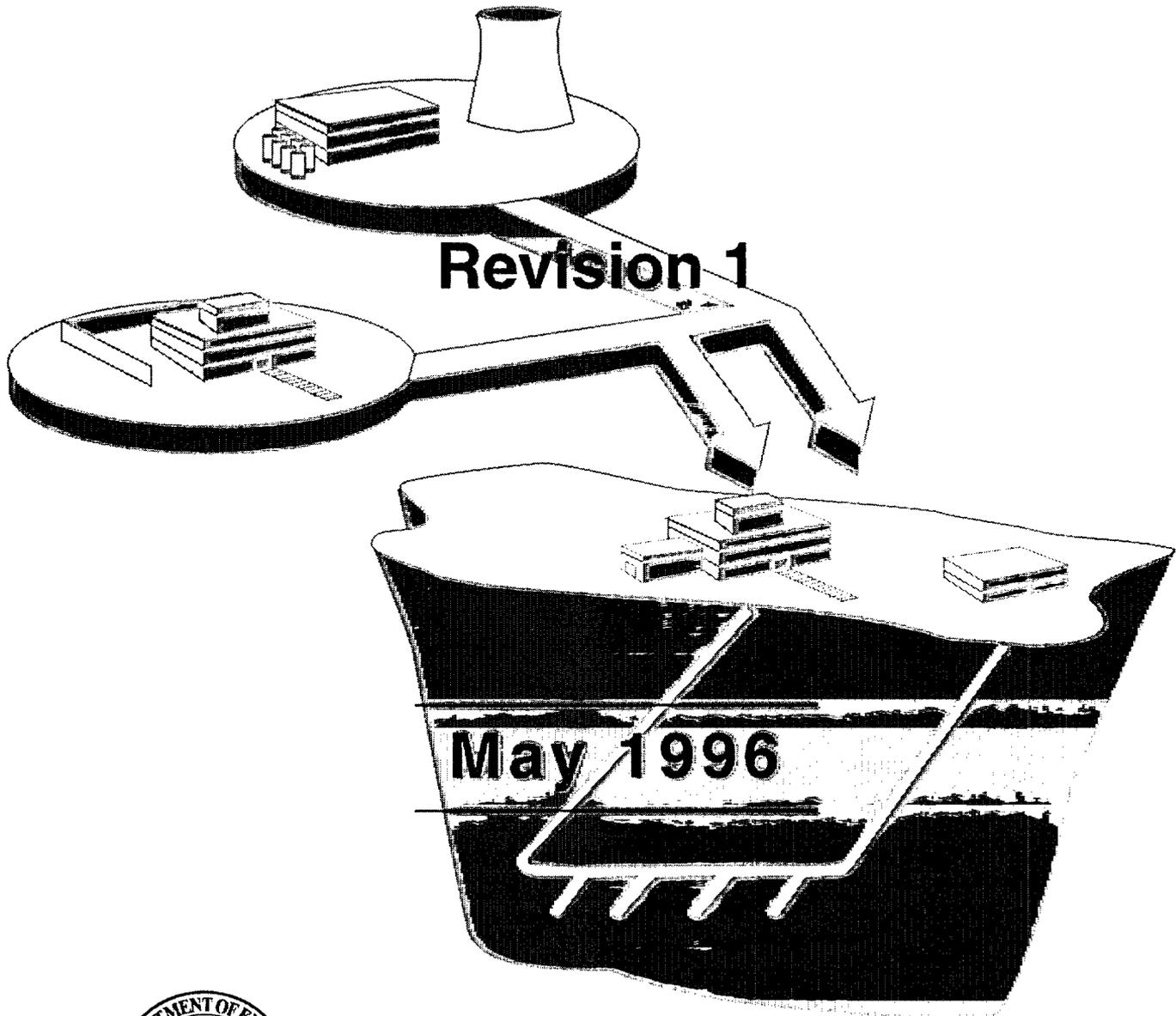


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Civilian Radioactive Waste Management Program Plan



U.S. Department of Energy

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Radioactive Waste Management (OCRWM).

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DRAFT

Civilian Radioactive Waste Management

PROGRAM PLAN

REVISION 1

May 1996

**Office of Civilian Radioactive Waste Management
U.S. Department of Energy**

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MESSAGE FROM THE DIRECTOR

BACKGROUND

In December of 1994, as the product of an extensive review of the Program, consultation with a broad spectrum of stakeholders, and a comprehensive strategic planning cycle, we published the *Civilian Radioactive Waste Management Program Plan*. That plan outlined an approach to accomplish the principal objectives of the Program with reasonable target dates and at substantially reduced cost compared to earlier estimates. It remained, however, within the statutory and regulatory framework governing the site suitability process for the Yucca Mountain Site Characterization Project and preserved the programmatic expectations and definitions that had evolved from that framework.

The Administration proposed the new program approach in its Fiscal Year 1995 budget request and the Congress approved the funding for the first year of the Program, a 37 percent increase over the previous fiscal year. Utilizing the Fiscal Year 1995 funding, and drawing upon the extensive scientific and analytical work already available, we have made a great deal of progress.

The Yucca Mountain Project completed a total system performance assessment that provides important insights into the critical factors that will affect the ability of the engineered and geologic features of a repository to meet long-term standards of public health and safety. Guided by these insights we are refining a waste containment and isolation strategy that, in turn, will focus the future scientific and engineering work on the critical factors. We will emphasize the scientific data collection and analyses required to confirm the hypotheses underlying the waste isolation strategy and concentrate our near-term design effort on the critical technological requirements of the engineered barriers. Finally, the exploratory tunnel has penetrated the repository formation itself and is beginning to provide solid confirmation of the general theory of the site conditions that has been developed from surface indications, drilling, and seismic work.

With regard to the Program's waste acceptance responsibilities, any future scenario of at-reactor storage, consolidated interim storage, and ultimate disposal will require an extensive transportation effort to remove spent fuel from reactor sites. A new generation of storage and transportation casks and canisters will have to be available to provide a comprehensive ability to service all fuel and all sites, to enhance standardization of equipment and operations, and to improve system-wide economics. In Fiscal Year 1995, the Program continued its work on transportation casks and initiated a major contract intended to make the first high-capacity, comprehensive multi-purpose canister system available to the marketplace by 1998.

FISCAL YEAR 1996 FUNDING IMPACTS

The Fiscal Year 1996 appropriation to the Program did not support the continuation of that program approach. Instead, the funding made available to the Program for expenditure is about 40 percent below the Fiscal Year 1995 level. The Congressional guidance accompanying the appropriation was to concentrate the work at Yucca Mountain on the most significant outstanding technical and engineering issues and to defer licensing activities as required by the funding constraint.

A portion of the appropriation was withheld from expenditure pending the enactment of new authorizing legislation addressing interim storage. That legislation has not yet been enacted.

The Program's first responsibility was to reduce its rate of expenditure to meet the restrictions of the Fiscal Year 1996 appropriation. In doing so, the Congressional guidance was followed. To the extent possible, the continuity of the core scientific work at Yucca Mountain, including progress on the underground exploration, has been preserved. Outside of the Yucca Mountain Project, the Program's activities have been reduced to carrying out its responsibilities for oversight of the Nuclear Waste Fund and of the contractual arrangements with nuclear utilities; limited coordination with transportation-related organizations; and only the necessary program-wide planning, management and administrative functions. Canister technology development activities have had to be terminated.

PROPOSED FUTURE PROGRAM

Planning for the Administration's Fiscal Year 1997 budget request had been initiated prior to the final 1996 appropriation action. In response to the new funding situation, the Program and the Administration immediately had to decide upon a long-term program plan to support the Fiscal Year 1997 budget request for the Program. There were three potential directions that could be considered for the Yucca Mountain Site Characterization Project:

- propose to return to the funding levels required to reestablish the previous program approach;
- consistent with Congressional guidance and the Fiscal Year 1996 funding level, convert the Project to a long-term research effort without firm targets for repository licensing; or
- prepare a new, more concentrated program plan that can regain a target for a license application within a reasonable time, but which requires only moderately increased funding in future years.

The Administration has chosen the third option and has incorporated it into the Fiscal Year 1997 budget proposal now pending before the Congress. The strong foundation of strategic planning that we had already developed and the recent convergence of more than a decade of scientific and engineering work at the site have made that option feasible.

In accordance with the Secretary's objectives for re-engineering of the Department and greater privatization, and consistent with the direction of the policy debate taking place in the Congress, we have also revised our program approach for the waste acceptance, storage, and transportation activities. We will place greater reliance upon the marketplace and utilize appropriately structured contractual arrangements to acquire the needed technologies and the logistical capability to carry out these responsibilities.

The revision to our December 1994 Program Plan presented in this document outlines the revised approach that is associated with the Administration's Fiscal Year 1997 budget request. The necessity to respond quickly to the unanticipated Fiscal Year 1996 appropriation actions and to concurrently develop a Fiscal Year 1997 budget proposal foreclosed the opportunity for an extensive consultative process during the development of this plan. The new plan, however, flows naturally from previous planning efforts. Its essential elements will be familiar to those who have closely followed our strategic planning process and the implementation of the Program in Fiscal Years 1995 and 1996. The major policy redirections have evolved out of the Congressional appropriations process in which many of our stakeholders have actively participated.

In this document we describe the work plan and schedule we propose to pursue. In a formal rulemaking that will be initiated soon, we will propose, and consider comments on, the process for completing the site suitability determination and the possible subsequent activities leading to a license application for the Yucca Mountain Site Characterization Project. We also will soon be initiating preliminary discussions with potential participants in the transportation service procurement process. If the Congress approves our Fiscal Year 1997 budget request, we will continue the Environmental Impact Statement process for the Yucca Mountain Project that has been suspended in Fiscal Year 1996. These formal processes, together with the continuing regular interactions with our oversight bodies and stakeholders, will provide the comment and advice we need to further refine the plan.

The program approach outlined in this document is consistent with the statutory basis for the Program and with our organizational mission. It preserves the essential program objectives, and it serves the needs of our customers within the authorities given us. It rests upon several key premises.

The Yucca Mountain Project will strive to reach an early conclusion of the site investigation. We will concentrate our resources on the most significant outstanding technical issues first. By 1998, we will assemble the wealth of scientific data already available in a system performance assessment to evaluate the behavior of a repository in the geologic setting. With focused design efforts we will ascertain that the technologies exist to construct a repository in that setting. We will also assess the technical, economic, and practical feasibility of the licensing and construction of the repository. If the repository appears to be viable, we will complete the work and pursue the process required by the Nuclear Waste Policy Act to make a formal recommendation of the site to the President and to present an acceptable license application to the Nuclear Regulatory Commission by the year 2002.

Concurrently, we will develop an approach and a capability to transport and store spent nuclear fuel with the greatest possible reliance upon the marketplace.

This approach is an appropriate modification of our Program to reflect the increased comprehension of the Yucca Mountain site, the current outlook for Federal budgetary policy in general, and the ongoing policy process concerning civilian radioactive waste management in particular.



Daniel A. Dreyfus, Director
Office of Civilian Radioactive
Waste Management

1

PROGRAM OVERVIEW

INTRODUCTION

The Civilian Radioactive Waste Management Program issued a program plan in December 1994 that described a new, more flexible approach to achieving the Program's objectives. During 1995, important progress was made. The Program has been required to revise that approach in response to guidance from the President and the Congress and to the funding reduction in the Fiscal Year 1996 program appropriation. This revised Program Plan has been prepared to describe the changes we have made in our activities to the Congress, regulatory and oversight bodies, other stakeholders, and the public.

Section 1, Program Overview, briefly reviews the Program's history and policy background, discusses Congressional and Administrative actions during the past year, and summarizes the revised program strategy, milestones, and funding requirements. *Section 2, Program and Project Activities*, describes the near-term activities planned under the revised strategy, and outlines longer-term activities that assume the Yucca Mountain site is found suitable and that, in 1999, an interim storage facility site is designated. *Section 3, Appendices*, presents additional information on program changes and background information on the Program.

In addition to incorporating changes that reflect current policy and funding realities, the *Civilian Radioactive Waste Management Program Plan, Revision 1*, charts a path forward that will allow the Program to achieve its ultimate goal: the safe disposal of the Nation's spent nuclear fuel and high-level radioactive waste.

1.1 SOLVING A NATIONAL PROBLEM

The safe, long-term isolation of spent nuclear fuel and high-level radioactive waste has become one of the most challenging environmental problems confronting the Nation. Spent nuclear fuel from commercial reactors has been accumulating throughout the United States since the first commercial nuclear power plant started operating in December 1957. Since the Manhattan Project began in 1942, the Federal Government has operated reactors and processed spent fuel for defense nuclear activities, generating large quantities of high-level radioactive waste.

Much is at stake in the effort to resolve the problem of accumulating spent nuclear fuel and high-level radioactive waste. Confidence in the ultimate removal of spent fuel from commercial reactor sites is critical to maintaining public support for the nuclear-generating capacity that currently supplies more than 20 percent of the Nation's electric energy. Permanent geologic disposal is also the long-term destination of the high-level waste resulting from cleanup of the Cold War weapons complex.

The challenge of safely managing and disposing of spent nuclear fuel and high-level radioactive waste has engaged the efforts of many individuals and organizations for decades. The Federal Government's effort to find a long-term solution to this problem is receiving increased attention from the Administration and the Congress as a result of escalating cost estimates, schedule delays, and the unmet expectations of the initial policies.

1.1.1

NATIONAL POLICY ADOPTED

The Nuclear Waste Policy Act of 1982 established the Federal Government's responsibility to provide for the permanent disposal of the Nation's high-level radioactive waste and spent nuclear fuel, and directed that the generators and owners of these wastes be responsible for the costs of their management and disposal. The Act authorized the Department of Energy to develop a system to safely manage and permanently dispose of the spent nuclear fuel accumulating at commercial reactors.

The primary goal of the Act was the siting, construction, and operation of a mined geologic repository. As originally enacted, the Act also directed the Department to

study the need for and feasibility of a monitored retrievable storage facility. The Act provided for the disposal of defense-related high-level radioactive waste as well as spent nuclear fuel, if the President determined that could be done. In 1985, the President found no basis to conclude that a defense-only repository was required and, therefore, under provisions of the Act, the Department was to proceed with plans and actions to dispose of defense waste together with commercial spent nuclear fuel in a single repository. *See box on this page for a discussion of spent nuclear fuel and high-level radioactive waste inventories.*

The Act directed that the civilian portion of the system be funded by the generators and owners of nuclear-generated electricity through a fee on the commercial generation of nuclear power to be deposited into the Nuclear Waste Fund. The portion of the system's cost for the disposal of waste generated or owned by the Federal Government was to be paid for by the Government.

Spent Nuclear Fuel and High-Level Radioactive Waste Destined for Ultimate Geologic Disposal¹

The United States has a growing inventory of spent nuclear fuel from commercial nuclear reactors, currently stored in 33 States at 72 operating and shut-down commercial reactor sites and one storage site. Existing pool storage facilities at commercial utility reactor sites are reaching their full capacities. By the end of 1996, a projected 12 of the 72 commercial reactor sites in 11 States will require additional on-site storage (either pool or dry storage). The total cumulative discharge of spent nuclear fuel from the 119 currently operating and shut-down commercial nuclear reactors will total about 84,000 metric tons uranium (MTU) by the year 2035, when the last commercial reactor completes its initial 40-year license period.

The Civilian Radioactive Waste Management Program estimates that approximately 13,800 canisters of primarily defense-related high-level radioactive waste will require disposal.² Program plans call for using approximately 10 percent of the repository's capacity for disposal of radioactive waste from defense nuclear activities and spent nuclear fuel owned by the Federal Government. The Government-owned spent nuclear fuel inventory is expected to be about 2,700 metric tons of heavy metal³ (MTHM) by the year 2035, most of which is spent fuel from weapons material production reactors. It also includes 65 MTHM of spent nuclear fuel from nuclear-powered naval vessels and 22 MTHM of spent nuclear fuel of U.S. origin from foreign research reactors.

¹ Data on spent nuclear fuel and high-level radioactive waste drawn from the following reports:

Department of Energy, *Spent Fuel Storage Requirements 1994-2042, Rev. 1*, DOE/RW-0431, June 1995; modified to include commercial spent nuclear fuel only.

Department of Energy, *Integrated Data Base Report - 1994: U.S. Spent Nuclear Fuel and Radioactive Waste Inventories, Projections, and Characteristics, Rev. 11*, DOE/RW-0006, September 1995.

Department of Energy, *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Environmental Restoration and Waste Management Programs Final Environmental Impact Statement*, DOE/EIS-0203-F, Vol. I, April 1995.

² Canister numbers may change depending on the treatment options and waste forms that the Department of Energy selects. The Program is developing terminology to designate canister capacity in terms of the equivalent of metric tons of uranium (MTU).

³ Primarily uranium, but includes small quantities of other highly radioactive heavy metals.

The Act directed the Department of Energy to undertake a national screening process for candidate repository sites. In 1986, the Department recommended three sites to the President for further study as possible geologic repositories. In the Nuclear Waste Policy Amendments Act of 1987, the Congress redirected the Department to investigate only one potential repository site, at Yucca Mountain, Nevada, and to report on the need for a second repository between 2007 and 2010. The Amendments Act also imposed conditions that restricted the Department's ability to site and develop a storage facility.

Appendix A provides a summary discussion of the "Evolution of the National Civilian Radioactive Waste Management Program."

1.1.2 **CHALLENGES IN IMPLEMENTING THE EVOLVING NATIONAL POLICY**

In the years since passage of the Nuclear Waste Policy Act, the Civilian Radioactive Waste Management Program has faced changing legislative mandates, regulatory modifications, fluctuating funding levels, and the evolving and often conflicting needs and expectations of diverse interest groups. During the 1980s, the real complexity of the scientific and regulatory challenge at the Yucca Mountain site began to be realized, and projected costs greatly exceeded initial expectations. It became increasingly clear that many of the expectations embodied in the Nuclear Waste Policy Act could not be met.

