use its gates system as a decision-making tool for managing its projects and as a vehicle for increasing cooperation between developers and users.

OST did not implement our recommendation. The Acting Deputy Assistant Secretary for OST told us that the office needed to determine how best to implement the gates system and whom to involve in the gates system reviews. However, OST has incorporated elements of the gates system in its

⁴Remediation activities at DOE's facilities are governed by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, and the Resource Conservation and Recovery Act of 1976, as amended. These acts lay out the requirements for identifying waste sites, studying the extent of their contamination and identifying possible remedies, and involving the public in making decisions about the sites.

⁵Figures are from OST data as of March 1999.

existing project reviews. Specifically, in March 1999, the Acting Deputy Assistant Secretary issued a memorandum directing the focus areas to use the major criteria from the gates system in annual assessments of their projects, known as midyear reviews. The midyear reviews address the progress of each project, the importance and feasibility of the technologies under development, the development stage of the project, and whether it has met the requirements in the gates system for that stage of development. The memo states that end users should be involved in the reviews and that focus areas should address the question, “Has an end user made a commitment to implement the technology?” The requirements in the gates system, however, are more specific. For instance, end users’ performance requirements must be incorporated before the project enters the advanced development stage. The Acting Deputy Assistant Secretary told us that he considers the midyear review guidance to be a first step in fully implementing the gates system.

We have some initial concerns about what has been implemented to date. We reviewed criteria that four of the focus areas had developed for their midyear review panels to use.⁶ Only one of the focus areas—deactivation and decommissioning—linked the review criteria to the development stage of the project, as the gates system does. This focus area provided reviewers with different sets of questions for projects in basic science research, applied development, demonstration, and deployment stages. We also note that, unlike the other three focus areas, the radioactive tank waste remediation focus area did not review all of its projects, but only those that were about to be demonstrated or deployed, or that had concerns identified at previous reviews.

While using some of the gates system criteria in the midyear reviews may be beneficial, we do not believe that the midyear reviews provide enough management attention to help ensure developer and user interaction and cooperation as a technology progresses through development phases. A fully implemented gates system could provide more assurance that the technologies being pursued are needed and will ultimately be deployed by users and that a specific “go/no-go” decision is made before substantial investments are made.

DOE has taken some other actions to better integrate the needs and technical requirements of end users into its technology development projects. For example, EM has set up user steering committees to advise

⁶Three focus areas have held their reviews, but as of May 10, 1999, review reports were not yet available. A fourth focus area plans to hold its midyear review during the last week of May 1999, while the fifth focus area does not plan a midyear review this year.

each of OST's focus areas, which carry out the development and demonstration of technologies. The user steering committees help focus areas develop their program plans. In addition, beginning with its fiscal year 2000 budget submission, OST used a new priority-ranking system for its program that analyzed sites' data on their specific cleanup projects and needs. The new priority-ranking system used information that sites generated for DOE's Accelerating Cleanup: Paths to Closure strategy⁷ rather than information generated by OST personnel. Priorities for OST's fiscal year 2000 funding decisions were based on factors such as the number and costs of DOE's cleanup projects that could benefit from the proposed technology development work, the degree to which the proposed work addresses the technology needs of the sites, and whether sites plan to deploy the resulting technologies. OST plans to continue using this user-based priority system. According to OST officials, the system encourages the focus areas to work more closely with end users at sites to identify work that will meet their needs. These initiatives move the program in the right direction. However, these initiatives, like the midyear reviews, also do not substitute for the full implementation of the gates system. Continued attention by OST management and focus areas will be needed to fully implement these initiatives and make developer-user cooperation a routine part of doing business.

Identification of Responsibilities for Modifying Technologies Is Needed

During our 1998 review, DOE field staff and contractor personnel responsible for cleanup told us that, in many cases, OST had developed generic solutions that either do not meet specific site needs or must be modified before they could be used. Site officials told us that it was unclear who was responsible for paying for the modifications to those technologies that could prove useful. For example, Hanford officials were interested in using OST's Electrical Resistance Tomography to help detect leaks in their high-level radioactive waste tanks. However, a Hanford official said that the technology needed substantial fine-tuning to make it work on the Hanford tanks and that no funding was available at the time. In some cases, technology vendors have been willing to fund the necessary modifications, but for some needs unique to a DOE site, the market may be too small to elicit such an investment from vendors. We recommended that OST identify the technologies that could be cost-effectively used to meet sites' needs and that EM identify funds for modification if needed.

⁷Accelerating Cleanup: Paths to Closure is an annual report on EM's strategy and progress in cleaning up the remaining 53 contaminated sites. Its development requires sites to identify the scope of work, time frames, and costs for each of the more than 350 projects at the cleanup sites.

