Summary

Site Characterization Meets Key Milestone; Waste Acceptance Issues Remain Open

Overview

Fiscal Year 1997 saw intense effort that produced advances programwide. By the year's end, we had met all commitments made in the Fiscal Year 1997 Performance Agreement between the Secretary and the President, and we were moving steadily toward major statutory decisions.

On schedule, we completed the main loop of the underground Exploratory Studies Facility that gives scientists direct access to the repository block at the Yucca Mountain site. Scientific studies proceeded above and below ground, and design of engineered barriers progressed. We worked to assemble the viability assessment for development of a repository at the site. We launched a major initiative to strengthen the total system performance assessment that is key to the viability assessment, to determining site suitability, and to licensing. We published proposed amendments to our repository siting guidelines. For the environmental impact statement that will support decisions about the site, we published a summary of scoping comments and our responses, and we began work on the draft statement.

Non-site-specific contingency planning for interim storage continued, as we submitted to the Nuclear Regulatory Commission (NRC) a generic Topical Safety Analysis Report that could facilitate development of a centralized interim storage facility, should national policy change. We issued a draft Request for Proposals to procure waste acceptance and transportation services. We further refined the policies and procedures for providing funding and technical assistance to States and Native American Tribes for training public safety officials along transportation routes.

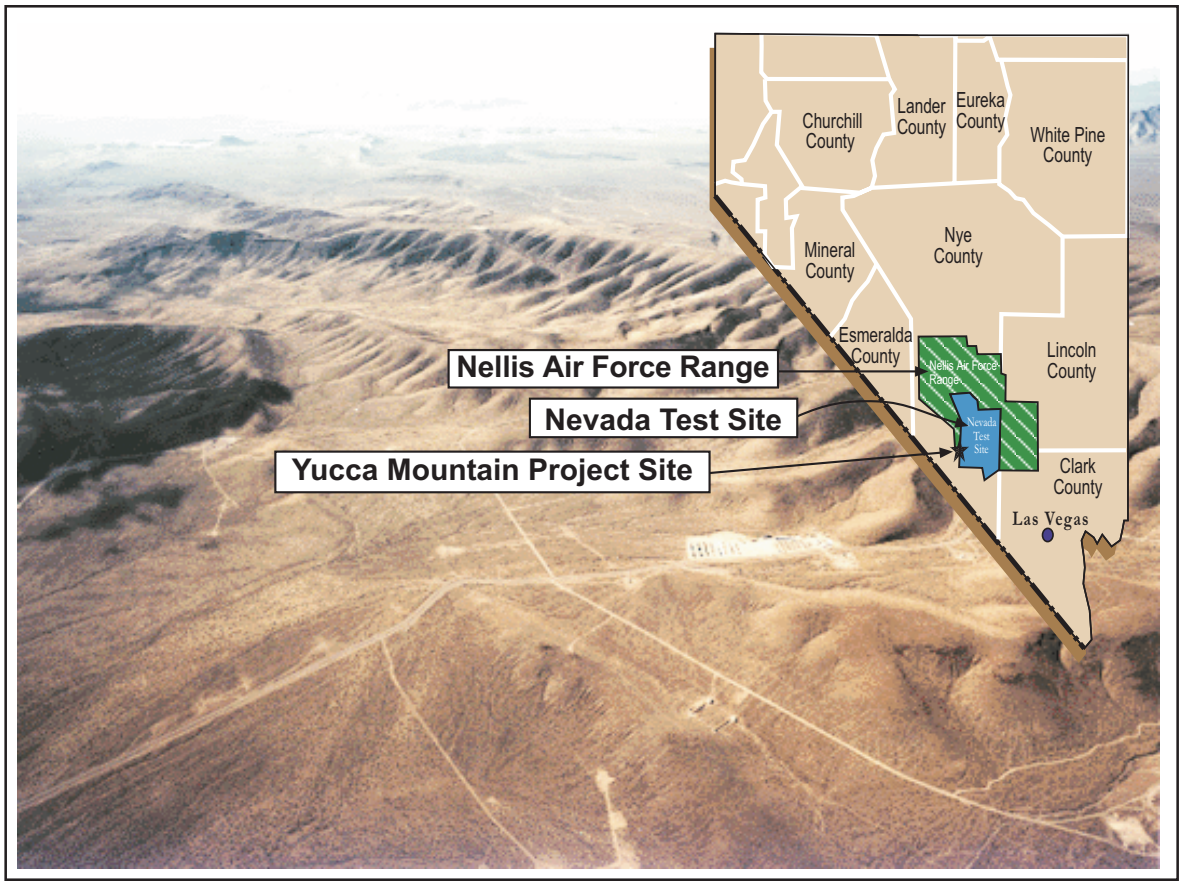
Preparations to accept Government-managed nuclear materials (primarily defense wastes) crosscut the program and involve coordination with the Offices of Environmental Management and Naval Reactors on detailed agreements that will govern our interfaces and on implementation of quality assurance procedures; coordination with the Office of Environmental Management on transportation planning; and consultation with these offices and the Office of Fissile Materials Disposition to factor data about their wastes into waste package design, performance assessments, and environmental impact statement analyses. Work to further integrate DOE and Naval spent nuclear fuel into waste management system planning and initiation of a change to incorporate surplus weapons-grade plutonium waste forms into the program baseline signaled our significant progress in this area.