The Nuclear Waste Policy Amendments Act of 1987 nullified the Department of Energy's proposal to site a monitored retrievable storage facility at one of three locations within the State of Tennessee and placed additional restrictions on interim storage siting. The Office of the Nuclear Waste Negotiator, established by the 1987 amendments, was unable to secure a volunteer host for a storage facility before the termination of the Office's authority in January 1995. While a number of local and Tribal governments considered the possibility of hosting a storage facility in their jurisdictions, considerable opposition was generated within their respective States and no final proposals for a Federal facility were developed.

The end result was increased Congressional and constituent dissatisfaction with the Program. By 1993, it became clear that continuation of the Program as then planned was no longer viable. The issue was not whether a new approach was needed, but whether one could be found that would accomplish the objectives of the Nuclear Waste Policy Act within practical resource limitations and reasonable schedules.

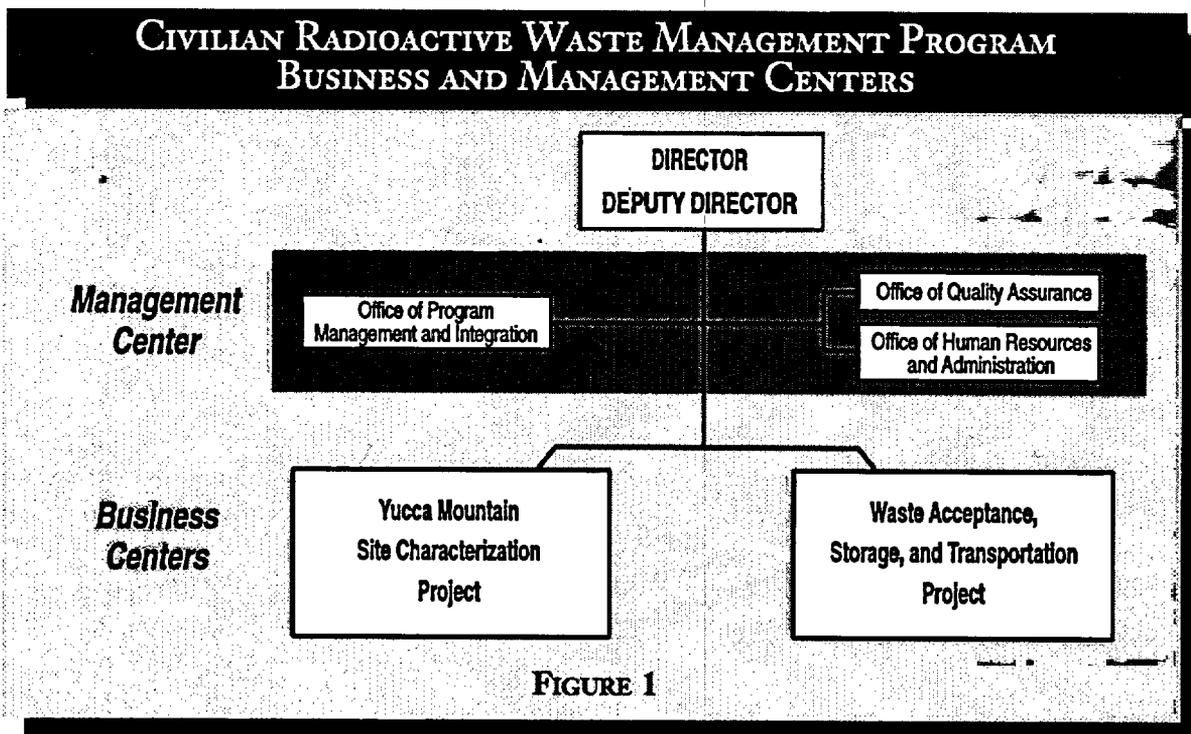
1.1.3 **THE 1994 PROGRAM PLAN AND EARLY ACCOMPLISHMENTS**

In 1993, we undertook a comprehensive assessment of the Program's activities to resolve the disparity between the activities that were actually being carried out and stake-

holder expectations for costs, schedules, and accomplishments. We obtained the opinions of our oversight and regulatory bodies, the Administration, the Congress, and key program stakeholders. From these deliberations, we developed a new, more flexible approach to make measurable and significant progress toward key objectives.

The new program approach, described in the December 1994 *Civilian Radioactive Waste Management Program Plan*, addressed concerns with cost increases and schedule slippages. The Congress endorsed the new approach by approving a 37 percent increase in funding for Fiscal Year 1995. It was also generally endorsed by the Nuclear Regulatory Commission and the Nuclear Waste Technical Review Board.

We defined two major projects or “business centers” within the Program — the Yucca Mountain Site Characterization Project and the Waste Acceptance, Storage, and Transportation Project — and created a Management Center to provide program integration and management support to the Program Director and the projects. *Figure 1* illustrates the program organization as restructured under the 1994 program approach.



The 1994 program approach refocused the work of the Yucca Mountain Site Characterization Project business center on (1) evaluating by 1998 the technical suitability of the Yucca Mountain site for development as a geologic repository; (2) delivering a statutory site recommendation and Environmental Impact Statement to the President by 2000, contingent on a positive suitability evaluation; and (3) submitting a license application to the Nuclear Regulatory Commission by 2001. We expected to receive authorization from the Commission to construct the repository in 2004, and 2010 remained the target for emplacing waste into a geologic repository.

The main objectives of the Waste Acceptance, Storage, and Transportation Project business center were to (1) make a new generation of spent fuel storage and transportation technology, multi-purpose canisters, available by 1998; (2) support timely resolution of waste acceptance and interim storage issues; and (3) maintain readiness to develop a centralized interim storage facility and a timely national capability to transport spent nuclear fuel.

In Fiscal Year 1995, we made significant progress toward achieving the new program approach objectives through the efficiencies gained from improved technical, cost, and schedule planning and implementation; through a restructured organization focused on attaining measurable results with clear lines of responsibility, authority, and accountability; and from the increased resources provided by the Fiscal Year 1995 Congressional appropriation of \$522 million.

YUCCA MOUNTAIN SITE CHARACTERIZATION ACCOMPLISHMENTS

The Yucca Mountain site investigation has been advanced greatly since the 1994 Program Plan was developed. Excavation of the exploratory tunnel into Yucca Mountain is proceeding faster than planned. No unexpected adverse features have been found. The rock quality at the potential repository level is as good as or better than predicted, increasing the probability that a repository with a nuclear waste capacity at the 70,000 metric tons uranium (MTU) statutory limit can be constructed. The potential repository area is as dry as expected, with some indications that ground water flow at the repository horizon has been very limited for 100,000 years or longer. The scientific strategy for evaluating the ability of the repository to isolate waste has matured significantly, due to the integration of available scientific knowledge and the new data being obtained from the exploratory tunnel. The Program has completed a comprehensive analysis of expected repository performance (*Total System Performance Assessment - 1995*) that materially increases our understanding of the key issues important to safety, and advances the development of a waste containment and isolation strategy for the repository concept.

These significant advances in the scientific evaluation of Yucca Mountain have allowed the Program to focus on completing the information needed for an assessment in 1998 of the viability of geologic disposal at the site as described in this revised Program Plan.

WASTE ACCEPTANCE, STORAGE, AND TRANSPORTATION ACCOMPLISHMENTS

In Fiscal Year 1995, the Program made meaningful progress in developing multi-purpose canisters. A contract was awarded for the design and preparation of safety analyses for a multi-purpose canister system, and a Preliminary Draft Environmental Impact Statement was developed. One half-scale model of a high-capacity truck cask was fabricated and testing was initiated. The Program also sought public comments on plans for providing technical and financial assistance for training public safety officials along waste transportation routes.

PROGRAM MANAGEMENT ACCOMPLISHMENTS

Substantial improvements have been made in the integration and efficiency of program management:

- Program participants at the Yucca Mountain Site Characterization Project have either been fully consolidated under the Management and Operating Contractor, or now work under a Memorandum of Understanding with that organization.
- Management systems, such as cost and schedule baselines and reporting processes, were restructured and streamlined to ensure more efficient utilization of resources and more effective control of work scope.

The improved management capability and planning basis have assisted in the Program's ability to preserve the core scientific programs at Yucca Mountain at a reduced level of funding, and to develop and propose a revised course of action that has the potential to regain the target of repository licensing within a reasonable time frame.

Most of the program objectives targeted for Fiscal Year 1995 were accomplished and progress is continuing, as indicated in *Table 1*. A few planned activities and milestones were revised or deferred in response to expected Fiscal Year 1996 funding reductions. *Appendix B* provides an expanded list of the Program's progress during Fiscal Year 1995.

1994 PROGRAM PLAN OBJECTIVES AND EARLY ACCOMPLISHMENTS

OBJECTIVES	ACCOMPLISHMENTS
Yucca Mountain Site Characterization	
Complete testing and begin operation of tunnel boring machine to excavate Exploratory Studies Facility	Done; tunneling ahead of schedule
Construct three testing alcoves in Exploratory Studies Facility	Done; testing underway
Drill one deep unsaturated-zone borehole and two other boreholes	Done
Issue Environmental Impact Statement Notice of Intent and conduct public scoping meetings	Done; 15 meetings conducted, comments collected
Complete <i>Total System Performance Assessment-1995</i>	Done
Complete and issue revised License Application Annotated Outline	Done
Complete one technical basis report and assess compliance with guidelines for surface processes, including erosion, surface characteristics, and preclosure hydrology; make recommendation to the Director regarding readiness to make higher-level findings	Report completed; assessment and recommendation deferred
Complete reviews of the advanced conceptual design for repository surface and underground facilities	Reviews completed in early FY 1996; report completed in March 1996
Complete conceptual design and initiate Title I Design for waste package	Conceptual design report completed in March 1996

TABLE 1

1994 PROGRAM PLAN OBJECTIVES AND EARLY ACCOMPLISHMENTS

OBJECTIVES	ACCOMPLISHMENTS
Waste Acceptance, Storage, and Transportation	
Issue report summarizing responses to Notice of Inquiry on waste acceptance issues	Done; final interpretation of waste acceptance obligation issued
Award one or more contracts for design and certification of multi-purpose canister system	One contract was awarded
Develop Preliminary Draft Environmental Impact Statement for multi-purpose canister system	Done
Complete fabrication of high-capacity legal-weight truck cask half-scale model and begin testing	Done
Issue a Notice of Proposed Policy and Procedures for implementing Section 180(c) of the Nuclear Waste Policy Act	Issued two Notices of Inquiry to solicit public comments; Notice of Proposed Policy and Procedures to be issued in FY 1996
Program Management	
Update the Program Strategic Plan as needed	Held strategic planning workshops; Strategic Plan release deferred pending program replanning to conform to budget action
Publish the <i>Civilian Radioactive Waste Management Program Plan</i>	Done; published December 1994
Complete consolidation of major program participants under Management and Operating Contractor	Done
Improve management tools (schedules, baselines, reporting processes) for more effective program management	Done
Complete consolidation of Department of Energy quality assurance procedures	Done
Provide integrated on-line automated configuration information system	In development
Complete preparation of the Civilian Radioactive Waste Management total system description	In development
Initiate an information management architecture project through a pilot test at Headquarters	Done
Begin implementation of Career Development Program tailored to individual employee needs	Done
Conduct collaborative process for stakeholder involvement	Ongoing
Participate in key deliberations regarding disposal of Department's radioactive materials	Ongoing

TABLE 1, continued



1.2.1

REVISITING THE NATIONAL POLICY ON RADIOACTIVE WASTE MANAGEMENT

While the Program was implementing its new approach, the national policy debate on the issues of the near-term management of radioactive waste intensified. Nearly a dozen legislative proposals were introduced in both chambers of the Congress during 1995. Some of these would, if enacted, significantly alter the basic policies established by the Nuclear Waste Policy Act of 1982 and its 1987 amendments.

The most comprehensive of the pending bills address demands by the nuclear power industry and State utility regulators in States with commercial nuclear power plants that the Congress declare that the Department of Energy has an unconditional obligation to begin acceptance of commercial spent nuclear fuel by 1998. These bills would authorize and direct the Department to begin development work immediately on an interim storage facility at a Congressionally designated site.

1.2.2

CONGRESSIONAL APPROPRIATIONS ACTION FOR FISCAL YEAR 1996

The Fiscal Year 1996 appropriations process took place in the midst of both this legislative activity and the larger debate over deficit reduction and balancing the national budget. Deficit reduction pressures and an emphasis on interim storage issues resulted in appropriations decisions that have had a significant impact on the Program.

The Energy and Water Development Appropriations Act of 1996 provided a total of \$400 million for the Program, \$85 million of which was designated to be used only for the development of an interim storage facility and only upon enactment of new statutory authority. Pending such authority, the Program was effectively reduced to a \$315 million funding level, or one-half of the \$630 million funding level anticipated for the continuation of the 1994 program approach.

The Congress recognized that the significant reduction in funding would require a more constrained repository program. The Conference Report accompanying the appropriations language provided the following guidance:

“The conferees agree on the importance of continuing existing scientific work at Yucca Mountain to determine the ultimate feasibility and licensability of the permanent repository at that site. The conferees direct the Department to refocus the repository program on completing the core scientific activities at Yucca Mountain. The Department should complete excavation of the necessary portions of the exploratory tunnel and the scientific tests needed to assess the performance of the repository. It should defer preparation and filing of a license application for the repository with the Nuclear Regulatory Commission until a later date. The Department’s goal should be to collect the scientific information needed to determine the suitability of the Yucca Mountain site and to complete a conceptual design for the repository and waste package for later submission to the Nuclear Regulatory Commission.”⁴

1.2.3 FISCAL YEAR 1996 APPROPRIATIONS IMPACT ON THE PROGRAM

Under the funding reductions for Fiscal Year 1996, the 1994 program approach was no longer sustainable. We were required to take immediate action to reduce spending in a manner that ensures the Program’s ability to meet its legal obligations and avoid a funding deficiency in Fiscal Year 1996. Our only recourse was to try to preserve the most critical activities while we made the required reductions and bore the resulting termination costs.

Based on the expectation of a reduced budget from the Fiscal Year 1995 level of \$522 million to \$400 million, and observing the guidance contained in the early Congressional reports, action was taken in September 1995 to reduce contractor work scope and eliminate about 875 contractor jobs during Fiscal Year 1996 primarily within the Yucca Mountain Site Characterization Project in Nevada.⁵ In November 1995, more than 200 additional contractor jobs were eliminated to reflect the Congressional reservation of \$85 million for the development of an interim storage facility. Consistent with the nature of that restriction and the already severe impact of the initial reduction on the repository program, this second reduction primarily affected the work of the Waste Acceptance, Storage, and Transportation Project and Management Center.

The Yucca Mountain Site Characterization Project’s funding was reduced from \$375 million in Fiscal Year 1995 to \$250 million in Fiscal Year 1996. Consistent with the Congressional guidance provided in the Conference Report accompanying the appropriations language, the Yucca Mountain Site Characterization Project was refocused to emphasize core scientific activity, excavation of sections of the Exploratory Studies

⁴ The Energy and Water Development Appropriations Act of 1996 Conference Report, *Congressional Record*, October 26, 1995.

⁵ *House Appropriations Committee Report on H.R. 1905, Energy and Water Development Appropriation*, House Report 104-149, June 20, 1995 (directed Department to downgrade, suspend or terminate activities at Yucca Mountain). *Senate Appropriations Committee Report on H.R. 1905, Energy and Water Development Appropriation*, Senate Report 104-120, July 27, 1995 (restricted \$250 million for core scientific activities at Yucca Mountain).

Facility necessary for scientific study, and completion of the repository and waste package conceptual designs. Activities supporting preparation and filing of a license application for the repository were deferred.

The Waste Acceptance, Storage, and Transportation Project's funding was reduced from \$57 million in Fiscal Year 1995 to approximately \$14 million in Fiscal Year 1996. As a result of this reduction, the Program has had to terminate funding for Phase II of the multi-purpose canister program, during which Nuclear Regulatory Commission certification of the design developed during Phase I would have been received. The contract for the multi-purpose canister development program is being brought to an orderly close. The Department of Energy ceased to be the lead agency on the Environmental Impact Statement for the multi-purpose canister, and responsibilities have been assumed by the Department of the Navy for naval spent nuclear fuel container selection.

We will also terminate the contract for certifying two General Atomics high-capacity transportation casks (the GA-4 and GA-9 casks), which would have provided an option for transporting uncanistered spent fuel from reactors to a storage or disposal facility by truck.

Cooperative agreements between the Program and external organizations involved in nuclear waste policy or activities have been reduced in Fiscal Year 1996 to approximately one-third of their Fiscal Year 1995 funding level.