DOE has not addressed this recommendation. In its written response to our report, DOE cited OST's Accelerated Site Technology Deployment (ASTD) program as addressing sites' concerns about using new technologies. ASTD provides DOE sites with funding for their first use of an innovative technology developed by OST or other organizations. The program is intended to increase the use of technologies that could speed cleanup or reduce costs. OST competitively evaluates sites' proposals for ASTD projects to select projects to fund. Of the 46 ASTD projects that OST has funded to date, 36 are using technologies developed by OST.⁸ The sites receiving ASTD funds must also provide funding for implementing the technologies, and ASTD funds are not targeted to specific purposes within the project, such as paying for modifications to technologies.

While ASTD may have facilitated some deployments, OST could be more proactive in identifying potential uses for its technologies and providing sites with assistance in such cases. This is particularly important, given that, of the 171 technologies that OST had completed by March 1999, 59 technologies—or more than 30 percent—have never been used by the sites. Of the 112 completed technologies used by the sites, about half have been used only once. Such proactive assistance might involve providing information on OST's technologies and technical advice or working with the sites to arrange and share the costs of technology modifications, if needed and cost-effective. These actions could identify additional cost-effective uses for technologies that OST has already completed and provide a greater return on past investments in the development of technology.

Some Actions Have Been Taken to Provide Sites With Technical Assistance, but Requirement Is Still Lacking

In our 1998 review, we found that OST was not fulfilling its role of providing users with the technical advice and assistance that they need to identify solutions to cleanup problems and to help implement those solutions. Focus areas' abilities to provide technical assistance varied, and some site officials told us that they were reluctant to consult with the focus areas because they were not convinced of the focus areas' technical expertise. We recommended that OST increase the expertise available for providing technical assistance on innovative technologies. We also recommended that EM require that an expert from OST participate in technology selection processes for site cleanup projects.

⁸In fiscal year 1998, OST provided \$27 million in funding for the 14 ASTD projects selected from its first call for proposals. In fiscal year 1999, OST is providing \$16.8 million for 32 additional ASTD projects selected from its second call for proposals, as well as \$14.7 million for nine of the first projects that continue into a second year. Another eight ASTD projects selected from the second call for proposals are expected to begin in fiscal year 2000.

DOE has taken some actions to implement our recommendation for increasing technical expertise. Specifically, OST recently selected a lead national laboratory for each of its focus areas. The purpose of establishing the lead laboratories is to improve the technical expertise available to the focus areas for assessing their technology development projects, identifying promising basic research for further development, and providing sites with technical assistance. With the exception of the radioactive tank waste focus area, which has worked with a national laboratory for several years, OST is currently in the process of defining the roles and responsibilities for their lead laboratories.

It is too soon to tell whether establishing lead laboratories will result in sites requesting technical assistance from OST more frequently. We note that multiple objectives exist for the lead laboratories and it is unclear whether technical assistance will receive adequate attention. In addition, since each lead laboratory is involved in developing some OST technologies, there is some question regarding their ability and willingness to support and assist technologies developed by other laboratories or organizations.

EM has not implemented our recommendation that experts from OST be required to participate in sites' technology selection processes. OST's focus areas have provided technical assistance for some technology decisions at DOE's sites but have not been routinely involved in all such decisions. For example, the subsurface contaminants focus area participates with the Office of Environmental Restoration in providing some DOE sites with consultations on groundwater and soil cleanups, and the deactivation and decommissioning focus area is participating in several value engineering studies with sites. According to an OST official, the radioactive tank waste focus area, assisted by the Pacific Northwest National Laboratory, has given beneficial technical assistance and advice to several key decisions for privatization projects at Hanford and Oak Ridge. In privatization projects, DOE uses fixed-price contracts, and vendors are responsible for identifying the technologies that they plan to use. Technical assistance can help sites develop performance specifications for the contracts, according to the Acting Deputy Assistant Secretary for OST.

The Acting Assistant Secretary for EM told us that he believes a policy on requiring OST's involvement in technical decisions for sites would not be as useful as other efforts, such as the ASTD program and integration teams that are studying waste problems common to several sites and trying to develop integrated responses to the problems. We believe that while

technical assistance to sites may be increased by these activities and by additional expertise in the focus areas, technical assistance is not consistently being used to ensure that sites' decisions are based on well-informed consideration of the full range of available technology alternatives. During our 1998 review, we found that sites infrequently sought technical assistance from OST and its focus areas. In addition, ASTD and the integration teams have dealt only with a relatively small number of innovative technologies. As a result, DOE needs to do more to ensure that OST's technical assistance role is reinforced and made more routine.