Debate over proposed interim storage legislation continued, as utilities and States pursued legal remedies for the hardships they claim will result from our inability to start accepting spent nuclear fuel in 1998. The Secretary and our Acting Director met with representatives of utilities and State utility regulatory commissions to explore how individual contract amendments might address these problems.

As statutory cuts in funding for the Waste Acceptance, Storage and Transportation Project and the Program Management Center challenged us to do more with less, we further strengthened and streamlined our management capabilities and consolidated our quality assurance functions.

Yucca Mountain Site Characterization Project

In the Department's Fiscal Year 1997 appropriation, Congress endorsed our approach to site characterization and our plans for a viability assessment. Congress also specified the components of the assessment, directing us to complete it by September 30, 1998. It authorized the full $325 million



Aerial view of Yucca Mountain with Inset Map of Nevada Showing Location of Yucca Mountain Project Site

for the Yucca Mountain Site Characterization Project that we requested—an increase of $75 million over the prior year. In keeping with congressional direction and our revised *Program Plan*, we focused on key technical issues related to the viability assessment and determination of site suitability.

At the Exploratory Studies Facility, the main loop is completed; planning accelerates for the cross-drift

On April 25, 1997, we completed the 31-month-long excavation of the 8 kilometer (5-mile) main loop of the underground Exploratory Studies Facility, meeting a major milestone. Our safety record continued to exceed mining industry performance; worker safety remains our top priority.

Running along the eastern side of the potential repository block, the main loop gives scientists direct access to the block and enables them to gather data they can use to model natural processes at the site and to design a repository and waste package tailored to the site. These models and designs are used to conduct performance assessments of how the natural site, together with engineered barriers, will perform under a range of conditions, over thousands of years.

Studies had been conducted in test alcoves within the Exploratory Studies Facility for several years, and hydrologic studies were initiated in niches in Fiscal Year 1997. With the main loop of the tunnel completed and construction support equipment removed, the tunnel functions primarily as the underground laboratory it was designed to be. Because the Ghost Dance Fault is a major geologic feature, scientists want to better understand water movement and chemistry in that zone. We completed the Northern Ghost Dance Fault Alcove, and we began testing in it and in the access tunnel to the Southern Ghost Dance Fault Alcove, which was later completed in October 1997.

We accelerated planning for a smaller-diameter cross-drift (a short tunnel) above the repository horizon. By traversing the strata of the potential repository block, the cross-drift will provide a more complete three-dimensional view of the mountain. Testing there will further reduce uncertainties about the site and help us better understand processes critical to site suitability and repository construction. We plan to use observational data gathered from within the drift to support the viability assessment.

Most surface-based testing is completed; underground studies expand our understanding of the site

Well over 80 percent of the surface-based testing needed for licensing had been completed by the end of the fiscal year. With completion of the main loop of the Exploratory Studies Facility, the focus of underground work shifted to investigations of the Ghost Dance Fault and to hydrologic and thermal studies.