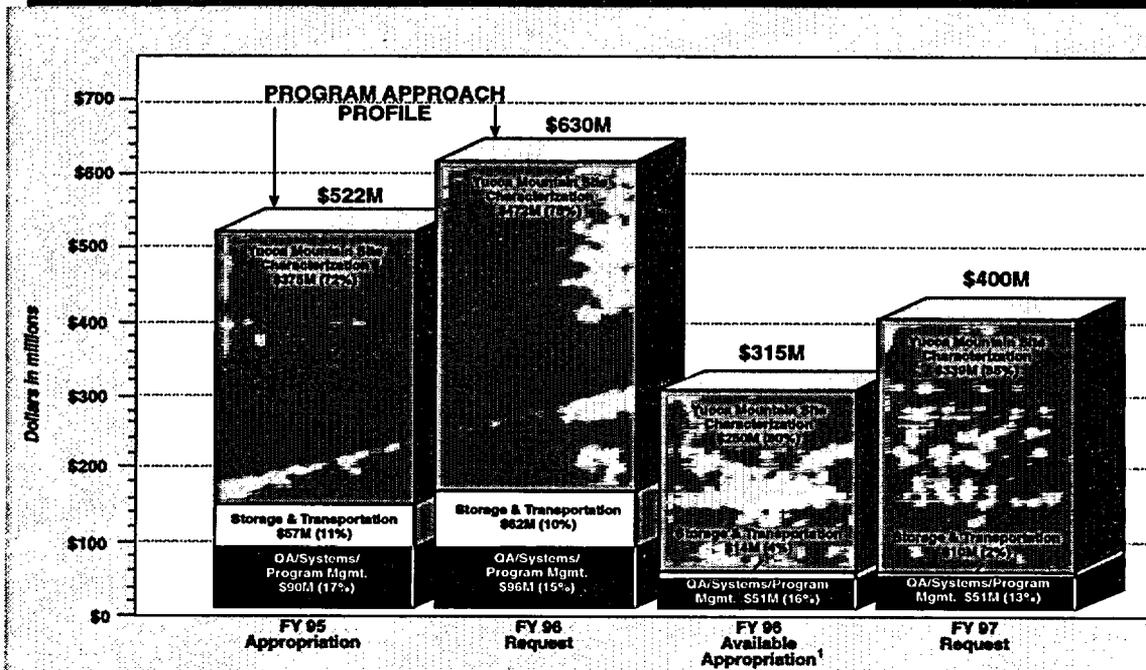
Program Management Center funding was reduced by 43 percent from \$90 million in Fiscal Year 1995 to \$51 million in Fiscal Year 1996. Major cuts have been made in the work scope and contractor support for program management functions, which include the activities of the Office of Human Resources and Administration, the Office of Quality Assurance, and the Office of Program Management and Integration.

1.2.4 **PRESIDENT'S PROGRAM GUIDANCE FOR FISCAL YEAR 1997**

The President's Fiscal Year 1997 budget request provided additional guidance to the Program by underscoring the Administration's continued commitment to geologic disposal. The budget request endorses Congress' recommendation to concentrate initially on addressing the major unresolved technical questions at the Yucca Mountain site. It provides \$400 million for the Program, \$339 million of which would go to the Yucca Mountain Site Characterization Project. Of the remaining funds, the Waste Acceptance, Storage, and Transportation Project would receive \$10 million and the Management Center \$51 million.

The President's Fiscal Year 1997 budget request defines a new program objective: to address by 1998 the remaining significant technical questions regarding the Program's hypotheses about the Yucca Mountain site and the scientific, engineering, and financial

BUDGET DISTRIBUTION COMPARISON FISCAL YEARS 1995-1997

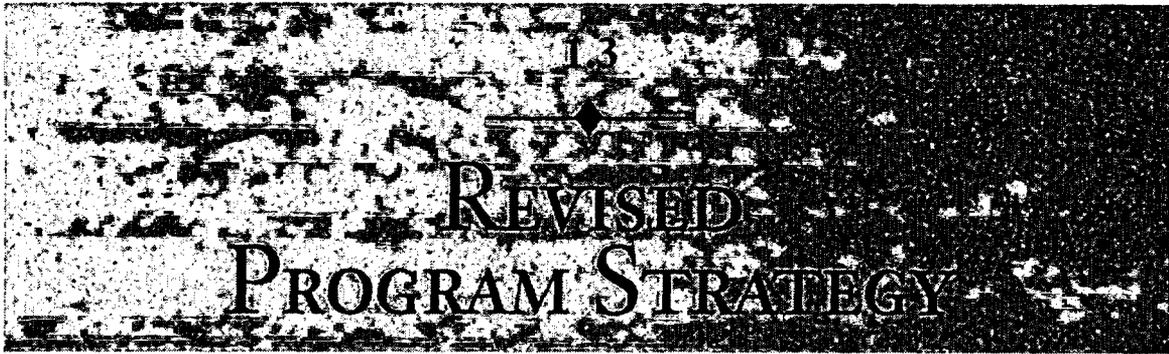


¹ The Energy and Water Development Appropriations Act of 1996 reserved \$85 million which shall be available for obligation and expenditure only for development of an interim storage facility and only upon enactment of specific statutory authority, effectively reducing the Program's funding level from \$400 million to \$315 million.

FIGURE 2

feasibility of building a geologic repository there. Consistent with Fiscal Year 1996 Congressional guidance, the Program will make an assessment in 1998 of the viability of geologic disposal at Yucca Mountain. The assessment will consist of a package of tasks that will provide an understanding of the repository design and its performance in the geologic setting; an estimate of the remaining work needed to prepare a license application; and a more precise estimate of the cost of a repository. The viability assessment will also contribute to the preparation of the subsequent, statutorily required Secretarial site recommendation to the President, if the site is found to be suitable, and to the license application to the Nuclear Regulatory Commission. The President's budget request also provides for funds to carry out the legal responsibilities of the Waste Acceptance, Storage, and Transportation Project and to perform contingency planning to maintain an ability to respond rapidly should the Administration and the Congress agree on new policy direction for interim storage.

Figure 2 presents the Program's budget distribution for the Fiscal Year 1995 appropriation, the Fiscal Year 1996 budget request and available appropriation, and the Fiscal Year 1997 budget request. Table 3 in Section 1.4, page 23, also shows the projected funding requirements to support the Program's revised strategy through Fiscal Year 2002.



REVISED PROGRAM STRATEGY

The Program has defined a revised program strategy consistent with the guidance provided by the President and the Congress, the exigencies of the Fiscal Year 1996 situation, and the outlook for future funding. Available resources have been concentrated on those efforts that are most essential to the long-range success of the Program's mission to manage and dispose of the Nation's spent nuclear fuel and high-level radioactive waste. With adequate future funding, the revised strategy will enable the Program to maintain progress toward accomplishing the goals of the Nation's civilian radioactive waste management policy on a reasonable schedule.

The revised program strategy is designed to maintain the momentum that has been achieved in the scientific investigation of the Yucca Mountain site and to regain target dates for determining the site's suitability for a geologic repository and for submitting a license application. The efforts of the Yucca Mountain Site Characterization Project have been redirected to address the major unresolved technical questions so that, in 1998, an assessment can be made of the viability of licensing and constructing a repository at the Yucca Mountain site. The Program will also consider revisions to the regulatory framework which may be needed to implement the restructured repository project plan. The Program expects to apply to the Nuclear Regulatory Commission in 2002 for a license authorizing construction of a repository at the Yucca Mountain site.

The Program will maintain a core capability in the Waste Acceptance, Storage, and Transportation Project to lay the groundwork for new policy direction regarding interim storage. We have devised a strategy based upon the assumption that an interim storage facility site will be designated in 1999. This assumption reflects the Administration's position that the interim storage facility siting decision should be informed by the results of the Yucca Mountain viability assessment to be completed in 1998.⁶

Some waste acceptance, storage, and transportation activities can be conducted prior to designation of an interim storage facility site, and could expedite the start of interim

⁶ Testimony of Secretary of Energy Hazel R. O'Leary before the Committee on Energy and Natural Resources, U.S. Senate, December 14, 1995.

storage operations when a site is designated and the facility authorized. These activities are the development of a market-driven approach that relies on the private sector for waste acceptance, storage, and transportation services, and the conduct of design, engineering and safety analyses for a non-site specific, phased, interim storage facility. Work to be accomplished after a site is designated includes facility development and the acquisition of waste acceptance, storage, and transportation equipment and services from the private sector. *Appendix C* discusses activities to be conducted after a site is designated.

Finally, the efficiency of program management has been significantly improved to reduce management costs. The program management function will be further refined to support the revised strategy and to enhance our management capabilities in the particular area of management information and control systems.

The key elements of the revised program strategy are summarized below. An expanded discussion is provided in *Sections 2.1, 2.2, and 2.3*.

1.3.1 **UPDATE THE REGULATORY FRAMEWORK FOR A REPOSITORY AT YUCCA MOUNTAIN IN 1997**

Based on our site characterization progress and the policy changes that have occurred over the past 10 years, we will propose amendments to the Department's siting guidelines (10 CFR Part 960) that will lead to a more efficient process for evaluating the suitability of the Yucca Mountain site for development as a geologic repository. Efficiencies will result from adopting a streamlined methodology specific to the Yucca Mountain site for applying the siting guidelines. Siting guideline revisions will be developed concurrently with the development of a site-specific radiological protection standard for Yucca Mountain by the Environmental Protection Agency and conformance of the licensing regulations to this new standard by the Nuclear Regulatory Commission. We will continue to consult with the Agency, the Commission, and other stakeholders as the regulatory framework for the geologic repository is updated.

1.3.2 **COMPLETE VIABILITY ASSESSMENT OF THE YUCCA MOUNTAIN REPOSITORY SITE IN 1998**

A principal objective of the revised strategy is to address by 1998 the major unresolved technical questions so that an informed assessment can be made of the viability of licensing and constructing a geologic repository at the Yucca Mountain site. This objective will require the completion of tasks that constitute a logical convergence point in the Program's work. The tasks include:

- a package of more specific design work on the critical elements of the repository concept and the waste package;

- a total system performance assessment, based upon that design concept and the scientific data and analysis that will be available to us by 1998, which will describe the probable behavior of the repository in the Yucca Mountain geologic setting;
- a plan and cost estimate for the remaining work required to complete a license application; and
- an upgraded estimate of the costs to construct and operate the repository in accordance with the design.

The Congress directed, and the reduced funding level in Fiscal Year 1996 has required, that repository licensing activities be deferred. The goal of submitting a successful license application to the Nuclear Regulatory Commission, however, remains central to the Program's mission. The work completed for the viability assessment will be an early and integral step on the path to a license application. The Administration's budget request for Fiscal Year 1997 sets forth a scope of work, budget profile, and schedule for the Yucca Mountain Site Characterization Project that are capable of supporting an application to the Commission for the repository license in 2002. The revised Program Plan is consistent with that funding outlook, with the Nuclear Waste Policy Act, as amended, and with the current understanding of the waste containment and isolation strategy appropriate to the Yucca Mountain site. The Program's regulatory approach and plans set forth earlier in the evolution of the Yucca Mountain Project will be revised to reflect the new approach.

1.3.3

RECOMMEND A REPOSITORY SITE TO THE PRESIDENT IN 2001 AND SUBMIT A REPOSITORY LICENSE APPLICATION TO THE NUCLEAR REGULATORY COMMISSION IN 2002

The Program's strategy for the Yucca Mountain Site Characterization Project has been revised to identify, prioritize, and schedule a focused set of site characterization activities that will allow us to submit a license application for construction authorization in 2002. Our activities will concentrate on the factors that are significant to the performance of a repository at the Yucca Mountain site. After completion of the viability assessment in 1998, we will prepare the additional information required for the Secretary of Energy's site recommendation to the President and for the license application to the Nuclear Regulatory Commission. As part of the site recommendation and license application process, we will issue the Draft Repository Environmental Impact Statement for public review and comment in 1999 and issue the Final Repository Environmental Impact Statement and Record of Decision in 2000. If the site is found suitable in accordance with our revised siting guidelines, the Secretary will issue a site recommendation in 2001, following public hearings that the Program will conduct in the State of Nevada prior to the possible site recommendation. The decision on site

recommendation will be based on the data obtained from site characterization, a description of the proposed repository and waste package, the Final Repository Environmental Impact Statement, preliminary comments from the Nuclear Regulatory Commission on the sufficiency of our information for licensing, the views and comments of the State of Nevada, and other relevant information required by the Nuclear Waste Policy Act, as amended. If the site is approved, we will submit a license application in 2002. This schedule will allow us to meet our long-term goal of starting repository emplacement operations in 2010.

1.3.4

**DEVELOP MARKET-DRIVEN WASTE ACCEPTANCE,
STORAGE, AND TRANSPORTATION APPROACH**

The revised program strategy includes a market-driven approach that relies on the private sector for transportation, storage, and waste acceptance services. The approach will allow for the maximum use of private industry capabilities, expertise, and experience in accepting, transporting, and storing commercial spent nuclear fuel. The Program plans to develop and implement a competitive procurement process resulting in awards of fixed-price, multi-year, performance-based contracts to obtain needed services and equipment at a reasonable cost. Incentives and flexibility will be offered to encourage innovative private sector approaches. Under this approach, private industry will act for the Department in carrying out certain functions under the *Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste* (10 CFR Part 961) to accept spent nuclear fuel at utility sites for delivery to a Federal facility.

1.3.5

**CONDUCT NON-SITE SPECIFIC DESIGN AND
ENGINEERING SAFETY ANALYSES**

Our interim storage readiness capability will be based upon a phased interim storage facility consistent with the concept discussed during Congressional debate. We will address the technical, safety, and procedural issues involved in licensing an interim storage facility to expedite the process if an interim storage site is designated. We have initiated development of a non-site specific topical safety analysis report for the first phase of operations at an interim storage facility. This report is scheduled to be submitted to the Nuclear Regulatory Commission for review in 1997. Completion of a topical safety analysis report and its subsequent submittal to the Commission for review and approval are contingent upon adequate future funding.

1.3.6

RESTRUCTURE PROGRAM MANAGEMENT ACTIVITIES

The revised strategy also restructures program management activities consistent with a reduced funding level and the Program's refocused priorities. The Management Center will provide continued administrative support and strategic planning assistance to the Yucca Mountain Site Characterization Project and Waste Acceptance, Storage, and Transportation Project as the revised Program Plan is implemented. It will address the crosscutting issues affecting both business centers, and support the Director's office in overall management and representation of the Program and in development of program policies and strategic plans. Efforts will concentrate on improving and updating management systems to ensure the efficient application of reduced funding levels to program priorities. Emphasis will also be placed on increasing the ability of the Federal management staff to carry out its responsibilities with reduced contractor support.

Table 2 on the following page compares the objectives of the 1994 Program Plan with the objectives of the Program Plan, Revision 1, and indicates the immediate actions taken in response to the Fiscal Year 1996 funding level reductions (center column). Figure 3 on page 20 illustrates 1996-2002 major program milestones for the Program's revised strategy.

COMPARISON OF KEY OBJECTIVES BETWEEN THE 1994 PROGRAM PLAN AND THE PROGRAM PLAN, REVISION 1

Yucca Mountain Site Characterization Project

1994 PROGRAM PLAN OBJECTIVES	ACTIONS TAKEN IN RESPONSE TO FISCAL YEAR 1996 APPROPRIATION	PROGRAM PLAN, REVISION 1 OBJECTIVES
1998: Technical Site Suitability Evaluation based on Siting Guidelines (10 CFR Part 960) <ul style="list-style-type: none"> - Technical basis reports - National Academy of Sciences' peer review - Higher-level findings - Public participation 	<p>Canceled technical site suitability process and eliminated preparation of technical basis reports and National Academy of Sciences' peer review</p> <p>Implemented development of discrete design products in lieu of consolidated design packages</p>	1998: Viability Assessment <ul style="list-style-type: none"> - Repository and waste package designs for critical elements - Total system performance assessment - License application plan - Repository cost and schedule estimates
2000: Environmental Impact Statement and site recommendation to President	<p>Deferred contract award for Environmental Impact Statement preparation; deferred documentation of Environmental Impact Statement scoping results and eliminated preparation of Implementation Plan</p>	2000: Environmental Impact Statement 2001: Site recommendation to President
2001: License application to Nuclear Regulatory Commission for construction authorization	<p>Eliminated revision to License Application Annotated Outline and reduced interactions with Nuclear Regulatory Commission</p>	2002: License application to Nuclear Regulatory Commission for construction authorization
2010: Initial emplacement of spent fuel in repository		2010: Initial emplacement of spent fuel in repository

Waste Acceptance, Storage, and Transportation Project

1994 PROGRAM PLAN OBJECTIVES	ACTIONS TAKEN IN RESPONSE TO FISCAL YEAR 1996 APPROPRIATION	PROGRAM PLAN, REVISION 1 OBJECTIVES
1998: Develop and deploy a multi-purpose canister system for waste acceptance, storage, and disposal	<p>Terminated program funding; bringing multi-purpose canister development program to orderly close</p>	<p>Contingent on 1999 interim storage facility site designation:</p> <p>1999: Award contracts for waste acceptance, storage modules, and transportation services and equipment</p> <p>2000: Submit Phase I interim storage facility license application</p> <p>2002: Commence Phase I interim storage facility operations</p>
1998: Develop a prototype for advanced technology truck cask	<p>Canceled; bringing truck cask development program to orderly close</p>	

