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ENERGY MANAGEMENT

Technology Development Program Taking Action to Address Problems

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Resources, Community, and
Economic Development Division

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July 9, 1996

The Honorable John Glenn
Ranking Minority Member
Committee on Governmental Affairs
United States Senate

Dear Senator Glenn:

In 1989, the Department of Energy (DOE) adopted a new mission: to clean up and restore its contaminated facilities and sites in compliance with federal and state environmental laws and regulations. To centrally manage this new mission and ensure that cleanups are implemented as efficiently and cost-effectively as possible, DOE established the Office of Environmental Management (EM).[1] Since 1989, EM has spent $34 billion on cleanups, but schedules have slipped and progress has been slow. In 1995, EM projected that cleanups could take another 75 years to complete and cost an additional $200 billion to $350 billion (not including the cost of cleaning most contaminated groundwater or currently active facilities).

According to DOE, innovative cleanup technologies are key to the most efficient and cost-effective use of funds—a goal that has grown in importance as funding constraints have increased. EM has estimated that using new technologies could reduce its total cleanup costs by as much as $80 billion. Recognizing the importance of new technologies, DOE created the Office of Science and Technology (OST)[2] within EM to manage a national program of technology development in support of EM's other program offices.

Throughout its 7-year history, EM has taken steps to improve its programs. For example, in January 1994, EM implemented a major reorganization to improve the coordination and management of the technology development program by creating five "focus areas." However, concerns persist that management weaknesses continue to contribute to the overall lack of progress in environmental cleanup. To ensure that EM is using its funds as efficiently and cost-effectively as possible, you asked us to examine EM's current management practices in selecting innovative technology projects for funding. Specifically, you asked us to examine whether EM is managing

[1]This office, originally named the Office of Environmental Restoration and Waste Management, was renamed the Office of Environmental Management in 1994.

[2]This office, originally named the Office of Technology Development, was renamed the Office of Science and Technology in 1995.

its program to prevent (1) unnecessary duplication and overlap and (2) an unwarranted concentration of projects at certain field offices. (For a discussion of our objectives, scope, and methodology, see app. I.)

Results in Brief

EM has not coordinated technology development activities among all of its program offices to prevent overlap and duplication. In fact, EM has no comprehensive list of technology development projects. Using partial lists of projects, we found that in one area—melter technology[3]—several DOE offices had funded 60 different melters at various locations across the country. Each of these melters could cost between $15 million and $30 million to develop fully. In 1996 alone, EM spent an estimated $40 million on melter projects. According to a group of outside experts convened by DOE as well as DOE officials themselves, such duplication and overlap are excessive and unnecessary.

We also found a significant increase in the concentration of technology development projects at certain field sites that DOE had designated as the lead sites for particular focus areas. We analyzed the processes for selecting proposals in the five focus areas and found that DOE had not used independent reviewers, as the National Research Council recommends, to ensure that the proposals from various sites received equitable treatment.

Recognizing these and other problems, the Office of Science and Technology took steps, starting in December 1995, to improve the management of technology development within its own office, as well as across EM as a whole. For example, to reduce duplication and overlap within OST, it (1) scheduled a comprehensive review of all projects, (2) combined two focus areas into one, and (3) began closing out melter projects. While the proposed changes appear promising, it is not clear that OST can effectively coordinate technology development across EM's program offices without EM's leadership and support.

Background

Historically, several DOE offices—including Defense Programs and the Office of Energy Research, as well as EM—have funded projects to develop innovative technologies for cleaning up nuclear waste. Within EM, innovative technology projects have been funded by OST, the Office of

[3]Melters are used to heat and melt a mixture of waste and other materials. This mixture, when cooled, becomes a glassy product that immobilizes the waste, facilitating its safe disposal.