Using surface-based boreholes, monitoring wells, and boreholes drilled from within the Exploratory Studies Facility, we continued to study how water moves through the mountain, above and below the water table. Data indicate that there may be more moisture percolating in some locations within the mountain than we had previously thought; the significance of this information and the consequences for repository performance are still being analyzed. We also continued to collect data to characterize seismicity, weather, and pneumatic pathways. And we drilled another borehole to the depth of the water table west of the Exploratory Studies Facility, in what would be the repository block, to study rock properties, deep stratigraphy, and the saturated zone. These data will support three-dimensional geologic and hydrologic modeling.

Because radioactive waste emits heat, it is important to understand how cycles of heating and cooling might affect the thermal, mechanical, hydrologic, and chemical characteristics of the proposed repository environment. Three studies using electric heaters to simulate heat emitted by waste are being conducted for this purpose. The first study, a large-scale underground test, used a single heater to heat a 25-cubic-meter (883-cubic-foot) volume of rock to 100 degrees Celsius; more than 300 thermometers distributed throughout the test alcove are measuring the effects. The test began in August 1996; the heater was turned off in May 1997. Data were collected as the rock heated up and are being collected as it cools down.

The second study involves heating a large block of rock carved from the same geologic formation as the potential repository. Because the rock is a discrete block, we can more closely control and monitor test parameters. This study began in February 1997.

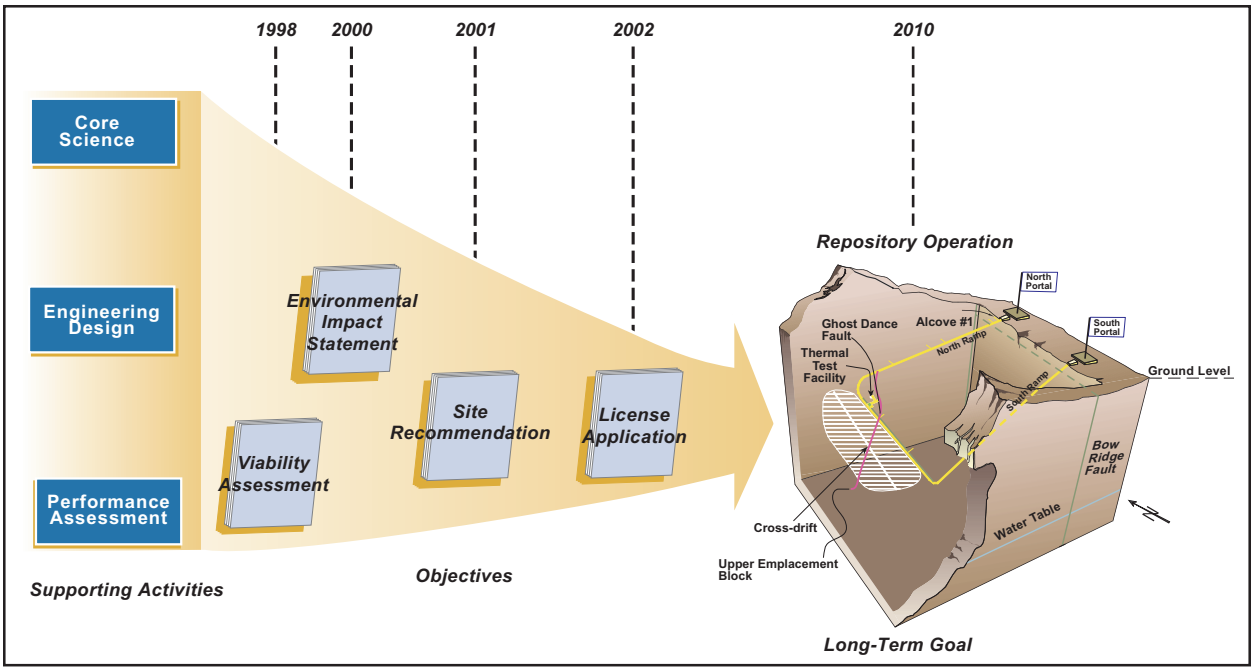
The third study, one thousand times larger in volume than the single-heater test, is the largest underground thermal test ever conducted. To provide information on a scale more representative of repository conditions, it will simulate conditions in an actual waste emplacement tunnel by heating an underground alcove about 48-meters (157-feet) long over several years. In Fiscal Year 1997, we finished excavating the alcove and installed instrumentation. Testing began in December 1997 and will continue through a 4-year heat-up period and a 4-year cool-down period.