TABLE 2

MAJOR PROGRAM MILESTONES

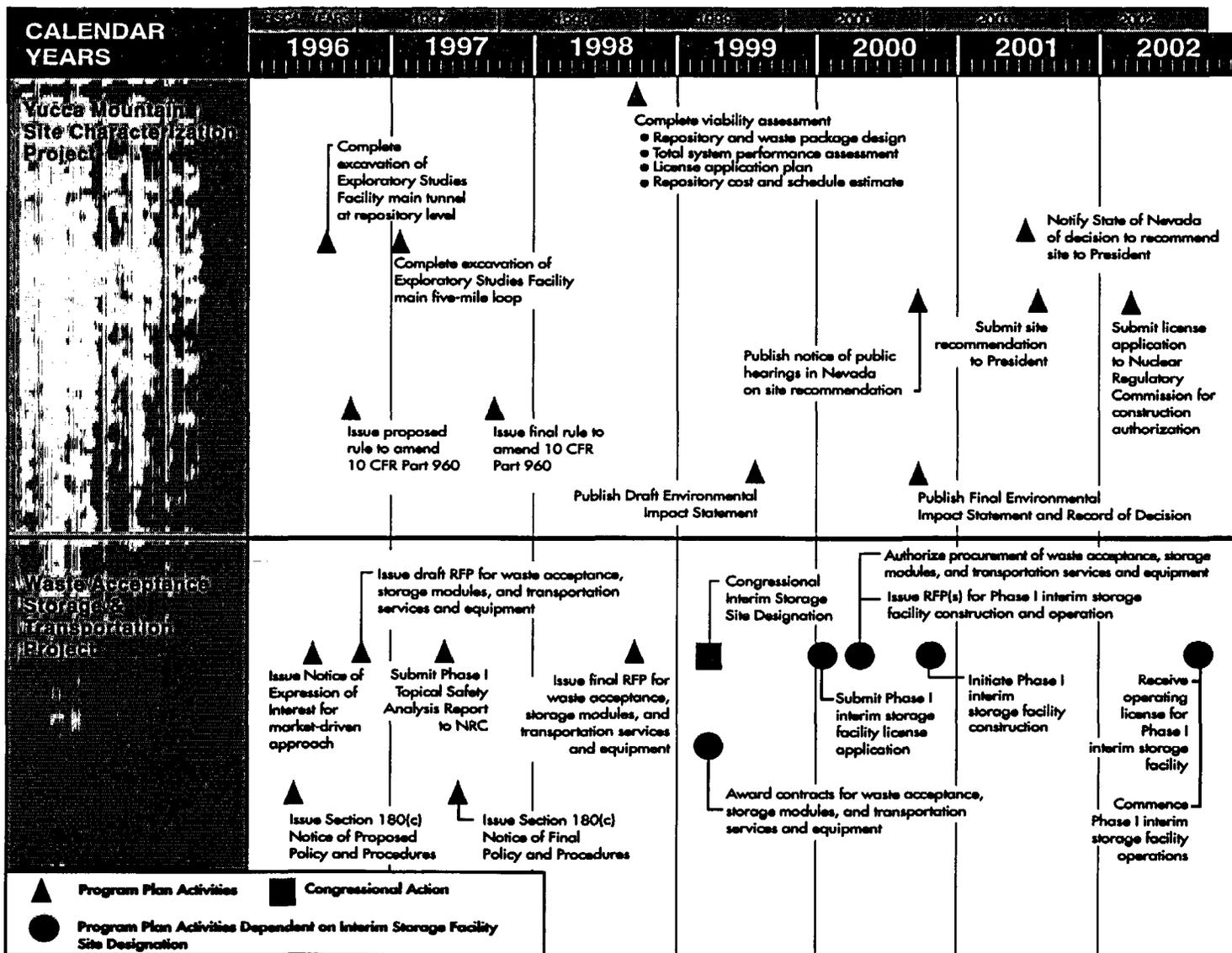
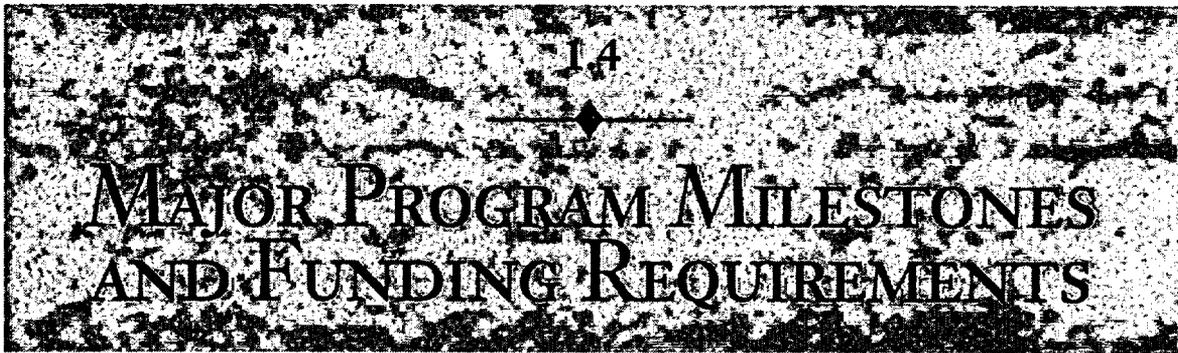


FIGURE 3



14

MAJOR PROGRAM MILESTONES AND FUNDING REQUIREMENTS

The major program milestones for the Program's revised strategy are listed below by fiscal years and the funding requirements are shown in *Table 3* on page 23. The Fiscal Year 1996 dollars reflect the Program's Congressional appropriation. The 1997 dollars reflect the Administration's Fiscal Year 1997 budget request, and Fiscal Year 1998-2002 dollars reflect estimated funding requirements for the revised program strategy.

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

Fiscal Year 1996

- Complete excavation of the Exploratory Studies Facility main tunnel at the repository level
- Issue proposed rule to amend the repository siting guidelines (10 CFR Part 960)

Fiscal Year 1997

- Complete excavation of the south ramp back to the surface to finish the Exploratory Studies Facility main, U-shaped, five-mile underground loop
- Issue the final rule amending the repository siting guidelines (10 CFR Part 960)

Fiscal Year 1998

- Complete the viability assessment of the Yucca Mountain site, including the following components:
 - Repository and waste package designs
 - Total system performance assessment
 - License application plan
 - Repository cost and schedule estimates

Fiscal Year 1999

- Publish Draft Repository Environmental Impact Statement

Fiscal Year 2000

- Publish Final Repository Environmental Impact Statement and Record of Decision
- Publish notice of public hearings in Nevada on possible site recommendation

Fiscal Year 2001

- Secretary of Energy notifies State of Nevada of decision to recommend site to the President
- Secretary of Energy submits repository site recommendation to the President

Fiscal Year 2002

- Submit license application to the Nuclear Regulatory Commission for repository construction authorization

WASTE ACCEPTANCE, STORAGE, AND TRANSPORTATION PROJECT

Fiscal Year 1996

- Issue Section 180(c) Notice of Proposed Policy and Procedures
- Issue Notice of Expression of Interest to solicit views on the proposed market-driven waste acceptance, storage, and transportation approach

Fiscal Year 1997

- Issue draft request for proposals for waste acceptance, storage modules, and transportation services and equipment
- Submit non-site specific Phase I interim storage facility Topical Safety Analysis Report to the Nuclear Regulatory Commission
- Issue Section 180(c) Notice of Final Policy and Procedures

Fiscal Year 1998

- Issue final request for proposals for waste acceptance, storage modules, and transportation services and equipment

Fiscal Year 1999⁷

- Award multiple contracts for waste acceptance, storage modules, and transportation services and equipment

Fiscal Year 2000

- Submit Phase I interim storage facility license application to the Nuclear Regulatory Commission
- Authorize contractor procurement of waste acceptance, storage modules, and transportation services and equipment
- Issue request(s) for proposals for Phase I interim storage facility construction and operation

Fiscal Year 2001

- Initiate Phase I interim storage facility construction

Fiscal Year 2002

- Receive Phase I interim storage facility operating license
- Commence interim storage facility operations

⁷ Successive Waste Acceptance, Storage, and Transportation Project milestones for Fiscal Years 1999 - 2002 are contingent on Congressional interim storage authorization, funding, and site designation.

CIVILIAN RADIOACTIVE WASTE MANAGEMENT PROGRAM FUNDING REQUIREMENTS

Dollars in Millions

	FY 1996 <i>as enacted</i>	FY 1997 <i>requested</i>	FY 1998 <i>projected</i>	FY 1999 <i>projected</i>	FY 2000 <i>projected</i>	FY 2001 <i>projected</i>	FY 2002 <i>projected</i>
Yucca Mountain Site Characterization Project¹	250	339	330	300	300	300	300
Waste Acceptance, Storage, and Transportation Project²	14	10	105	185 ⁵	250 ⁵	250 ⁵	328 ⁵
Program Management Center	51	51	50	50	60	60	70
Program Total Available	\$315	\$400	\$485	\$535	\$610	\$610	\$698
Reserve	85 ³	---	- 85 ⁴	---	---	---	---
NET APPROPRIATIONS	\$400	\$400	\$400	\$535	\$610	\$610	\$698

¹ Funding requirements for Yucca Mountain Site Characterization Project are identified through Fiscal Year 2002 to reflect activities specified in the revised Program Plan through submission of a license application to the Nuclear Regulatory Commission.

² Funding requirements for the Waste Acceptance, Storage, and Transportation Project are identified through Fiscal Year 2002 to reflect activities specified in the revised Program Plan through the start of Phase I interim storage facility operations.

³ The Energy and Water Development Appropriations Act of 1996 reserved \$85 million which shall be available for obligation and expenditure only for an interim storage facility and only upon enactment of specific statutory authority, effectively reducing the Program's funding level to \$315 million.

⁴ Release of \$85 million reserve based on the assumption that the Administration will request the release of the reserve for non-site specific interim storage activities in Fiscal Year 1998.

⁵ FY1999-FY2002 amounts for the Waste Acceptance, Storage, and Transportation Project assume the enactment of legislation authorizing and siting an interim storage facility and providing appropriate funding arrangements.

TABLE 3

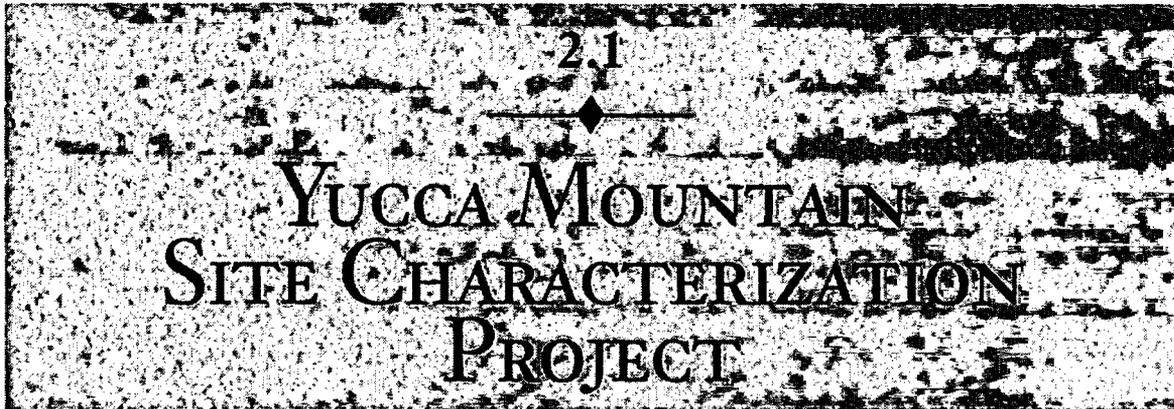
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PROGRAM AND PROJECT ACTIVITIES

INTRODUCTION

This section describes the near-term activities planned under the revised program strategy, and provides redefined schedule targets. The section also addresses some of the longer-term activities contemplated, based on the assumption that the Yucca Mountain site is found suitable and that the President and the Congress provide further direction regarding interim storage policy.

Section 2.1 addresses activities of the Yucca Mountain Site Characterization Project, *Section 2.2* describes Waste Acceptance, Storage, and Transportation Project activities, and *Section 2.3* describes support activities to be conducted by the Management Center.



BACKGROUND

The 1988 Yucca Mountain Site Characterization Project's *Site Characterization Plan*, required by the Nuclear Waste Policy Act, had a threefold purpose: (1) to describe the Yucca Mountain site and preliminary designs for a repository and waste package; (2) to identify issues related to the Yucca Mountain site's suitability as a repository, based on our level of knowledge about the site in 1988, that could be resolved during site characterization, and to identify a strategy for resolving these issues; and (3) to describe plans for a comprehensive program of scientific investigations and engineering design that could be conducted to obtain sufficient information to resolve these issues. Our level of knowledge about the site has increased over the last decade as we collected and analyzed scientific data from the surface and subsurface. This knowledge has enabled us to evolve our strategy. This evolution, together with the recognition that the level of resources that would be required to carry out the full program described in the *Site Characterization Plan* had not been provided, led to our 1994 Program Plan. Substantial progress in the past few years in scientific investigations and underground construction, combined with the necessity to determine the least costly acceptable work plan, has resulted in this revision to our 1994 Program Plan.

The 1994 Program Plan represented a fundamental change in the site characterization strategy. Scientific investigations and engineering design activities were re-prioritized to assure that information would be available to support an early evaluation of technical site suitability of the Yucca Mountain site in 1998. In addition, concurrent work on the development of an Environmental Impact Statement and license application was planned, with the expectation that this work would continue beyond the suitability determination and result in a Final Environmental Impact Statement, Record of Decision, and site recommendation in 2000. Confirmatory testing was planned after the license application to increase confidence and refine designs. The 1990 report, *Rethinking High-level Waste*, by the National Academy of Sciences, stressed that it was unrealistic to assume that all information for resolving all issues could be available before a repository was constructed. Furthermore, the Congress, through the Nuclear Waste Policy Act, recognized that information would continue to be evolving through

the construction, operation and potential retrieval periods of a repository. Under the 1994 Program Plan, we expected to submit a license application to the Nuclear Regulatory Commission in 2001, and start repository operations in 2010.

In the Fiscal Year 1996 appropriation cycle, the Yucca Mountain Site Characterization Project funding was reduced by 33 percent from \$375 million in Fiscal Year 1995 to \$250 million in Fiscal Year 1996. The Congress recognized that a more constrained repository program would be required. The Conference Report accompanying the appropriations language provided specific guidance to refocus the Yucca Mountain Project to: emphasize core scientific activities; complete excavation of necessary portions of the Exploratory Studies Facility and scientific tests needed to assess performance of the repository; and complete the repository and waste package conceptual design. The guidance also provided for the deferral of activities supporting preparation and filing of a license application for the repository.

In response to this guidance and the additional policy decisions associated with the development of the President's Fiscal Year 1997 budget request, the strategy for the Yucca Mountain Site Characterization Project has been revised to identify, prioritize, and schedule a set of site characterization activities that will allow us to maintain our long-term objective of starting repository operations in 2010. Based on the knowledge we have gained through scientific investigations and engineering design activities conducted to date, as well as streamlining and focusing both technical and regulatory elements of our site characterization program, we have defined three near-term objectives: complete an update to our regulatory framework in 1997; complete a viability assessment in 1998; and recommend the repository site to the President in 2001 and submit a license application to the Nuclear Regulatory Commission in 2002. These objectives are summarized below.

Update the Regulatory Framework for a Repository at Yucca Mountain in 1997

In 1996 we plan to publish a notice of proposed rulemaking to amend our siting guidelines (10 CFR Part 960) to make them specific to the Yucca Mountain site. This revision is in response to national policy changes as well as the significant increase in our understanding of the Yucca Mountain site since these guidelines were promulgated in 1984. After completion of the public comment period, we will publish the final rule in 1997. The Program will also continue to interact with the Environmental Protection Agency and the Nuclear Regulatory Commission as they promulgate regulations specific to a repository at Yucca Mountain.

Complete the Viability Assessment of the Yucca Mountain Site in 1998

This assessment will consist of repository and waste package designs; an evaluation of the probable performance of the system of natural and engineered barriers; a plan and cost estimate to complete the additional technical work needed to prepare a license application; and an estimate of the costs to construct and operate a repository using these designs. We believe that these components, taken together, will provide a better understanding of the repository design and its performance in the geologic setting, a

better appreciation of the remaining work needed to prepare a license application, and a more precise estimate of the cost of a repository. The completion of these components will constitute a logical convergence point at which we can make a measurably improved appraisal of the prospects for geologic disposal at the Yucca Mountain site and provide this information to the Administration and the Congress.

To support this objective, we plan to complete excavation of the Exploratory Studies Facility main tunnel at the potential repository level in 1996. This excavation will allow underground testing to collect key scientific and engineering data for site characterization and design.

Recommend a Repository Site to the President in 2001 and Submit a Repository License Application to the Nuclear Regulatory Commission in 2002

After 1998, we will complete the activities described in a license application plan developed as part of the viability assessment. A Project Integrated Safety Assessment will be prepared in 1999 and submitted to the Nuclear Regulatory Commission for preliminary comments on its sufficiency for licensing. We will issue the Draft Environmental Impact Statement for public review and comment in 1999 and issue the Final Environmental Impact Statement and Record of Decision in 2000. If the site is found suitable, the Secretary will issue a site recommendation in 2001. Prior to making a decision on site recommendation, we will announce a schedule for public hearings in the vicinity of Yucca Mountain on the possible recommendation. After the hearings and prior to recommending the site to the President, we will notify the State of Nevada about the decision to recommend the site. If the site is approved, we will submit a license application for construction authorization to the Commission in 2002.

The remainder of *Section 2.1* further describes our revised Project objectives, the bases for the revised objectives, key technical activities supporting the revised objectives, key management activities, project milestones, and funding requirements.

Figure 4 on the following page illustrates the key activities and objectives of the Project's revised technical and regulatory strategy.