Process Is Needed to Ensure the Quality of Deployment Data

Our 1998 report found that OST's deployment data were of poor quality. Specifically, we found that, for deployment instances claimed from the start of the program through January 1998, 38 percent should not have been counted as deployments. The most common type of error we found was counting technology demonstrations that did not result in cleanup progress as deployments. OST's focus areas are responsible for obtaining information about the use of OST-developed technologies at field sites and for inputting the data into a central database. While our review was under way, OST began to verify its deployment data for fiscal year 1997. We recommended that OST verify the accuracy of future deployment data and label the earlier data that had not been verified as an estimate.

Since our review, OST has completed a verification effort for deployments that occurred in fiscal years 1997 and 1998, and DOE's February 1999 report on the deployment of innovative technology indicated that data from earlier years had not been verified. OST verified its data through a Technology Achievements Study, which used structured interviews with DOE field sites and technology vendors to identify and obtain information about the deployments at cleanup sites. OST corrected the errors found by the Technology Achievements Study prior to publishing the deployment report.

OST's verification of fiscal year 1998 data found that only about half of the deployments were correct as listed in the database. Specifically, 18 percent of the deployments claimed should not have been counted as deployments (compared with the 38 percent that we found), and 43 deployments had been omitted from the database. Other errors included deployments that were recorded in the wrong year or that required major changes to the information provided.

Several actions were taken during 1998 to improve the quality of the data. In August 1998, OST issued a definition of deployment for its focus areas to use in gathering and inputting deployment data. The definition emphasizes that a deployment occurs only if the use of the technology furthers site cleanup goals. OST also has site officials check deployment information that focus areas have entered into OST's database. This step occurs prior to verification through the Technology Achievements Study. In addition, beginning in 1998, focus areas have been required to fill out deployment fact sheets about each claimed deployment. This requirement may help focus areas to improve their knowledge about deployments and avoid such errors as the reporting of deployments in the wrong year or wrong location because the fact sheets require specific information about the site and project where the technology was used and the identification of end users.

OST officials told us that they plan to continue the Technology Achievements Study in fiscal year 1999 but have not decided if this approach will be followed in the future. OST is hiring consultants to conduct a one-time independent check of deployment data for fiscal year 1998, study reasons for the poor quality of the data, and provide advice on ways of improving data quality. If, as a result of this study, OST develops and systematically implements an approach for ensuring the accuracy of its data, the quality of deployment data may improve.

Vendor Information Is Generally Available for OST-Developed Technologies

Private vendor companies generally provide the innovative technologies that are selected for use at DOE sites. Therefore, it is important that DOE's field and contractor personnel have access to information about the vendors for OST-developed technologies. OST's database, accessible to DOE site personnel and the public, includes information on vendors. We reviewed vendor information in the database for the 171 technologies that OST had completed as of March 1999. Thirty-three of the completed technologies were not commercially available, leaving 138 technologies that should have information for contacting vendors. For 122 of the 138 completed, commercially-available technologies (88 percent), OST's database included the basic information that site personnel would need to contact a vendor—namely, the company's name, a contact name, and a phone number.⁹ According to OST officials, if the necessary information is not in the database, site personnel can contact staff in OST's focus areas to obtain vendor information. We called focus area staff about 3 of the 16 completed technologies that lacked information for contacting vendors in

⁹Some of the listings lacked other information, such as the company's street address or fax number.

the database. The focus area staff provided three vendor contacts for two of these technologies and told us that the third technology is not currently commercially available. We then attempted to contact the three vendors with the information that the focus areas provided for the other two technologies. For one of the vendor contacts, the area code provided by the focus area was out-of-date. However, we were able to contact the three companies and confirmed that they are current vendors of the technologies.

OST officials told us that they plan to improve the vendor information in the database. First, OST plans to change its database so that the field for vendor information must be completed by focus area staff when they are preparing deployment fact sheets. If the vendor information is not complete, the focus area will not receive credit for the deployment. Second, the Technology Achievements Study obtains vendor information during its surveys that OST plans to put into its database. According to OST officials, vendor information changes frequently because companies may sell their patents, go out of business, relocate, or change the trade name of the technology. The manager of the Technology Achievements Study estimates that each year, 10 to 20 percent of the vendors may have some type of information change including new addresses or area codes and new contact points due to staff turnover or company mergers. If OST implements these two planned actions, it will have greater confidence that its information on vendors is complete and current.

Mr. Chairman, this concludes my statement, and I would be pleased to respond to any questions the Subcommittee may have.

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