Initial data from all three thermal studies will be used in the total system performance assessment for the viability assessment.

Viability assessment proceeds

The viability assessment involves shaping the results of many years of work into documentation that presents: (1) preliminary design concepts for critical elements of the repository and waste package; (2) a total system performance assessment that synthesizes scientific, design, and engineering information to predict the repository system's probable performance under a range of conditions and various design options, over thousands of years; (3) a plan for developing a license application and an estimate of what executing that plan would cost; and (4) an estimate of what it would cost to construct, operate, and close a repository, based on the preliminary design concepts.

This comprehensive compilation of what has been learned from site characterization will provide decision-makers with timely information and a common frame of reference for deliberations over appropriate funding levels and future direction for our program.



The Viability Assessment is the Next Step in a Careful Process

Total system performance assessment: key to site suitability and licensing

Because understanding the probable performance of the repository system is key to decisions about the viability, suitability, and licensability of the site, we convened a multidisciplinary panel of distinguished independent peer reviewers to monitor and review our performance assessment models and techniques. The panel's 2-year review will serve the goals of (1) making the total system performance assessment transparent to technical peers, regulatory and oversight bodies, and departmental and congressional decision-makers; and (2) ensuring the traceability of decisions and assumptions that support that assessment. The panel's recommendations are being factored into the viability assessment, as appropriate.

To further strengthen total system performance assessment tools, we conducted formal, documented expert elicitations to quantify uncertainties in some models of natural processes at the site. We also conducted a series of nine workshops, observed by staff from the NRC, the Nuclear Waste Technical Review Board, the Environmental Protection Agency, and others, to strengthen the technical validity of our models.

Repository and waste package designs advance

Information from surface and underground site investigations, laboratory studies, and performance assessments continued to shape our designs for the repository and waste package, and we used systems studies to examine design options and improve the total repository system. Considerations of safety, performance, operations, and cost governed this work, along with a strategy that relies on multiple barriers with diverse properties and failure modes over a range of repository conditions.

We refined the repository concept of operations, and we incorporated into the design of the repository and waste package certain features that will enhance performance and may lower costs. The results will be included in the viability assessment. We also completed viability assessment designs for surface facilities, the underground operations area, and the engineered barrier system. Cost estimates based on these designs were begun for the viability assessment. Design focused on thermal management; performance confirmation design; waste handling emplacement and retrieval; development of systems, structures, and components important to safety that have no precedent; and design-basis event analyses. Site-scale models of geologic

processes were used to bound uncertainties in anticipated environmental conditions. Design options for the license application were evaluated.

For the waste package, design focused on developing the methodology for criticality analysis; preliminary thermal, structural, and shielding analyses; fabrication of containment barriers; analyses of closure; and conceptual design and selection of materials for tunnel floors. Long-term corrosion tests, which will be used to refine waste package material selection, continued. Using data provided by producers and custodians of Government-managed nuclear materials, we factored data provided by producers and custodians of Government-managed nuclear materials into waste package and repository design and performance assessment modeling.

We propose amendments to repository siting guidelines

Since we published our repository siting guidelines in 1984, Congress has narrowed the search for a repository site to Yucca Mountain, and we have gained a more sophisticated understanding of what is required to assess repository performance. On December 16, 1996, we published a Notice of Proposed Rulemaking in the *Federal Register* proposing to amend our siting guidelines to reflect the fact that only one site is under consideration and to streamline the determination of site suitability for repository development to focus on overall repository system performance, rather than on independent technical considerations of individual features of the site. This reflects our belief that judgments about the Yucca Mountain site should be based on the site's ability to protect public health and safety and the environment as measured by overall system performance.