PATH TO REPOSITORY OPERATION

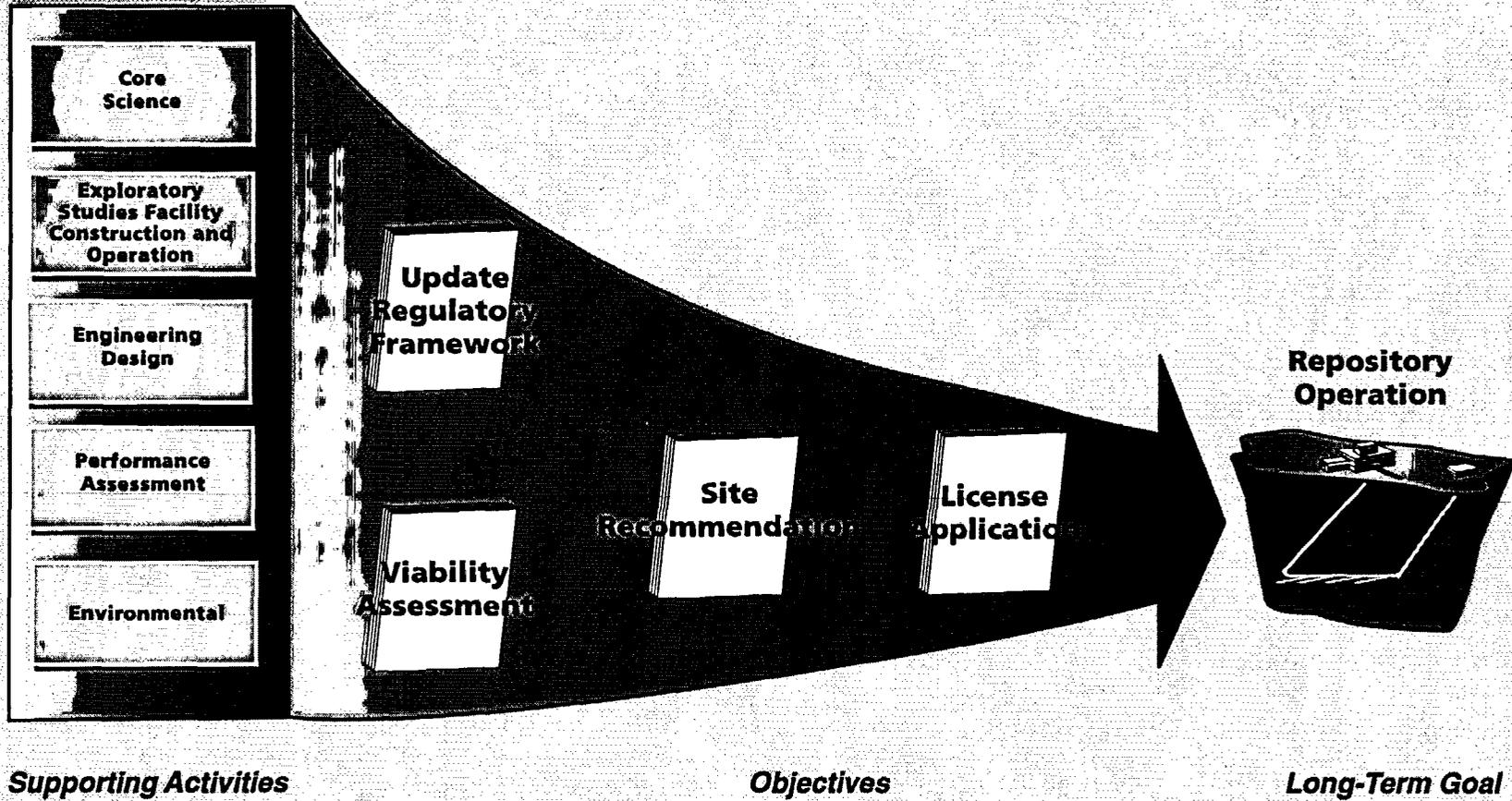


FIGURE 4

2.1.1

REVISED PROJECT OBJECTIVES

The three near-term Project objectives are described in more detail below.

UPDATING THE REGULATORY FRAMEWORK FOR A REPOSITORY AT YUCCA MOUNTAIN IN 1997

The Nuclear Waste Policy Act of 1982 set forth the requirements from which the repository Program's current regulatory framework was developed. This regulatory framework has three key components. The Act required: (1) the Department of Energy to issue general guidelines for the recommendation of sites for repository development; (2) the Environmental Protection Agency to promulgate generally applicable standards for protection of the environment; and (3) the Nuclear Regulatory Commission to promulgate technical requirements and criteria to be used for repository licensing. In response to this Congressional direction, the Department of Energy issued 10 CFR Part 960, the Environmental Protection Agency issued 40 CFR Part 191, and the Nuclear Regulatory Commission issued 10 CFR Part 60.

Rationale for Regulatory Revision

Two significant developments have occurred since the regulatory framework for developing geologic repositories was established more than a decade ago. At the inception of the Civilian Radioactive Waste Management Program, the Nuclear Waste Policy Act required the characterization of several potential repository sites in different geologic media. This policy changed when the Nuclear Waste Policy Amendments Act of 1987 directed the Department to characterize a single site, Yucca Mountain, Nevada, instead of all three sites being considered at the time. The regulatory framework discussed above was not based upon criteria relevant to a specific site, but rather was intended to be applied generically to any potential geologic repository site. Although it was evident that not every factor included in the Department's siting guidelines (10 CFR Part 960) would be significant to evaluating the suitability of a particular site, the scientific and technical understanding of the Yucca Mountain site was not then sufficient to support revising these guidelines.

A second change that impacted the regulatory framework occurred when the 1992 Energy Policy Act directed the Environmental Protection Agency to promulgate a site-specific radiation protection standard for Yucca Mountain. This standard is currently being developed. It will replace 40 CFR Part 191, which is no longer applicable to Yucca Mountain. The Energy Policy Act also directed the Nuclear Regulatory Commission to revise its licensing regulations (10 CFR Part 60) to be consistent with the site-specific standard developed by the Environmental Protection Agency.

In addition to these policy developments, the Program has greatly improved its understanding of the conditions at the Yucca Mountain site. In light of the recent Congressional direction to the Environmental Protection Agency and the Nuclear Regulatory Commission to develop site-specific regulations, and the recent significant advances

we have made in our understanding of the site, the Program has decided to clarify and streamline our siting guidelines. The resulting regulatory framework will provide a more efficient and understandable process for site evaluation and repository development that more clearly focuses on protecting the health and safety of the public.

The Nuclear Waste Policy Act recognized that revisions to the siting guidelines might be necessary and authorized the Secretary to revise them as needed. These guidelines will be amended through a public rulemaking process that will provide an opportunity for public participation. The resulting guidelines must be concurred on by the Nuclear Regulatory Commission. The Program will work to ensure that we receive this concurrence by focusing on safety, consistent with the licensing requirements of the Commission.

Scope of Regulatory Revision

The siting guidelines will be revised to identify the criteria and clarify the process for evaluating the suitability of the Yucca Mountain site. The amendments will reflect the technical knowledge gained at Yucca Mountain and the changes made since the guidelines were initially promulgated in 1984. The proposed revision will add a methodology for applying the siting guidelines specific to Yucca Mountain.

We will propose to evaluate the suitability of Yucca Mountain based upon the overall performance of the repository system during operations and after closure, rather than separately evaluating individual aspects of the site. An overall system performance approach is the appropriate method to consider all relevant site features, because it identifies, in an integrated manner, those attributes of the site and engineered components that are most important to the protection of health and safety. The information gained from the site investigations and the total system performance assessments show that the significance of selected site characteristics should not be judged in isolation from one another or from a specific design concept. For example, a geologic structural feature that provides a fast pathway for groundwater flow through the mountain may seem a detriment when considered alone but, when considered in conjunction with a specific repository design, may act beneficially by channeling flow away from the waste and thus reducing the potential for groundwater contact with the waste packages.

While the proposed rule will identify the criteria and process that will be used by the Program to evaluate the suitability of Yucca Mountain, the details regarding site characterization activities and the relationship between the revised testing plans and the 1988 *Site Characterization Plan* will continue to be reported through the semiannual *Site Characterization Progress Reports*, as required by the Nuclear Waste Policy Act. The relationship between the siting guidelines and these documents will be described in the rulemaking.

COMPLETING THE VIABILITY ASSESSMENT OF THE YUCCA MOUNTAIN SITE IN 1998

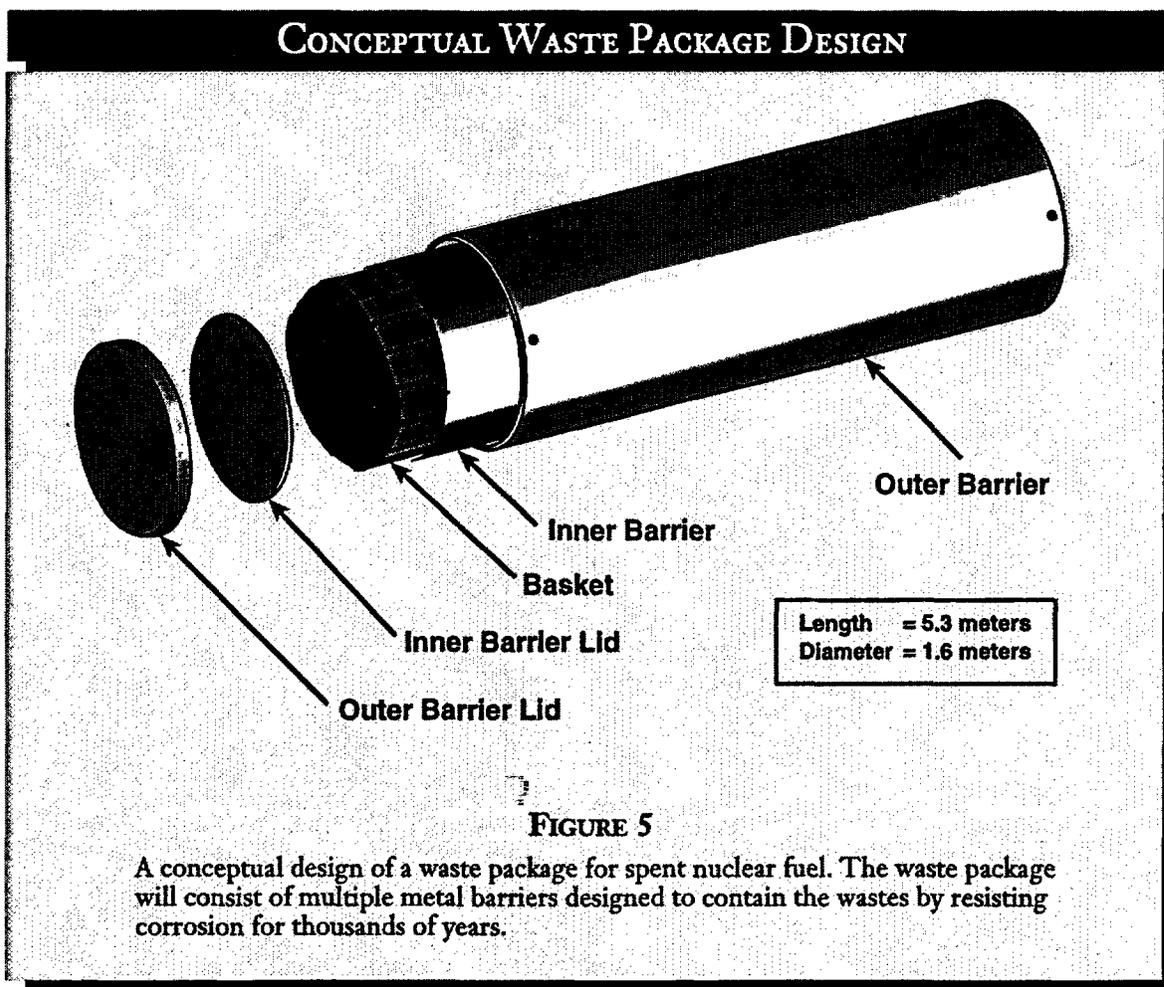
The viability assessment will include four components: (1) designs for critical underground features of the repository and for the waste package; (2) an updated total system

performance assessment; (3) a license application plan; and (4) repository cost and schedule estimate. We have prioritized and integrated our science, engineering, and management activities to support completion of these components in 1998.

After completion of the viability assessment, this same body of work will serve as a foundation for the Program's evaluation of site suitability, development of an Environmental Impact Statement, a Secretarial site recommendation to the President, and a license application to the Nuclear Regulatory Commission.

Repository and Waste Package Design

The first component of the viability assessment will address those design elements that are critical to determining the feasibility and performance of the repository and the engineered barrier system. The effort will evaluate the technological feasibility of the designs but will not yet contain the detail needed for licensing. The designs will build on our existing design work documented in the 1996 *Mined Geologic Disposal System Advanced Conceptual Design Report*, with emphasis placed on the key technical questions that affect waste containment and isolation, performance, and cost. These questions revolve around thermal management of the waste-generated heat, corrosion of waste



packages, the role of supplemental engineered barriers, and transport of radioactive wastes. In addition, the effort will address concepts for waste retrieval operations, performance confirmation requirements, safety systems, and other factors that significantly affect repository costs.

Scientific and engineering information gained during construction and testing in the Exploratory Studies Facility, as well as results from surface-based and laboratory testing, will be incorporated into the designs. Scientific investigations and performance assessment activities will provide data and requirements for these designs. These designs for the viability assessment will identify the additional design detail needed to support the license application, and will contribute to the total system performance assessment. *Figure 5 (on the preceding page) and Figure 6 (on this page) illustrate our current conceptual design for the waste package and potential repository.*

CONCEPTUAL DESIGN OF THE POTENTIAL REPOSITORY

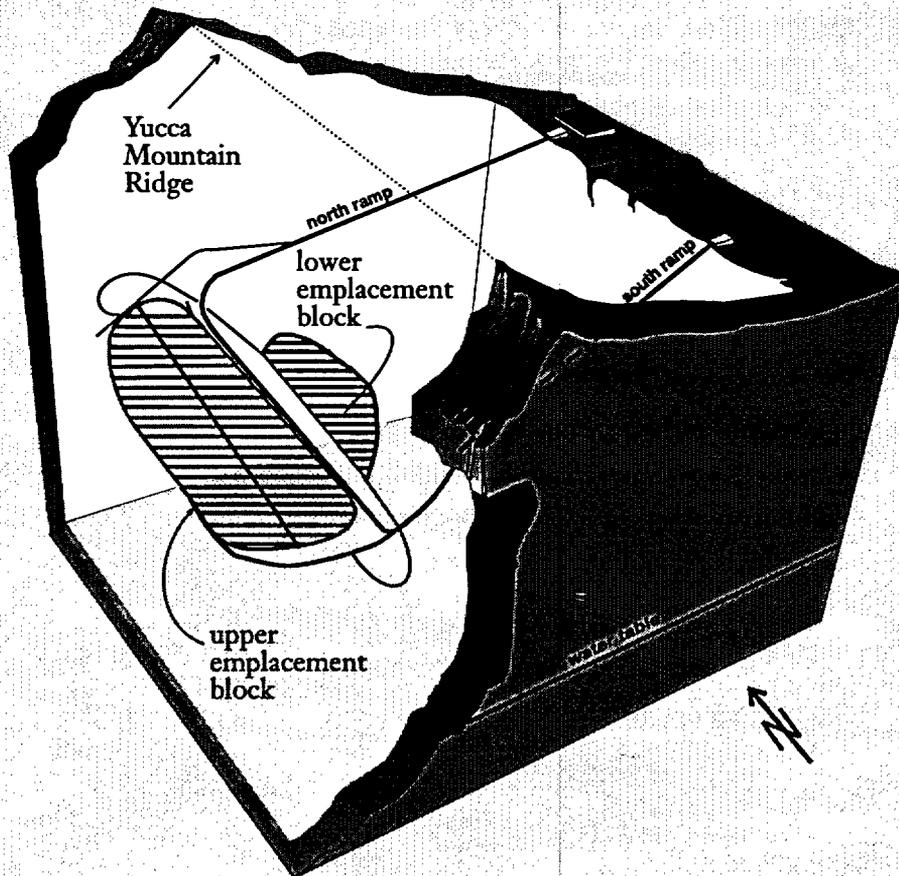


FIGURE 6

A schematic view of the design of the potential repository. The emplacement drifts will be divided into two areas. The upper block will be larger and will lie to the west of and slightly higher than the lower block.

Total System Performance Assessment

The second component of the viability assessment will be an updated total system performance assessment based on our design concepts and the analyses of available site and engineering data. The primary objective of the total system performance assessment, as described in the box on this page, is to evaluate the probable behavior of the potential repository. An additional objective is to further refine our evaluations of repository performance under a range of normal conditions and under conditions imposed by potentially disruptive events, such as earthquakes and volcanism. The performance assessment will also evaluate the possible range of performance caused by uncertainty in predicting key factors such as ground-water flow, thermal effects, and corrosion.

Total System Performance Assessment

Performance assessment is an analytical technique that uses computer models to evaluate the ability of the repository site to contain and isolate wastes within the context of applicable safety standards. This ability will depend on the characteristics of the natural geologic barrier and the engineered barrier, which includes the waste package and any supplemental man-made barriers. Mathematical models of the physical processes that affect waste containment and isolation, such as water flow in the geologic setting, are abstracted, or simplified, and linked to one another in order to develop an estimate of the overall performance of the repository, referred to as a *total system performance assessment*. To evaluate potential radiation exposure to the public from the waste emplaced in the repository site, performance assessment uses biosphere models. A biosphere model describes the pathways by which individuals in the vicinity of Yucca Mountain might receive doses from radionuclides that have been released from a repository. Performance assessments are iterative, in that the information gained from each effort, together with newly acquired scientific and engineering information, is used to guide subsequent assessments. The latest iteration, *Total System Performance Assessment - 1995*, has provided insights for the development of this revision to the Program Plan.

The overall philosophy of any total system performance assessment is to evaluate future repository behavior by using models and parameters that are as representative as current information allows. In those cases where representative information is not available or is very uncertain, conservative assumptions must be made.

An important objective of performance assessment modeling is to identify the significance of the current uncertainty in processes, models, and parameters on the system performance. The impact of the uncertainty is directly evaluated in the assessments themselves by the probabilistic nature of the analyses. Those components that are most significant and uncertain are identified as warranting additional investigation. This provides direct input to the site characterization and design programs to assist in prioritizing the necessary testing to, in turn, develop more robust and defensible performance assessments.

Total system performance assessments evolve with time. As science and design information matures, performance assessment analyses are revised to become more representative of the expected conditions. Iterations of total system performance assessments of the Yucca Mountain site and associated engineered barriers have been conducted in 1991, 1993, and 1995. Activities supporting *Total System Performance Assessment*, a key component of the 1998 viability assessment, are underway.

License Application Plan

The third component of the viability assessment is the license application plan, which will identify the remaining scientific investigations and engineering information needed to complete a license application. Our long-term goal of submitting a docketable license application to the Nuclear Regulatory Commission, should the Yucca Mountain site be found suitable, remains central to the Program's mission. The preparation of the license application plan will also provide an opportunity to assess the adequacy of our revised approach to site characterization and design and the effectiveness of updates to the Program's regulatory framework.