Waste Management, the Office of Environmental Restoration, and the Office of Nuclear Material and Facility Stabilization.[4]

In August 1994, we reported that insufficient coordination and integration of technology development activities across EM's program offices, and between headquarters and the field, had limited the use of innovative cleanup technologies.[5] In response to our concerns and the concerns of others, in January 1994, EM restructured its technology development program around five high-priority problems, or "focus areas":[6]

- radioactive tank waste remediation (Tanks);
- characterization, treatment, and disposal of mixed waste (Mixed Waste);[7]
- containment and remediation of contaminant plumes (Plumes);
- stabilization of landfills (Landfill Stabilization); and
- decontamination and decommissioning (D&D).

Within each focus area, the restructuring created teams of technology developers, users, and other stakeholders, including members from both headquarters and the field, to increase the likelihood that new technologies would be used to clean up the contamination at DOE's sites. In addition, EM made OST responsible for centrally managing technology development to ensure the coordination of activities and the elimination of unnecessary duplication across all of EM's program offices.

Project Duplication and Overlap

Within the research and development community, experts agree that some duplication in projects is useful to provide the competition that results in the best science. However, EM officials and peer review experts we spoke with generally agreed that several projects competing in a specific area of technology would be sufficient.

Our August 1994 report said that although OST's mission was to manage EM's nationwide technology development program, other program offices

[4]After EM adopted the focus area approach, the Office of Environmental Restoration directed its field sites to cease technology development activities and work with the focus areas to ensure that the office's needs are met. Since this change took place, the office has limited the field sites' activities to those required to comply with regulatory requirements.

[5]Management Changes Needed to Expand Use of Innovative Cleanup Technologies (GAO/RCED-94-205, Aug. 10, 1994).

[6]In October 1995, EM established a sixth focus area to develop technologies for stabilizing and immobilizing plutonium. This focus area is to be managed by the Office of Nuclear Material and Facility Stabilization.

[7]Mixed waste has both radioactive and hazardous components.

within EM conducted their own projects, which often overlapped and conflicted with OST's activities. We also found that DOE did not have a comprehensive needs assessment for ranking and funding technology development projects as effectively as possible.

Although EM originally established the focus area approach to coordinate technology development activities across its program offices, we found that only OST was evaluating the projects that it funded to identify areas of possible overlap and excessive duplication. EM directed its other program offices to support the focus area approach by appointing "user" representatives to serve on focus area management teams, but some of these offices did not inventory their projects, and their projects did not receive the same level of scrutiny as OST's.

As a result, no comprehensive list of EM's technology development projects had been compiled. We were able to determine that, apart from OST, only the Office of Waste Management funded technology development at field sites during fiscal years 1995 and 1996.[8] We were unable to verify the extent of the possible overlap and duplication between the two offices, since no comprehensive list of the Office of Waste Management's projects was available. Partial lists had, however, been prepared for the Mixed Waste and Tanks focus areas. The Office of Waste Management did not formerly require its sites to describe their technology development projects because it viewed technology development as an integral part of the sites' waste management activities. However, the office plans to begin collecting this information in support of its fiscal year 1998 work plan.

In a preliminary review of projects funded by OST and the Office of Waste Management, we found that these offices had funded a large number of melter projects and that several projects had received funds from other DOE program offices as well. At our request, OST compiled a comprehensive list of all DOE-funded melter projects. This list revealed that DOE had contributed funds for 60 different melters at various sites across the country and fully funded 52 of them. According to a DOE official, a melter costs between $15 million and $30 million to develop fully. OST's list indicated that most of the funding for these melters came from Energy Research and certain EM program offices but some also came from Defense Programs. OST has no summary information on the total amount of funding dedicated to melter projects; however, in 1996, EM funded melter projects totaling more than $40 million.

[8]The Office of Nuclear Material and Facility Stabilization's technology development activities associated with the Plutonium Stabilization and Immobilization focus area are still in the planning stages.