On January 23, 1997, we held a public hearing on our proposal in Las Vegas, Nevada. We twice extended the public comment period, to a total of 151 days.

Regulatory and oversight bodies play key roles

Nuclear Regulatory Commission. To prepare for licensing proceedings, we continued our twice-yearly, comprehensive briefings to the NRC and our frequent interactions with Commission staff. Reflecting the increasing importance of total system performance assessment, the focus of our interactions shifted from past years' concern with how individual features of the repository system will perform in isolation, toward the goal of achieving a common understanding of the issues important to overall repository performance and of the adequacy of proposed methodologies and approaches to key technical issues.

Nuclear Waste Technical Review Board. The Board continued to actively oversee our work, holding three Full Board meetings to discuss a range of issues related to our program. The Board's panels met as well. The Board's March 1996 *Report to the U.S. Congress and the Secretary of Energy* presented recommendations on issues related to interim storage, standardization of waste canisters to be used in the waste acceptance and transportation initiative, and technical aspects of the repository system. Our October 1997 response to the Board's recommendations addressed our consideration of repository design alternatives, construction of the cross-drift above the Exploratory Studies Facility, and the use of peer review in expert elicitations.

Work resumes on the environmental impact statement

In Fiscal Year 1996, budget cuts forced us to suspend our work on the environmental impact statement that will, if the Yucca Mountain site is found suitable, accompany the Secretary's site recommendation to the President. In Fiscal Year 1997, we prepared a summary of the public comments we had received during scoping hearings. The summary includes responses that indicate how we plan to approach issues but do not constitute a formal agency position. The comments fell within four categories: transportation, repository performance, legal issues, and policy issues, with transportation drawing the most concern.

We also began to prepare the draft environmental impact statement that will be published in Fiscal Year 1999. An Executive Committee, which consists of Departmental Secretarial Officers, and a Management Council, which includes representatives of the Office of Environmental Management with responsibility for Government-managed nuclear materials, are helping us guide development of the statement and ensure coordination within the Department.

Waste Acceptance, Storage and Transportation Project

Policy debate and litigation continue

Throughout Fiscal Year 1997, congressional debate over interim storage legislation continued. The Administration's position remained constant: any decision about interim storage should be based on objective, scientific criteria and should be informed by the results of the Yucca Mountain viability assessment. The Nuclear Waste Technical Review Board stated its belief that a primary centralized interim storage facility should not be sited at Yucca Mountain until the site's suitability for a repository has been determined.

In July 1996, the U.S. Court of Appeals for the District of Columbia Circuit held that the Department has an obligation to commence spent nuclear fuel disposal by January 31, 1998, but stated that it was premature to address the remedy available because the Department had not yet failed to meet its obligation. On December 17, 1996, the Department notified holders of the *Standard Contract* that it did not expect to be able to start accepting spent nuclear fuel by January 31, 1998, and it solicited their views on how best to accommodate this delay. Soon after his confirmation, in April 1997, the Secretary met with utility executives to discuss options for addressing the Department's delay in spent nuclear fuel acceptance. However, no agreements were reached. In January 1997, a coalition of utilities and a coalition of State agencies filed a petition for the court to issue a writ of mandamus enforcing its earlier decision and compelling the Department to begin accepting spent nuclear fuel by January 31, 1998.

While litigation proceeded, the Department explored with some contract holders how it might alleviate the impacts of a delay on a case-by-case basis, by modifying individual contracts under clauses of the *Standard Contract.* Under existing delivery schedules, 14 of 59 contract holders have 1998 delivery dates.

On November 14, 1997, the U. S. Court of Appeals for the District of Columbia Circuit concluded that "the remedial scheme of the standard contract offers a potentially adequate remedy." The court did not direct the Department to start accepting waste on January 31, 1998, nor did it allow contract holders to escrow Nuclear Waste Fund payments until waste acceptance begins. It did issue a writ precluding the Department from excusing its failure to accept waste on the grounds that it had not yet established a permanent repository or an interim storage program.