The license application plan will, in 1997, describe the additional information we believe is needed to submit a docketable application for repository construction authorization to the Nuclear Regulatory Commission. In developing the plan, we will draw on the available models and data that describe the natural system, the repository and waste package designs, and the total system performance assessment, together with the strategy for evaluating waste containment and isolation. The plan will describe additional tests that will support the safety analysis for a repository design and which will be completed before submittal of the license application. It will also describe the performance confirmation program that will continue during repository construction and operation, to further reduce the uncertainties in predicting the long-term performance of the repository. The plan will also include a cost estimate for completing the activities needed to prepare the license application.

Repository Cost and Schedule Estimates

The cost and schedule estimates for the repository system, the fourth component of the viability assessment, will address completion of site characterization; performance confirmation; and construction, operation, and closure of a potential repository at Yucca Mountain. The life-cycle cost and schedule estimates will provide information for policy decisions regarding the feasibility and rationale for continuing with licensing and construction of a geologic repository.

The cost estimates will be based on the repository and waste package designs, and scientific testing completed in 1998. We will use some design assumptions to augment the completed designs. To reduce the uncertainties inherent in such assumptions, design activities will place an emphasis on defining repository and engineered barrier system concepts and components that significantly affect costs.

RECOMMENDING A REPOSITORY SITE TO THE PRESIDENT IN 2001 AND SUBMITTING A REPOSITORY LICENSE APPLICATION TO THE NUCLEAR REGULATORY COMMISSION IN 2002

If the site is suitable, we will proceed with issuing the statutorily required Environmental Impact Statement and Secretarial recommendation to the President in 2001. If the site is approved, we plan to submit a license application to the Nuclear Regulatory Commission in 2002.

Environmental Impact Statement

The Nuclear Waste Policy Act requires that a Final Environmental Impact Statement accompany the Secretarial site recommendation and the license application. We began the Environmental Impact Statement process by publishing a Notice of Intent in the *Federal Register*, which initiated the public comment period on the proposed scope of the Environmental Impact Statement. As part of the scoping effort, we conducted 15 public meetings across the nation. The public comment period closed on December 5, 1995.

Because of the reduced funding in Fiscal Year 1996, we deferred further action on the Environmental Impact Statement until Fiscal Year 1997. The Project schedule now calls for publishing the Draft Environmental Impact Statement in 1999, and a Final Environmental Impact Statement in 2000.

Site Recommendation

If the site is determined to be suitable with respect to the revised siting guidelines, a decision by the Secretary of Energy to recommend the site is expected in 2001. We will publish a Notice of Consideration to inform the public and announce a schedule for public hearings in the vicinity of Yucca Mountain on the possible recommendation. After the hearings and prior to recommending the site to the President, we will notify the State of Nevada about the decision to recommend the site. The basis for this decision will include: (1) a description of the proposed repository, including preliminary engineering specifications; (2) a description of the waste form or packaging and an explanation of the relationship between the geologic environment and the waste packages and waste forms; (3) a discussion of data obtained during site characterization relating to the safety of the site; (4) the final Environmental Impact Statement; and (5) preliminary comments by the Nuclear Regulatory Commission concerning the sufficiency of site characterization. The site recommendation will also include the views and comments of the Governor and State legislature, as well as other information the Secretary considers appropriate, and any impact report submitted by the State of Nevada.

A Project Integrated Safety Assessment will be completed in 1999. This document will be provided to the Nuclear Regulatory Commission for preliminary comments on its sufficiency for licensing. Section 114 of the Nuclear Waste Policy Act requires the Nuclear Regulatory Commission's comments to address the extent to which at-depth site characterization analysis and the waste form proposal seem to be sufficient for inclusion in a license application.

License Application

To ensure that our activities prior to the viability assessment are consistent with our objective of submitting a repository license application in 2002, we will continue interacting with the Commission to receive feedback on the regulatory applicability and sufficiency of our work. We will also continue to publish the semi-annual *Site Characterization Progress Reports*, as one means of informing the Commission, and others, of our progress.

After completion of the viability assessment, we will prepare the additional information required for the license application, such as an emergency response plan and a description of the quality assurance program. A detailed description of our planned performance confirmation testing program will also be prepared. The Project Integrated Safety Assessment will be used to develop the license application. This additional information will result in a repository license application that meets Nuclear Regulatory Commission requirements.

In 1999, we will acquire a computer-based Licensing Support System designed to meet the requirements of the Nuclear Regulatory Commission's Licensing Support System Administrator and to facilitate an efficient licensing review. The system will allow access to the comprehensive documentation required for the licensing proceedings and will be certified by the Commission at least six months before a license application is submitted.

2.1.2

BASES FOR THE REVISED PROJECT OBJECTIVES

Progress in site characterization is enabling the Project to streamline and focus both technical and regulatory elements of our plan to conduct site characterization. This progress is also a basis for updating our strategy for evaluating waste containment and isolation. This section gives examples of technical progress and discusses the updated strategy. *The box on the following page outlines steps the Project has taken or will be taking to streamline and focus both technical and regulatory elements.*

PROGRESS IN CHARACTERIZING THE YUCCA MOUNTAIN SITE

Our progress in characterizing the Yucca Mountain site covers three areas: scientific programs, construction and operation of the Exploratory Studies Facility, and engineering design.

Scientific Programs

Recent progress in the site characterization program has resulted in completion or near completion of some investigations and increased confidence in the adequacy and significance of other investigations. In the areas of groundwater flow and radionuclide transport, our models have been made significantly more robust than earlier versions through the incorporation of new data. In the area of geologic hazards, our work to bound the estimate of volcanic hazards is nearly complete, and the field-based portion of seismic hazards investigations is also reaching completion. These and other areas of progress are discussed below.

Groundwater flow in the unsaturated zone. Using isotopes such as carbon-14, tritium, uranium-series, and chlorine-36, fracture-fill materials and pore water samples collected in the Exploratory Studies Facility and from boreholes are being dated. This age dating is providing data on water residence times and the times of past water move-

Streamlining and Focusing Technical and Regulatory Elements

In response to Congressional direction and our progress in site characterization, we have revised both the technical and regulatory elements of our strategy for completing site characterization, determining the suitability of the Yucca Mountain site for a geologic repository, and preparing and submitting a license application for construction authorization to the Nuclear Regulatory Commission. Ways in which the technical and regulatory elements have been both streamlined and focused are discussed below.

Streamlining Technical Elements

- Efficiencies and operating experience gained by actual tunnel boring machine operations have allowed us to accelerate Exploratory Studies Facility excavation.
- We have tied revisions of our site process models to key decision points, thereby reducing the number of iterations and reports.
- Instead of large, formal design reports for the repository and waste package, we will control and release elements of these designs as they progress.

Focusing Technical Elements

- We plan to emphasize data synthesis and documentation of what we have learned to date, in order to conduct a smaller, more focused site data collection program.
- We plan to focus documentation of our progress in integrated, rather than element-specific reports, including total system performance assessment reports, peer reviews of our performance assessment models, and a Project Integrated Safety Assessment.
- We have developed a strategy to help us focus on early evaluation of those parts of the natural barriers and engineering design that our performance assessment models tell us are most significant to predicting waste containment and isolation in a potential repository.

Streamlining Regulatory Elements

- We have reduced the number of times we plan to revise the license application annotated outline and submit it to the Nuclear Regulatory Commission for review.
- We have reduced the number of topical reports we plan to prepare and submit to the Nuclear Regulatory Commission for review.

Focusing Regulatory Elements

- We have focused our meetings with the Nuclear Regulatory Commission on areas where we can make progress in resolving issues.
- We plan to use the authority granted by the Nuclear Waste Policy Act to revise the Department's siting guidelines (10 CFR Part 960). The revision will clarify our approach to evaluating the suitability of the Yucca Mountain site. This approach will focus on the overall safety of the repository system during operations and after closure.

ment through preferential flowpaths. These data are consistent with the hypothesis that the residence times of pore water currently in the potential repository horizon are generally long, on the order of tens of thousands to hundreds of thousands of years.

The pneumatic monitoring program has improved our understanding of air flow through the mountain and is providing data for calibrating the unsaturated zone flow model. The effects of faults and stratigraphic contacts on air flow are being monitored and characterized. These data are being compiled and used to calibrate the unsaturated zone flow model to match pressure responses and constrain the bulk properties of major hydrologic units for controlling air flow. Data collection by scientists working for Nye County, Nevada has provided important input to this effort.

The unsaturated zone flow model has also been improved by advances in our understanding of pore-scale processes in natural fractures, effective hydraulic conductivities of fracture networks, and hysteresis of moisture-tension relations. These advances give us additional confidence in modeling groundwater flow in fractures. Observations of moisture distributions, including perched water occurrences, have been used to calibrate the unsaturated zone flow model. Zeolitic zones in the Calico Hills geologic unit appear to control perched water occurrences along the interface between the Calico Hills and Topopah Spring geologic units. This increase in our understanding has led to a numerical flow model that credibly represents much of the hydrologic data collected to date and is being used to focus additional work.

Radionuclide transport in the unsaturated zone. Results from the unsaturated zone transport model completed in Fiscal Year 1995 suggest that sorption and matrix diffusion may be effective site-scale retardation mechanisms. Laboratory and modeling studies are providing a more robust characterization of potential radionuclide transport at the site. Recent advances have allowed us to reduce the number of radionuclides to a few key ones that are being studied in detail to evaluate post-closure site performance.

Groundwater flow and radionuclide transport in the saturated zone. Testing has been initiated at the C-Hole complex to help characterize flow and transport in the saturated zone. Analysis of transient pressure data from pumping tests has yielded local flow properties for the saturated zone. Analysis of tracer breakthrough has provided an estimate of longitudinal dispersivity. These data have been supplemented with hydraulic and geochemical data from aquifer tests from other boreholes to support development of a repository-scale model of flow in the saturated zone.

Thermal effects. A peer review team of independent scientists was organized to review the *in situ* testing program that is planned to improve our understanding of coupled thermal-hydrologic-chemical-mechanical processes. The peer review team is nearing completion of its task. Based on the thermal-hydrologic-chemical-mechanical laboratory tests that we have completed, and the peer review team recommendations, we have focused our plans for heater tests that will be used to validate our current site-scale process models.

Volcanic hazards. During the past two years, the Yucca Mountain Site Characterization Project conducted an expert elicitation for a probabilistic volcanic hazard analysis. This was an assessment, from a panel of expert earth scientists, of the probability of a volcanic event disrupting the potential repository at Yucca Mountain. Additionally, the panel was asked to quantify the uncertainties associated with their assessment.

The probabilistic volcanic hazard analysis included four workshops and two field trips that provided an opportunity for technical discussions and interactions, to ensure the panel had a common understanding of the issues to be addressed. The panel was supplied with relevant data gathered by the Project, as well as by the State of Nevada and by the Center for Nuclear Waste Regulatory Analyses.

The final expert elicitation workshop was held during December 1995. While a wide variety of approaches were used by the expert panel members, the panel's mean probability estimate of a future volcanic event directly intersecting the repository was approximately 2.0×10^{-8} events per year, or about a 1 in 50,000,000 chance per year. The expert panel's estimate of probability is virtually identical to that produced by Project scientists, suggesting that the volcanic hazard is now well bounded by a wide range of scientific interpretations that yield reasonably consistent and defensible results.

Seismic hazards. Fieldwork to support the seismic hazards investigation is now reaching completion. This work includes surface geologic mapping and construction of trenches across potentially active faults to help estimate the magnitudes and recurrence intervals for earthquakes. Data from these surface studies will be integrated with geophysical information to construct an updated 3-D geologic framework model that will provide added confidence to our estimates of seismic hazards. A probabilistic seismic hazard analysis, which will be conducted in Fiscal Year 1997, will be used to complete the evaluation of the potential hazard to the site from seismic activity and to produce seismic design parameters for facilities to be constructed at Yucca Mountain.

To confirm our estimates of seismic hazards, the Project will continue to monitor seismic activity in the Yucca Mountain area. Fifteen new digital seismic stations have been added to the Southern Great Basin Seismic Network. These new stations are proving to be considerably more sensitive than the older analog recording stations. The new stations allow us to record seismic events that are well below the threshold for potential damage. Analysis of these small events increases our understanding of the earthquake potential of the region.

Exploratory Studies Facility Construction and Operation

We have made significant progress in constructing the Exploratory Studies Facility. This progress has permitted our scientists and engineers to begin direct observation and testing of subsurface geologic and hydrologic conditions and of the engineering properties of the rock and its response to construction activities.

The north ramp starter tunnel was constructed with conventional (drill and blast) techniques and was completed in September 1993. The remainder of the Exploratory Studies

DESIGN OF THE EXPLORATORY STUDIES FACILITY

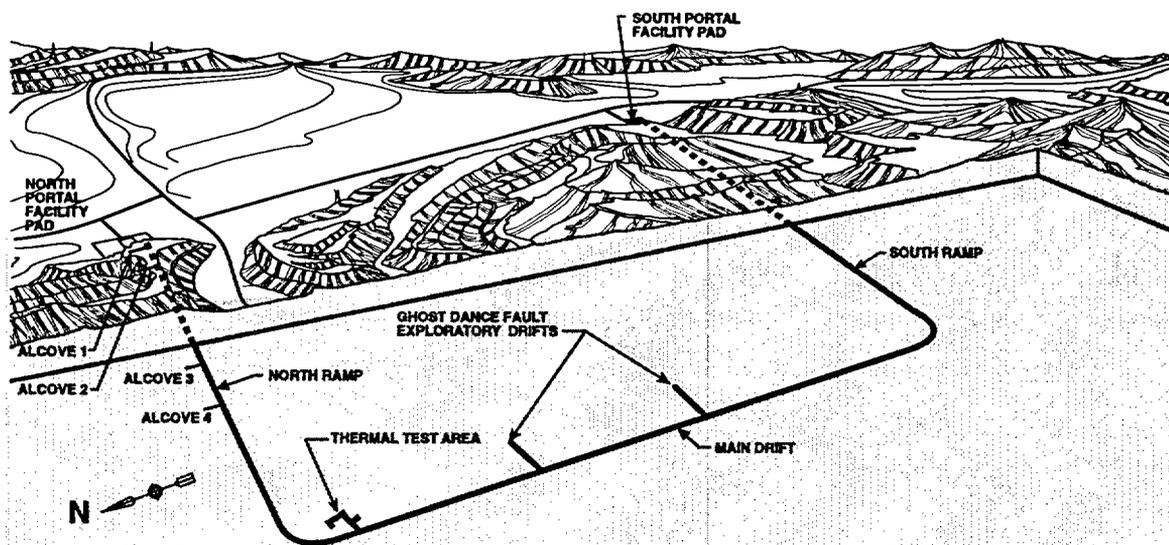


FIGURE 7

Design of the Exploratory Studies Facility. The Exploratory Studies Facility is providing scientists and engineers with the ability to observe underground geologic features that might affect repository and waste package design or repository performance. It is currently under construction, with progress well ahead of schedule. The completed facility will be a five-mile, U-shaped underground loop, 7.6 meters (25 feet) in diameter.

Facility has been excavated using a tunnel boring machine. Four alcoves have been constructed in the north ramp of the Exploratory Studies Facility, as described in *Figure 7*, above. Excavation of the Upper Tiva Canyon alcove (Alcove 1) was completed in December 1993. Excavation of the Bow Ridge Fault alcove (Alcove 2) was completed in August 1995. Excavation of the Upper Paintbrush Tuff Contact alcove (Alcove 3) was completed in August 1995. Excavation of Lower Paintbrush Tuff Contact alcove (Alcove 4) was completed in October 1995. These alcoves have allowed the scientific testing to proceed in the general area where waste would be emplaced in a potential repository. A thermal testing alcove is under construction off the main Exploratory Studies Facility tunnel. Excavation of that alcove will proceed far enough to place a single heater test in 1996. The remainder of the alcove will be constructed in 1997 for the much larger drift-scale heater test. Two additional alcoves, called the north Ghost Dance fault and south Ghost Dance fault alcoves, will be constructed off the Exploratory Studies Facility main tunnel to allow *in situ* testing near the Ghost Dance fault. Both Ghost Dance fault alcoves are planned to be completed in 1997, and the resulting testing results used to support the 1998 viability assessment.

We are now more than half-way through the five-mile underground loop. We plan to complete excavation of the south ramp back to the surface to finish the Exploratory Studies Facility U-shaped, five-mile underground loop in 1997.

Engineering Design

The 1988 *Site Characterization Plan Conceptual Design Report* has served as the reference design for the repository and waste package. The 1996 *Mined Geologic Disposal System Advanced Conceptual Design Report* documents the current level of detail for the repository and waste package. This report provides us with a new design, or a benchmark, based on the work performed to date. The report describes the design process, depicts the major repository and waste package configurations, components, and operational concepts, and identifies those areas of the design requiring further refinement. Some significant changes from the 1988 *Conceptual Design Report* include thermal loading and emplacement mode in the repository and the size, capacity, and materials for the waste package. This new design report will serve as the initial basis for the viability assessment design.

Information on design and performance parameters in this report were integrated with the scientific investigations, systems engineering, and performance assessment elements. Particular emphasis was placed on waste package handling and nuclear shielding requirements for worker safety.

UPDATING THE STRATEGY FOR EVALUATING WASTE CONTAINMENT AND ISOLATION

Rationale for an Updated Strategy

The Project is in the process of updating its strategy for evaluating waste containment and isolation for the Yucca Mountain site. The original strategy was described in the 1988 *Site Characterization Plan*. Since that time, much has been learned about the site, as discussed above. What has been learned leaves a relatively few, but important, technical questions about significant features and processes of the natural geologic and hydrologic system that influence the functioning of the engineered systems (especially the waste package) that would be part of a potential Yucca Mountain repository. *The Program's strategy for evaluating the containment and isolation of radioactive wastes at Yucca Mountain is described in the box on the following page.*

Progress in characterizing the Yucca Mountain site is occurring in parallel with progress in defining the design of the engineered system. As engineered system concepts mature, testing of selected materials under conditions that either mimic or bound expected conditions can also become more focused.