In November 1995, concerned about possible overlap and duplication, the managers from the Mixed Waste and Landfill Stabilization focus areas convened a group of experts in melter technology from outside the agency to determine whether the number of melter projects should be reduced. The experts concluded that although some duplication is useful, DOE was sponsoring far more melter projects than were needed.[9] The experts characterized DOE's technology development effort as "a proliferation of melter systems" and recommended that the Department reduce the number of melter projects significantly because many of the technologies, such as joule-heated melters,[10] are already available in the commercial sector. The experts noted that when enough vendors are available to bid competitively on cleaning up a site using a particular type of technology, DOE should say "enough is enough" and cease to support the research and development of that technology.

Project Concentration at Lead Sites

When EM first conceived the focus area approach, OST was responsible for managing the technology development program centrally at headquarters. However, as this approach evolved, EM shifted the program's leadership to the field as part of a Department-wide effort to decentralize. Between July 1994 and February 1995, EM delegated the leadership for the five focus areas to the following locations:

- Tanks: Richland, Washington;
- Mixed Waste: Idaho Falls, Idaho;
- Plumes: Savannah River, South Carolina;
- Landfill Stabilization: Savannah River, South Carolina;
- D&D: Morgantown, West Virginia

OST chose three of the lead sites through a competitive process, considering each site's experience in an area and the strength of the management team described in the site's proposal. Thus, OST chose Richland for Tanks, Idaho Falls for Mixed Waste, and Savannah River for Plumes. Subsequently, OST selected Savannah River, without competition, to lead the Landfill Stabilization focus area. Because the Landfill Stabilization and Plumes focus areas are interrelated, OST did not consider competition necessary. Finally, OST chose Morgantown to lead the D&D

[9]Report of the Technical Peer Review of Thermal Treatment for TRU, TRU Mixed & Mixed Low-Level Waste, Part I: November 1995, prepared for the Office of Technology Development [now OST], EM (distributed Mar. 15, 1996).

[10]These melters pass an electrical current between electrodes immersed in waste to provide the heat (between 1,050 and 1,500 degrees centigrade) needed to melt the waste and form the glass that immobilizes contaminants.

focus area because its staff had expertise in contracting—an important consideration, since many D&D technologies are available in the private sector. OST gave the lead sites the responsibility for managing the nationwide program for their respective focus areas. Their responsibilities included (1) making nationwide funding decisions among potential technology development projects and (2) ensuring that the needs of customers across all DOE sites and EM offices, as well as various stakeholder groups nationwide, were met. However, OST provided the lead sites with no specific guidelines for selecting projects.[11]

We found that by delegating the lead responsibility for the focus areas to field locations and by not providing any guidelines for selecting projects, EM created an organizational structure that allows certain lead sites to favor their own projects. Within each focus area, the funding for projects has begun to be concentrated at the lead sites. For fiscal year 1996, each lead site received more dollars for projects in its focus area than it had received for fiscal year 1995, before the restructuring (see table 1).

Table 1: Concentration of Funding at Lead Sites, by Focus Area

Dollars in millions

	Funding			
	Fiscal year 1995		Fiscal year 1996	
Lead site (focus area)	Amount	Percentage of focus area's total	Amount	Percentage of focus area's total
Richland, Washington (Tanks)	$11.8	51	$15.8	52
Idaho Falls, Idaho (Mixed Waste)	$13.9	46	$25.1	49
Savannah River, South Carolina (Plumes)	$4.6	14	$9.2	30
Savannah River, South Carolina (Landfill Stabilization)	$2.4	8	$7.3	27
Morgantown, West Virginia (D&D)	$0.4[a]	3[a]	$6.3	43

[a]Although Morgantown was designated as the lead site for the D&D focus area in February 1995, Morgantown did not receive a significant amount of funding until fiscal year 1996.

Source: GAO's presentation of data from OST.

[11]Shortly after EM established the focus areas in 1994, OST prepared a framework for independent peer review. The initial objectives of the process included (1) ensuring that technological solutions reflect the best available science and (2) identifying redundant and overly costly projects. After submitting the framework to the National Academy of Sciences and receiving their response that the process was overly cumbersome, OST did not implement the process.