In December 1997, the Department filed a petition for rehearing, arguing that the D.C. Circuit Court lacks jurisdiction to decide the adequacy and appropriateness of contractural remedies, since such issues are committed to the Court of Federal Claims. In February 1998, State regulators and utilities petitioned the court on several issues. They asked the court to bar the Department from using the Nuclear Waste Fund to compensate utilities, authorize utilities to escrow their fee payments, order the Department to file a plan for immediately beginning spent nuclear fuel disposal, and appoint a Special Master to oversee the Department's activites. On May 5, 1998, the court denied the Department's December 1997 request for a rehearing and the February 1998 petitions filed by the States and utilities.

As of May 31, 1998, no utility has sought the contractual remedy the court discussed in its November 1997 opinion, which would require the Department to process claims pursuant to the Standard Contract. Two utilities, however, have filed claims in the Court of Federal Claims for partial breach of contract.

In an attempt to end the litigation, on May 18, 1998, the Department proposed a settlement for utilities that have standard contracts with the Department. The Department proposes that utilities limit Nuclear Waste Fund payments to the proportionate share of fees needed to administer the civilian radioactive waste program. The remaining portion of the fee, normally paid quarterly, would be postponed until the Department is ready to accept spent nuclear fuel. A utility would remain obligated to pay the withheld fees, with interest at the Treasury rate, when receipt of spent nuclear fuel begins. Until then, a utility would be able to invest the withheld funds at higher interest rates and use the extra earnings to pay for its costs resulting from the contract delay. The Department estimates a benefit of approximately $2.8 to $5 billion to all utilities. The utilities, through the Nuclear Energy Institute, contend that the proposal is inadequate because it does not provide a mechanism for the Department to meet its

obligation to accept spent nuclear fuel and does not directly provide funds for continued on-site storage.

We pursue only contingency planning for interim storage

In accordance with congressional and Administration direction, we maintained capability to develop a centralized interim storage facility if one is authorized and sited. On May 1, 1997, we submitted to the NRC a Topical Safety Analysis Report for a non-site-specific facility that would handle canistered commercial spent nuclear fuel using commercially available storage-and-transportation casks. We expect that the Commission will complete its review of the report in late 1998. This work could support preparation and review of a Topical Safety Analysis Report for a specific interim storage site, if one is designated.

We prepare to acquire waste acceptance and transportation services

Acceptance and transportation of commercial spent nuclear fuel to Federal facilities will require a nationwide shipping campaign that must run smoothly for decades. In Fiscal Year 1996, we determined that, rather than develop a Federal capability to accept and transport this spent nuclear fuel, we would take advantage of private sector technical and management capabilities. To acquire the necessary equipment and services from commercial vendors, we designed a procurement approach that will stimulate the market to develop the equipment and services we need and that will foster competition and innovative approaches. This procurement will also involve managing the potentially significant market risks and uncertainties that both vendors and the Department will face.

To develop an approach that will attract vendors and serve the government's best interests, we have consulted with private sector vendors and other program stakeholders. On December 27, 1996, we published a draft Request for Proposals in the *Federal Register*, inviting public comment. On February 25, 1997, we held our second presolicitation conference, announced in the *Federal Register* and *Commerce Business Daily*, in Washington, D. C., to solicit stakeholder views on technical and contractual issues. Approximately 1,000 comments received from the attendees and other stakeholder organizations helped us prepare a revised draft Request for Proposals which was published on November 24, 1997.

We revise our proposed policies and procedures for training and technical assistance

Section 180(c) of the Nuclear Waste Policy Act mandates that the Department provide funding and technical assistance to States and Native American Tribes for training of public safety officials in jurisdictions along transportation routes. We have been working closely with many parties for many years to resolve issues related to eligibility for and timing of grants and the definition of activities allowable under the Act. On July 17, 1997, we published a Notice of Revised Proposed Policy and Procedures in the *Federal Register* inviting comments through September 15, 1997. Based on those comments another Notice of Proposed Policy and Procedures was published in the Federal Register on April 30, 1998.