Finally, the 1992 Energy Policy Act directed the Environmental Protection Agency to promulgate a site-specific radiation protection standard for Yucca Mountain. This standard is currently being developed and early indications are that it will be a health-based standard, likely requiring dose calculations to a critical group. To address this type of standard, modeling of the saturated zone and the biosphere needs to be enhanced over the types of models we have used to address the previously applicable release based standard.

Strategy for Evaluating Waste Containment and Isolation For The Yucca Mountain Site

The Program's strategy for evaluating the containment and isolation of radioactive wastes relies on engineered barriers, geologic features, and natural processes to delay and minimize releases of radionuclides to the environment outside of the Yucca Mountain site and to minimize any exposure to the public. The strategy is based on the observation that there is very little available water in the rocks in and around the repository to dissolve radionuclides and transport them to the accessible environment.

Engineered Barriers. Waste arriving at the repository site will be placed in a special disposal container, or waste package, consisting of multiple metal barriers designed to contain the wastes by resisting corrosion for thousands of years. A backfill of crushed rock around the waste packages, an example of another engineered barrier, is being evaluated with the intent that it may be used to limit water contact with the packages, further delaying corrosion and, following corrosion, to limit dissolution and transport of radionuclides. The heat output of the waste will dry the rock, decreasing relative humidity and thus delaying corrosion of the disposal packages, while the major portion of hazardous radionuclides decay to background levels.

Geologic Features and Natural Processes. The repository's long-term behavior, following corrosion of the waste packages and transport of radionuclides from the engineered barrier, will be controlled by geologic features and natural processes. Water movement through the repository level, which could lead to dissolution and transport of radionuclides, is the most important feature for determining the long-term behavior of the potential repository. Based on observations of generally dry conditions in the Exploratory Studies Facility and preliminary analyses of age dates of water from the rock pores at the potential repository level and of mineral coatings deposited by water flowing along fractures, we believe today's dry conditions are likely to persist in the future. Mathematical models developed to characterize gas and fluid flow at Yucca Mountain predict that water movement will continue to be slow in the future even with potential changes in climatic and hydrologic conditions. Some of the radionuclides that are released from corroded waste packages will be delayed as they move through the rocks below the repository horizon. Radionuclides that reach the water table will mix with flowing groundwater and be diluted.

Doses to the Public. We have defined isolation with a system-level safety goal as "an acceptable dose to a member of the public living near the site." The project will report quantitative dose modeling results. More attention will be paid to evaluating potential doses for the first ten thousand years. However, evaluations will, qualitatively, be carried out over longer times in order to provide insight into peak dose potential and to support system enhancement studies.

Three developments have contributed to the need to update the strategy for evaluating waste containment and isolation: (1) new site characterization information; (2) updated repository and waste package conceptual designs; and (3) considerations related to the change from a release standard to a dose or risk-based standard, with an as yet unspecified regulatory time frame.

Concepts and Status of the Updated Strategy

The Project's updated strategy for waste containment and isolation for a potential repository at the Yucca Mountain site will maintain the core strategy of the 1988 *Site Characterization Plan*: the Yucca Mountain site, at potential repository depth, is approximately 1000 feet above the water table and experiences very low rates of water infiltration from the surface. This site characteristic is the first line of defense against the corrosion of waste packages and the release of radionuclides from breached waste packages in the potential repository (leading to loss of containment). Secondary lines of defense to enhance containment and isolation lie in potential engineered barriers adjacent to the waste package and in the geochemical environment provided by the natural system, which suggests considerable sorption will exist along potential flow paths for many radionuclide species that could eventually be released from the waste package.

The updated strategy currently being developed maintains a number of fundamentals of the original strategy. The updated strategy continues to recognize the important role of the relatively "dry" conditions at Yucca Mountain, which contributed to the site originally being selected for characterization studies. The updated strategy also continues to recognize the geochemical setting provided by Yucca Mountain as important to determining the rate at which radionuclides may be released into the environment in the future, when containment by the engineered barriers is eventually lost.

However, this update differs from the original strategy for four reasons. First, because much has been learned since 1988, there is an opportunity to focus resources on the remaining technical questions that have been demonstrated, through total system performance assessments, to be important to waste containment and isolation. Second, to make an evaluation of the viability of committing further resources to the licensing process for Yucca Mountain, there is a need to make this appraisal independent of evolving specific regulations. Third, the strategy update incorporates an enhanced engineered system design that more effectively complements important features of the natural system. Finally, the updated strategy reflects the revised schedule and recognizes the need for a sufficient technical basis to support the viability assessment in 1998 and the license application in 2002.

In order to support the societal decision that needs to be made on geologic disposal, the Project is defining waste containment and isolation for purposes of conducting the viability assessment. We have defined waste containment as the "near-complete containment of radionuclides by waste packages for several thousands of years." We have defined isolation with a system-level safety goal as "an acceptable dose to a member of

the public living near the site." Quantitative dose modeling results will be reported by the Project. More attention will be paid to evaluating potential doses for the first ten thousand years. However, evaluations will qualitatively be carried out over longer times in order to provide insight into peak dose potential and to support system enhancement studies.

The technical questions identified in recent total system performance assessments as key to evaluating repository and waste package performance are related to the following key attributes of the system:

1. rate of water seepage into the repository;
2. integrity of waste packages (containment);
3. rate of release of radionuclides from waste in the breached waste packages;
4. radionuclide transport through engineered barriers and natural barriers; and
5. dilution in the groundwater below the repository.

The strategy will include more detail as to what we now understand about these five attributes, as well as what our approach is to gathering data and developing models to make better predictions of these attributes over time. As the repository generates heat and then gradually returns to ambient temperatures, it is expected that at least the first four of these attributes will be affected, changing their relative importance to system performance as a function of time.

The strategy will guide our plans for a viability assessment in 1998, but also looks forward to and beyond the license application. We will continue to conduct scientific and engineering studies to aid us in confirming or revising the basis for modeling performance of the repository system. This Program Plan indicates our expectation to have more information available for a license application. It also recognizes that, if a license is granted, confirmatory technical work will continue beyond the license application during the construction and operational phases of the repository.

2.1.3

KEY TECHNICAL ACTIVITIES SUPPORTING THE REVISED PROJECT OBJECTIVES

To support the work for the viability assessment and continuing through license application, we are concentrating our activities into four integrated areas: (1) core science; (2) Exploratory Studies Facility construction and operation; (3) engineering design; and (4) performance assessment.

In addition to these four areas, environmental activities are ongoing. The Project will continue to comply with all applicable statutes and regulations. For example, the Project operates under several permits that are designed to protect natural and cultural re-

sources and complies with air quality permits, water quality permits, and other such permits issued by the State of Nevada.

National Environmental Policy Act compliance activities will be resumed in Fiscal Year 1997 with the award of a contract for preparation of the Environmental Impact Statement. These activities include reviewing and responding to public scoping comments and data gathering and impact analyses. These activities will lead to development and issuance of a Draft Environmental Impact Statement, followed by a public hearing period and a Final Environmental Impact Statement, and a Record of Decision.

CORE SCIENCE ACTIVITIES

Scientific testing will continue to support model development, design, performance assessment, and performance confirmation. *In situ* testing in the Exploratory Studies Facility and related laboratory tests will be emphasized. Crucial initial results from Exploratory Studies Facility testing will be available for incorporation into process models being developed in support of the total system performance assessment for viability assessment.

A principal near-term objective of the core science program is to complete the hydrologic flow and radionuclide transport models that will support the performance assessment calculations for the viability assessment. The Project will analyze and synthesize the existing data gathered over the past decade to confirm or modify the conceptual and mathematical models that are used to support performance assessment calculations. This effort will help narrow the probable range of effects on repository performance from such key factors as water infiltration through the repository, release and transport of radionuclides from the waste package to the saturated zone, dilution of any radionuclide releases, and the degree of drying in the repository from waste-generated heat.

The core science program will also identify which data sets or modeling efforts are sufficiently complete to support a future license application and areas where additional information is needed. This work will serve as a basis to delineate the testing and performance confirmation programs to be described in the license application plan.

We will complete four major types of models in Fiscal Year 1997 to a level of sufficient maturity to support a comprehensive site description, which will include geologic, hydrologic, geochemical, and climatological processes, and to support the total system performance assessment for the viability assessment. We will confirm the sufficiency of these models for license application with the additional data that will be available in Fiscal Year 1999. Site-scale flow models will describe groundwater flow above and below the water table. These models will characterize the movement of gas and fluid through Yucca Mountain and will be used to predict their future behavior. Site-scale and regional-scale transport models will evaluate potential radionuclide releases to the accessible environment. The transport models use the results of the flow

models and add the chemical interactions between the rock units below the repository horizon and potential radionuclide releases. The geologic framework model will present the distribution of rock units and geologic structures, such as faults, at the site. This basic geologic information is the foundation for the hydrologic flow and transport models. Climate models will evaluate potential future climate changes. We will use the results of these modeling efforts to prescribe bounding values of precipitation for the flow models.

The core science activities that will support completion of these four types of models include:

- *Testing and modeling groundwater flow above the water table*, to understand the hydrology in the unsaturated zone where the potential repository horizon is located. The testing activities in the unsaturated zone are directed primarily at evaluating the amounts and rates of water moving through the rocks in and around the potential repository and at measuring hydrologic parameters required to develop and calibrate the numerical flow models of vapor and fluid flow. Continued monitoring of gas pressure, temperature, and water pressure in surface-based boreholes will provide some of these hydrologic parameters. Testing in boreholes drilled in alcoves in the Exploratory Studies Facility will continue to provide pneumatic and hydrologic data on the effects of faults and boundaries between different rock units on water movement within the unsaturated zone. The hydrologic testing in the Ghost Dance fault alcoves will begin in Fiscal Year 1997 and end in Fiscal Year 1999. We will continue to use several different techniques of isotopic dating of water samples collected from rocks in the Exploratory Studies Facility to evaluate the length of time that the water has resided in the rock. Isotopic dating techniques will also continue to be used on loose material in faults to determine the past history of water movement through potential flowpaths along faults.
- *Testing and modeling groundwater flow below the water table*, to understand the hydrology in the saturated zone. Testing in the saturated zone is focused on determining the capability of the groundwater flow system to dilute and disperse dissolved radionuclides and to provide hydrologic data for input to flow models for the saturated zone. Hydraulic and tracer testing will continue at a complex of three test wells east of the Yucca Mountain site, and hydraulic testing is being conducted in a well north of the site to collect hydrologic flow data.
- *Radionuclide transport modeling*, to integrate what is known about the flow of water, the effects of waste-generated heat, and the geology of Yucca Mountain with laboratory measurements of geochemical processes. Laboratory work, hydrologic model development, and field work to support the development of this modeling have been progressing for some time. To complement the integrated three-dimensional model for unsaturated zone transport at Yucca Mountain that we produced in Fiscal Year 1995, we will develop the first model for saturated zone transport in Fiscal Year 1996. In addition, we are updating the unsaturated zone transport model to incorporate better defined radionuclide source terms, to incorporate a better calibrated flow

model, to consider additional types of radionuclides, and to include additional physical processes that affect transport. Laboratory studies are underway to support the modeling and provide additional confidence in performance assessments. These studies have been prioritized to maximize our efforts on processes that are most important to waste isolation. In Fiscal Year 1997, we will conduct a limited number of field and laboratory studies and converge on robust transport models to support performance assessment.

- *Bounding the radionuclide release rates*, to determine defensible values for releases of different radionuclides as a function of time from the waste packages and other components of the engineered barrier system. This work involves laboratory experiments, observations and tests in the Exploratory Studies Facility, and modeling to assess the effects of the thermal pulse from waste-generated heat on the chemical interaction of introduced materials, such as grout or backfill, with ground water and rock on transport of radionuclides. Of particular interest for corrosion and radionuclide transport processes is the temporal and spatial distribution of water contacting the waste packages and the humidity of the surrounding air. We will obtain experimental data on these attributes for the rocks at Yucca Mountain to provide realistic constraints on the models used to predict performance during the time there is high heat output from the emplaced waste as well as afterwards. Thermal testing in the Exploratory Studies Facility is one part of this effort. In Fiscal Year 1997, we will develop repository-scale models based on available laboratory data and initial thermal test results. Laboratory experiments will be substantially completed in Fiscal Year 1998. These data and results from *in situ* thermal tests will be used to update the repository-scale models to support the license application.
- *Geologic investigations and synthesis*, to complete the description of the geologic framework and an assessment of volcanic and seismic hazards for Yucca Mountain. In Fiscal Year 1996, surface-based geologic mapping of the repository block will be completed and fracture data from surface and underground mapping will be synthesized, and we will update the preliminary three-dimensional geologic framework model. In Fiscal Year 1997, we will complete the three-dimensional geologic model for Yucca Mountain with associated information on the distribution of rock properties, mineral occurrences, and results from geophysical surveys of subsurface features. We will also complete an assessment of potential natural resources in the vicinity of Yucca Mountain. Assessments of volcanic and seismic hazards will be completed in Fiscal Year 1996 and Fiscal Year 1998, respectively. Geological mapping of the Exploratory Studies Facility will continue as excavation progresses. Surface geologic maps will be completed.
- *Surface-based drilling activities*, which are used to obtain subsurface data both within and outside of the repository area. In Fiscal Year 1996, we completed drilling one additional borehole to complement the existing suite of approximately 40 boreholes drilled since 1992, when our quality assurance program was approved, and another 40 boreholes drilled earlier. In addition to providing rock and water samples, drilling activities allow data collection and analysis of air flow through Yucca Mountain. In-

stallation of pneumatic instrumentation into three boreholes in Fiscal Year 1996, together with data from instrumentation already installed in four boreholes during Fiscal Year 1995, will support models of air flow to predict the behavior of water vapor and gaseous radionuclides in response to heat from the emplaced wastes. Future activities will focus on data needed to improve our understanding of the saturated zone flow system.

- *Climate modeling*, to predict future climate conditions in the Yucca Mountain region for evaluating possible future rates of water infiltration into the unsaturated zone and of recharge to the regional ground water system. The climate model predictions for a number of possible future climate scenarios will be developed in Fiscal Year 1997, and used by the flow and transport models producing a range of infiltration and recharge values to assess the effects of possible future climatic extremes on waste containment and isolation.
- *Thermal testing*, to examine the effects of the introduction of heat generated by radioactive decay in the wastes, which should evaporate a large amount of water from the rocks around the repository level at Yucca Mountain. The role of this water, if it condenses, is a major uncertainty in assessing repository performance, and a series of experiments will be conducted to help determine the effects of the water vapor and any condensed water. In addition to evaporation and condensation, geochemical and geomechanical processes may also have long-term effects on the amount and composition of water entering and leaving the rocks near the waste package. Experiments will be performed in the Exploratory Studies Facility, beginning in Fiscal Year 1996, to help bound the effects of the thermal pulse. Measurements will include temperature, relative humidity, gas pressure, water chemistry, moisture content, and other appropriate variables to determine the thermal, hydrological, geochemical, and geomechanical responses of the tunnel and surrounding rocks, representative backfill materials, and potential waste package materials, to heating and cooling over a temperature range likely to be encountered during the life cycle of a repository. Confirmation of near-field environment models is necessary for engineered materials selection, repository design, estimation of waste package failure rates, and determination of the possible radionuclide releases for performance assessment calculations. The results from the thermal testing will be used to support completion of the near-field environment models in Fiscal Year 1998, and will be used in Fiscal Year 2000 to confirm their sufficiency for license application.

We will continue other monitoring activities in order to obtain the baseline data required for licensing. These activities include operation of a seismic network to locate and characterize earthquakes, pneumatic and water-level monitoring in selected boreholes, meteorologic and surface water flow measurements, and construction monitoring in the Exploratory Studies Facility. We will analyze data from these activities for significant anomalies and enter them in technical data bases, where they will be available for use in design activities. Monitoring activities and data collection to support environmental compliance are also continuing and will be integrated with data needs for core science and performance assessment.

The Project also conducts scientific and engineering reviews of hazardous and solid waste handling and Exploratory Studies Facility designs to ensure compliance with environmental regulations and requirements. Additionally, the Project gathers data and reports on ambient air monitoring data and preconstruction surveys to identify and characterize biological and cultural resources. Finally, the Project prepares data synthesis reports for radiological and terrestrial ecosystems field monitoring.

After completion of the viability assessment, we will continue long-term testing and monitoring activities to confirm performance estimates for both the natural system and the engineered barrier system. Of particular interest is waste package material corrosion behavior as well as that of the waste form itself. *In situ* thermal testing will continue in the Exploratory Studies Facility with the long heat-up and cool-down times required to properly simulate expected waste package behavior. Environmental monitoring will continue to support final radiological safety assessments for the period of operations as well as other requirements of the Environmental Impact Statement.

EXPLORATORY STUDIES FACILITY CONSTRUCTION AND OPERATION ACTIVITIES

The Project will continue construction of the Exploratory Studies Facility using the tunnel boring machine. In Fiscal Year 1996, we plan to complete excavation of the main drift portion of the Exploratory Studies Facility at the repository level, which will allow observation and testing of the geology and hydrology along the north-south length of the potential repository. We initiated excavation of two alcoves in Fiscal Year 1996. One will be used for conducting thermal tests to study the response of the groundwater and rocks to heat that will be generated by the wastes. A single heater test in the initial part of this alcove is scheduled to begin in Fiscal Year 1996 and end in Fiscal Year 1998. The much larger drift scale heater test in the back part of this alcove will be started in Fiscal Year 1997, with heat-up to be complete in Fiscal Year 1999. The other new alcove will provide access near the Ghost Dance fault to study its hydrologic characteristics and to determine if this fault acts as a preferential path of water flow through the repository.