The concentration of funding at certain lead sites may, in part, reflect an extended history of work in a particular area, yet in some instances it also represents a dramatic shift in funding away from the nonlead sites. At Idaho Falls, for example, the increase in funding for Mixed Waste projects evolved from this lead site's long-term work on buried waste. At Savannah River, however, the increase in funding for Landfill Stabilization projects—from 8 percent in 1995 to 27 percent in 1996—may have occurred, to some extent, because management wanted to secure support for researchers at the lead site. According to researchers and field representatives at Savannah River, one reason for the increase in funding at Savannah River was to provide support for researchers on-site whose work had previously been funded through DOE's Defense Programs office. Meanwhile, the percentage of funding for Landfill Stabilization projects at Idaho Falls, for example, dropped from 46 percent in 1995 to 20 percent in 1996. Such shifts in workload have led to expressions of concern by nonlead sites that their proposals are not being treated fairly because their focus area's management has a vested interest in selecting proposals submitted from the lead site.

To ensure that proposals are selected fairly on the basis of their scientific merits, the National Academy of Sciences' National Research Council recommends that agencies use some form of peer review to judge the quality of proposals.[12] The Council defines "peer reviewers" as established working scientists or engineers from diverse institutions who are deeply knowledgeable about a field of study and who provide disinterested technical judgments as to the scientific significance of a proposed work, the competence of the researchers, the soundness of the research plan, and the likelihood of success.

We found, however, that although the lead sites used significantly different systems to select projects, none of them used disinterested reviewers to determine the technical merit of the proposed work. For example, in the Plumes focus area, the members of Savannah River's lead team decided which projects should receive funding; no peer reviewers evaluated the proposals' technical merit. Although the Landfill Stabilization and Mixed Waste focus areas did use peer reviewers, most were associated with the local leadership team and, therefore, were not independent. The Tanks focus area used an elaborate system of technical review, but many of the reviewers were not independent. Finally, the D&D focus area did not use peer reviewers for fiscal year 1996 because the large demonstration

[12]Allocating Federal Funds for Science and Technology, Committee on Criteria for Federal Support of Research and Development (Washington, D.C.: National Academy Press, 1995).

projects upon which the fiscal year 1996 D&D program is based were competitively selected.

During a 1995 review of EM's technology development program, the National Research Council noted that EM's process for selecting projects should incorporate a review of proposals by a knowledgeable independent review group comprising individuals from outside the agency with no vested interests in the outcome. According to the Council, this independent peer review system should (1) exclude those reviewers who might be considered to have a conflict of interest and (2) be carefully implemented to ensure equity.[13]

Actions Taken by OST to Improve EM's Technology Development Program

Starting in December 1995, OST began taking actions independently to improve the technology development program's management within its own office and within EM as a whole. To eliminate duplication and overlap and to promote coordination across EM's programs, OST developed a strategy in February 1996 that will coordinate and rank technology development projects funded by EM's various program offices. To eliminate overlap among focus areas within its own office, OST scheduled a comprehensive review of all ongoing work in each focus area to clarify which projects each focus area should be funding. OST's review is scheduled to be completed by the end of June 1996. In addition, in February 1996, OST combined the Plumes and Landfill Stabilization focus areas into the Subsurface Contamination focus area. Responding to the recommendations of the OST-sponsored melter review panel, the focus areas began to close out melter projects in December 1995, and in April 1996, the Deputy Assistant Secretary of OST told us that OST had decided to stop funding melter projects because most melter technologies are now available commercially.[14]

To help ensure that the funding for projects is not being concentrated at the focus areas' lead sites unless warranted by the projects' technical merits, senior OST officials told us that they plan to direct the focus areas' managers to use independent peer reviewers in selecting projects. OST indicated that this system will be in place for the fiscal year 1997 selection process. Reviewers are to be "external, independent, and technically qualified" to determine the technical and scientific merits of specific

[13]Improving the Environment: An Evaluation of the DOE's Environmental Management Program (Washington, D.C.: National Academy Press, prepublication copy, 1995).