We prepare to accept Government-managed nuclear materials

Under current planning assumptions, four categories of Government-managed nuclear materials are destined for disposal in the repository: DOE spent nuclear fuel and high-level radioactive waste, managed by the Office of Environmental Management; surplus weapons-grade plutonium waste forms, managed by the Office of Fissile Materials Disposition; and Naval spent nuclear fuel, managed by the Office of Naval Reactors. We have been working with the Offices of Environmental Management and Naval Reactors to develop memoranda of agreement that will govern the logistical, technical, financial, and administrative aspects of the process by which their nuclear materials will be transferred to our custody. In Fiscal Year 1997, we further defined respective roles and responsibilities.

From those offices and the Office of Fissile Materials Disposition, we obtained information that we need for waste package design, performance assessments, and analyses for the repository environmental impact statement. To facilitate close coordination, liaison personnel from the Office of Naval Reactors and the Idaho Engineering and Environmental Laboratory National Spent Nuclear Fuel Program were stationed at the Yucca Mountain Site Characterization Office.

We worked to further integrate DOE and Naval spent nuclear fuel, already in the program baseline, into waste management system planning. We conducted an assessment of the impacts of incorporating proposed surplus weapons-grade plutonium waste forms into the baseline, and we determined that impacts would be manageable and acceptable. We initiated a change proposal to modify the baseline accordingly.

Program Management

OCRWM's Director, Daniel A. Dreyfus, the third permanent Director of our program, resigned effective January 18, 1997. Lake H. Barrett, Deputy Director, was appointed Acting Director, the ninth person to hold the position since the program's inception in 1983.

Our Fiscal Year 1997 appropriation further reduced funding for program management and administration. Actual dollars shrank by almost 50 percent from Fiscal Year 1995 to Fiscal Year 1997. The consequence was a major, continuing challenge to adapt to budget cuts and manage with greatly reduced contractor support, while preserving the integrity of our work.

We completed the organizational realignment we had begun in 1996 to better carry out congressional direction, restructuring our organization and narrowing work scope, and we strengthened our ability to direct and monitor activities across the program. The award in February of a new management and technical support services contract contributed to better program integration. Consolidating quality assurance efforts under one existing contractor strengthened the independence of quality assurance, yielded more consistency in its application, eliminated redundancies and excessive infrastructure, and reduced costs.

A task team was formed to develop the safeguards and security program policy required for successful design, licensing, and operation of the repository. The Offices of Environmental Management and Naval Reactors will participate in this effort.

Preparing for formal implementation of the Government Performance and Results Act of 1993, we developed a preliminary draft *OCRWM Program Plan, Revision 2*, that will integrate and directly link OCRWM and departmental plans and milestones. Programwide, our advanced information technology applications were in routine use, offering ready access to data bases of higher caliber, promoting greater efficiencies and sounder management processes, and reducing overall program costs. Benefits included the ability to learn more quickly about policy, legislative, technical, scientific, and institutional matters and to respond more quickly and fully to congressional and other requests for information.

We issued the annual report on fee adequacy in October 1996. It found the fee paid by utilities to be adequate to cover the full costs of the program, based on the 1995 total system life-cycle cost estimate. We began work for a 1998 estimate that will use cost estimates prepared for the Yucca Mountain viability assessment and will reflect changes that Congress has directed in the program, advances in repository and waste package design, and improvements in performance assessment.

Conclusion

Under the Nuclear Waste Policy Act, the year 1998 was to mark the start of repository operations. That milestone is now scheduled for 2010, but the year 1998 is acquiring new significance. As a result of work performed under our revised program approach, the elements of the viability assessment are converging in what will constitute the first major assessment of the prospects for geologic disposal at the Yucca Mountain site since the 1987 amendments to the Nuclear Waste Policy Act directed us to characterize only that site.

Completion of the main loop of the Exploratory Studies Facility, findings from scientific studies conducted in that facility, advances in design and related cost estimates, rigorous peer review of total system performance assessment and greater reliance on expert elicitations—all are contributing to comprehensive documentation that the Administration and Congress can use in directing our program.

OCRWM's restructured program has now been tested, under demanding conditions, over the course of 2 years, and it has proved sound. Our management structure is leaner and stronger; our program controls are better integrated; our information systems are more responsive; and our technical work is more focused. Given adequate funding, staff, and stability, we can continue to do quality work, on schedule—moving steadily closer to an operational waste management system.