[14]OST plans to continue funding one project involving U.S. support of Russian technology.

projects and to ensure that projects are selected on the basis of their merits without regard to the location of the work.

Agency Comments

We provided a copy of our report to DOE for its review and comment. The offices of Science and Technology, Environmental Restoration, and Nuclear Material and Facility Stabilization did not provide comments. A senior technical adviser in the office of the Deputy Assistant Secretary for Waste Management commented on our statement that, despite the promising steps taken to improve the management of technology development, it is not clear that OST can effectively coordinate technology development across EM's program offices without EM's leadership and support. According to the Office of Waste Management, EM has given OST leadership and support to coordinate technology development. Specifically, the Office of Waste Management cited the former Assistant Secretary for Environmental Management's strategic goals, and the newly confirmed Assistant Secretary for Environmental Management's guiding principles, for focusing EM's technology development efforts. While we agree that such goals and principles are important as guides to DOE's technology development efforts, we note that they do not provide specific direction for eliminating duplication and promoting coordination across EM's programs. Accordingly, we have not changed this portion of our report.

We conducted our review from May 1995 through June 1996 in accordance with generally accepted government auditing standards. Appendix I provides a detailed discussion of our scope and methodology.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days from the date of this letter. At that time, we will send copies to the appropriate congressional committees; the Secretary of Energy; and the Director, Office of Management and Budget. We will also make copies available to

others upon request. Please call me at (202) 512-3841 if you or your staff have any questions about the information provided in this report. Major contributors to this report are listed in appendix II.

Sincerely yours,

Victor S. Rezendes
Director, Energy, Resources,
and Science Issues

Contents

Abbreviations

D&D	decommissioning and decontamination
DOE	Department of Energy
EM	Environmental Management
OST	Office of Science and Technology

Objectives, Scope, and Methodology

At the request of the Ranking Minority Member, Senate Committee on Governmental Affairs, we examined the Office of Environmental Management's (EM) current management practices in selecting innovative projects for funding. Specifically, we determined whether EM is managing its program to prevent (1) excessive duplication and unnecessary overlap and (2) an unwarranted concentration of projects at certain field offices.

To determine whether excessive duplication and unnecessary overlap existed within EM's program, we obtained the opinions of experts on duplication in research projects. Specifically, we attended the 3-day melter review panel, which was sponsored by EM's Mixed Waste and Landfill Stabilization focus areas in November 1995, and we spoke with other researchers who have served as peer reviewers for the National Academy of Sciences. We requested descriptions of all technology development projects from each EM program office for fiscal years 1995 and 1996. After determining that the Office of Environmental Restoration and the Office of Nuclear Material and Facility Stabilization were not currently developing technology, we limited our review to information received on projects funded by the Office of Science and Technology's (OST) focus areas and the Office of Waste Management.

To determine whether there was an unwarranted concentration of projects at certain field sites, we compared the distribution of projects among sites for fiscal years 1995 and 1996. We also reviewed the process each focus area used to select projects for funding, after the focus areas' leadership was moved to the field.

In the course of our work, we interviewed the Deputy Assistant Secretaries of Environmental Restoration, Waste Management, Nuclear Material and Facility Stabilization, and Science and Technology, representing each of the EM program offices that have historically funded technology development activities. We also interviewed the leaders of each of the five focus areas. In addition, we attended several of the Technology Development Council's meetings, as well as the February 1996 meeting of the Focus Area Board of Directors, which OST convened to address the concerns we noted during our review. We obtained and reviewed pertinent documents, including copies of the proposals received by each of the focus areas for fiscal year 1996, as well as descriptions of the projects funded in fiscal 1996. We performed our review from May 1995 through June 1996 in accordance with generally accepted government auditing standards.

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