In Fiscal Year 1997, we will complete excavation of the south ramp back to the surface. This will complete the U-shaped, five-mile underground loop. We will complete excavation of the first (north) Ghost Dance fault alcove through the fault and also construct a second alcove through the Ghost Dance fault at the south end of the repository area. Exploratory Studies Facility activities will continue, including maintenance of the ground support systems and operation and maintenance of support utilities. If deemed necessary, we will excavate an east-west drift, off the main tunnel, to allow observation and testing across the width of the proposed repository. This access (the exact location is not yet determined) could provide additional confirmation that site conditions are suitable and that the emplacement tunnel layout and ground support concepts are feasible. If this work is determined to be needed, we plan to start excavation in Fiscal Year 1999, or earlier, if funding permits.

The Project continues to ensure the protection of employees, members of the public, the environment, and site facilities and equipment from hazards that may result from site characterization and construction activities. The Project also provides underground safety support and on-site safety support to construction; provides environmental support for operating hazardous waste accumulation facilities and managing hydrocarbon contaminated soil maintenance and disposal; and conducts surveillance of site activities to ensure compliance with environmental regulations and requirements. Additionally, the Project maintains medical emergency services and fire prevention programs to support field activities, continued implementation of the safety and health program, and the emergency management program.

ENGINEERING DESIGN ACTIVITIES

The design of the repository will be heavily dependent upon and closely integrated with performance assessment and core science activities. Coordination with performance assessment is needed to determine the adequacy of designs, performance margins for safety and isolation, and to make necessary design modifications. Coordination with core science activities will ensure the availability of adequate site data to support the designs. Design will also depend on the results of materials and waste form corrosion and performance testing.

In Fiscal Year 1996, we documented the advanced conceptual designs for the repository and waste package in the *Mined Geologic Disposal System Advanced Conceptual Design Report*. The report describes the design process, depicts the major repository and waste package configurations, components, and operational concepts, and identifies those areas of the design requiring further refinement. The design in this report will serve as the initial basis for the viability assessment design.

For the repository above-ground area, the design for the viability assessment and the cost estimate will include a description of the site area and the major surface facilities, including the waste handling building. For the subsurface area, the design will describe the subsurface region, layout and stability considerations for tunnels, ventilation, concepts for possible retrieval of wastes, and other operational considerations. The subsurface design will provide an estimate of the waste capacity of the repository.

The effects of the form and quantity of the wastes will be addressed by establishing bounding values for their important characteristics, such as amount of radiation, decay heat, and degradation behavior including radionuclide release. We will use these bounds as a basis for designs and operating concepts. Studies will be conducted to enhance spent fuel basket designs, to finalize waste package materials selection, and to establish feasibility of waste package fabrication techniques. A disposal criticality analysis methodology will be developed and documented in a technical report in Fiscal Year 1996. We will prepare a disposal criticality topical report, which we will submit to the Nuclear Regulatory Commission, in Fiscal Year 1998.

Repository design activities in the near term will concentrate on resolving subsurface-related repository issues. The surface facilities design, which can rely on a higher level of regulatory and technical precedent in the commercial nuclear industry, will be developed later. The new design activities will examine the assumptions made in the 1996 design report and address key uncertainties that affect repository performance and cost, such as thermal effects and corrosion.

Some specific engineering studies planned to support these designs are summarized below:

- *A thermal management study* will provide the detailed analysis that will support a thermal loading decision. The effort will provide an evaluation of thermal management concepts such as a multi-level repository, oldest fuel first, ventilation, selective emplacement, and aging, with the objectives of identifying thermal management options that should be pursued during design. The effort will examine a reference thermal load in the high range of 80-100 metric tons of uranium per acre, which would accommodate the full statutory limit (i.e., 70,000 metric tons) of wastes for the repository within the planned area.
- *Evaluation of backfill* will provide a technical basis for a recommendation on whether an additional engineered barrier system element, such as backfill or other concepts that perform similar functions, should be incorporated into the system design, and if so, describe alternative approaches. This study will discuss the design, operational, and cost considerations related to backfill and other potential supplemental engineered barriers, testing requirements to address uncertainties, and potential effects on performance.
- *Evaluation of corrosion and degradation* of waste package materials and waste forms. Short- and long-term degradation and dissolution testing of selected waste forms continued in Fiscal Year 1996. Short-term testing of waste package materials continued and long-term testing of container materials began in Fiscal Year 1996. Short-term results will be available before the 1998 viability assessment; the long-term results will contribute to a site recommendation, license application, and confirmatory testing during repository construction and operation. Alternative designs and materials will be further evaluated to ensure that they meet the regulatory requirements, are licensable, and are deployable at a reasonable cost.
- *Analysis of safeguard and security requirements.* This study will consist of analyses to assess possible threats and vulnerability to determine safeguards and security requirements for material control and accounting and physical protection, such as security lighting, surveillance, and intrusion detection equipment.

Specific activities to develop design detail to support the 1998 total system performance assessment and the cost and schedule estimates for viability assessment include:

- Refining the concept of operations for repository subsurface and surface activities, including assessments of reasonably available technologies.

- Continuing to develop the repository and engineered barrier designs to accommodate the requirements and enhance concepts established during the advanced conceptual design, including preliminary evaluations, material selections, and drawings of elements of design that are important to safety or waste isolation.
- Evaluating feasibility of the design of components of the engineered barrier system.
- Conducting safety assessments for the operational period, including analyses of credible accident scenarios and provisions to keep radioactive releases as low as reasonably achievable.
- Developing a preliminary design and strategy for demonstrating waste retrieval.
- Preparing a general description of the proposed transporters for moving waste packages underground.
- Preparing preliminary designs for sealing tunnels and shafts for final closure.
- Evaluating the stability of the tunnels during the period of operations and after closure as affected by seismic, thermal, and normal rock stresses.
- Describing the general arrangements of non-nuclear surface facility designs to develop a more precise cost estimate.

After the viability assessment, design activities will accomplish several objectives: identification of a complete concept of operations; demonstration of compliance with codes, standards and regulatory requirements; resolution of design issues for items with little or no regulatory precedents; assessment of design alternatives to bound environmental impacts; and support of potential licensing technical reports. License application design will support detailed safety assessments and accident analyses, and will describe designs in enough detail to demonstrate repository safety and enable compliance reviews by the Nuclear Regulatory Commission.

Additional design activities, building on the design products for the viability assessment, will provide an adequate level of detail to support a license application. We will complete more definitive designs for all elements of the repository and engineered barrier system that are important to safety or waste isolation. Components for these important elements that have not been proven will receive more detail, including extensive calculations and technical specifications, than those that have been proven. Elements that are not important to waste containment or isolation will be addressed only through a preliminary level of detail. In addition, we will complete a description of the Nevada transportation infrastructure necessary to support facility operations, as part of the development of the Environmental Impact Statement.

KEY PERFORMANCE ASSESSMENT ACTIVITIES

Based on *Total System Performance Assessment - 1995*, we will complete additional sensitivity analyses in Fiscal Year 1996 to improve our evaluation of the significance to total system performance of various components of the natural and engineered barriers.

These analyses will be used to refine the strategy for evaluating waste containment and isolation and to narrow the scope of our site characterization and design work by identifying the additional important site and design-related information required for performance assessments for the viability assessment and license application.

To support engineering design activities in addressing the major technical questions, we will continue analyzing the hydrological and thermal effects of waste-generated heat and backfill on the waste package. In addition, we will use improved data to refine models of waste package material degradation and waste dissolution to evaluate potential releases of radionuclides.

In 1998, the Project will complete another total system performance assessment. This performance assessment will build on previous iterations by using more complete models of the natural and engineered barriers than those in previous performance assessments. The Project is investigating models of potential biosphere pathways of radionuclides that may be released from the repository. We are also developing criteria and parameter validity tests and uncertainty analyses to use in selecting appropriate models for performance assessment.

A phased peer review of this performance assessment will be conducted. The review will occur in steps, beginning in Fiscal Year 1996 and finishing in Fiscal Year 1999. It will include the models of physical processes in 1996-1998, the abstractions of these models as used for performance assessment in 1998-1999, and the total system performance assessment itself in 1999. The comments and recommendations available from each step of the peer review will be incorporated, as appropriate, as the total system performance assessment is developed for the viability assessment. The comments and recommendations that are not received in time for the viability assessment will be incorporated into the total system performance assessment for the suitability recommendation and the license application.

The 1998 total system performance assessment will be subjected to sensitivity analyses to refine our strategy for evaluation of waste containment and isolation and to identify areas where the level of uncertainty needs reduction for the license application. Those analyses will also evaluate the latest results of thermal and materials testing to verify that performance is within expectations. Performance assessment will help define the performance confirmation testing program by identifying testing needs. The total system performance assessment input for the license application will respond to the final peer review of the 1998 total system performance assessment. Additional peer review may be performed if there are substantial changes in the total system performance assessment submitted for the license application.

2.1.4

KEY MANAGEMENT ACTIVITIES

Management activities have also been affected by funding reductions subsequent to the 1994 Program Plan. We are maintaining the necessary level of support to continue our

key activities, to ensure health and safety, and to fulfill our public participation responsibilities, while managing our resources in a fiscally responsible manner.

PROJECT MANAGEMENT ACTIVITIES

Project management functions include planning, budgeting, scheduling and managing funds of all Project elements, provision of facilities, administrative support services, telecommunications, records management and computer procurement and maintenance, operations and maintenance of wide area and local area networks, and motor pool operations. Project management functions also include cost and schedule baseline management and change control. Administration of the funds for financial and technical assistance to the State of Nevada, Affected Units of Local Government and Nevada universities, for the National Academy of Sciences, and for Payments-Equal-to-Taxes is also a Project management function.

SITE MANAGEMENT ACTIVITIES

An additional management function is the provision of site services at the Yucca Mountain site. These services include: emergency services such as fire protection; security services such as site access and property protection; transportation services including bus service to and from the Yucca Mountain site for employees, tour buses, and the on-site motor pool; communication services including the radio network link for workers in the field and communications to the Exploratory Studies Facility; and utility services such as power, water, and sanitation facilities.

MANAGEMENT OF INSTITUTIONAL ACTIVITIES

Institutional activities in Fiscal Year 1996 will center around informing stakeholders and the public about our revised program strategy. Major opportunities for formal public involvement will include the rulemaking process to revise our repository siting guidelines, the issuance of the Draft Environmental Impact Statement, and public hearings prior to the site recommendation.

The Project will continue to respond to information requests from the Congress and media. The Project will rely heavily on the new Yucca Mountain Internet Home Page to continue communication with interested groups and individuals in a cost-effective manner. Consistent with the Nuclear Waste Policy Act, we will continue to propose funding for the State of Nevada and Affected Units of Local Government oversight activities associated with site characterization. Program review meetings will continue to remain open to the public.

Fiscal Year 1996 funding has forced a sharp reduction in institutional activities. We are reducing participation in national meetings and conferences and terminating exhibitions at national events; reducing the production of information materials such as videos, photographs, and printed material; implementing a 50 percent reduction in educa-

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT MILESTONES

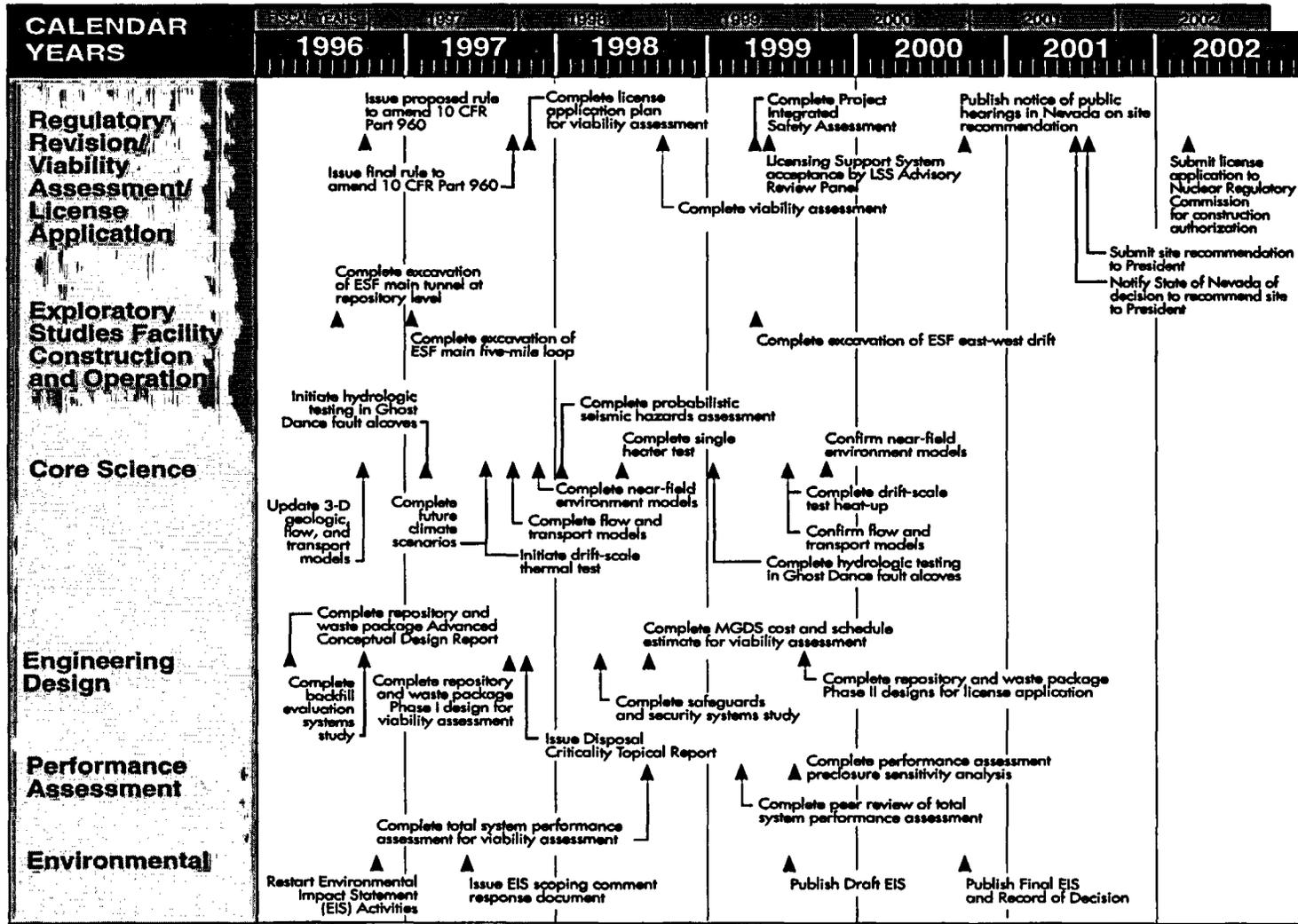


FIGURE 8

tion staff and events and an 86 percent reduction for educational materials; decreasing the hours of operation of our science centers and the toll-free information number; significantly reducing interactions with the State of Nevada, the Affected Units of Local Government, Native American tribes, and other government entities; deferring the creation of a site-specific advisory board; and implementing a 50 percent reduction in the number of national stakeholder meetings.

Figure 8 on the preceding page illustrates 1996-2002 milestones for the Yucca Mountain Site Characterization Project under the Program's revised strategy.

2.1.5

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT MILESTONES AND FUNDING REQUIREMENTS

The 1996-2002 milestones for the Yucca Mountain Site Characterization Project are listed below and the funding requirements are shown in *Table 4* on page 60. The Fiscal Year 1996 dollars reflect the Program's Congressional appropriation. The Fiscal Year 1997 dollars reflect the Administration's Fiscal Year 1997 budget request, and Fiscal Year 1998-1999 dollars reflect estimated funding requirements for the revised program strategy.

Fiscal Year 1996

- Complete the repository and waste package *Mined Geologic Disposal System Advanced Conceptual Design Report*
- Complete excavation of the Exploratory Studies Facility main tunnel at the repository level
- Update models for 3-D geologic framework; site-scale saturated zone and unsaturated zone flow; and saturated zone and unsaturated zone transport
- Complete backfill evaluation and determination systems engineering study
- Issue proposed rule to amend the repository siting guidelines (10 CFR Part 960)

Fiscal Year 1997

- Award contract for preparation of the Repository Environmental Impact Statement and restart Repository Environmental Impact Statement activities
- Complete excavation of the south ramp back to the surface to finish the Exploratory Studies Facility main, U-shaped, five-mile underground loop
- Initiate hydrologic testing in first (north) and second (south) Ghost Dance fault alcoves
- Issue Repository Environmental Impact Statement scoping comment response document

- Initiate the drift scale thermal test in the thermal test alcove
- Complete future climate scenarios
- Complete saturated and unsaturated zone flow and transport models to support the 1998 total system performance assessment
- Complete repository and waste package Phase I designs for viability assessment
- Issue the final rule amending the repository siting guidelines (10 CFR Part 960)

Fiscal Year 1998

- Issue *Disposal Criticality Topical Report*
- Complete license application plan for viability assessment
- Complete near-field environment models to support total system performance assessment
- Complete probabilistic seismic hazards assessment
- Complete safeguards and security requirements systems engineering study
- Complete single heater test in the thermal test alcove
- Complete total system performance assessment for viability assessment
- Complete Mined Geologic Disposal System (MGDS) cost estimate for viability assessment
- Complete the viability assessment of the Yucca Mountain site

Fiscal Year 1999

- Complete hydrologic testing in the north and south Ghost Dance fault alcoves
- Complete the peer review of the total system performance assessment
- Complete the Exploratory Studies Facility east-west drift
- Complete Project Integrated Safety Assessment
- Licensing Support System (LSS) acceptance by LSS Advisory Review Panel
- Complete the drift scale test heat-up in the thermal test alcove
- Confirm saturated zone and unsaturated zone flow and transport models for the license application
- Publish Draft Repository Environmental Impact Statement
- Complete performance assessment preclosure sensitivity analysis for license application
- Complete repository and waste package Phase II designs for the license application

Fiscal Year 2000

- Confirm near-field environment models for the license application
- Publish Final Repository Environmental Impact Statement and Record of Decision
- Publish notice of public hearings in Nevada on possible site recommendation

Fiscal Year 2001

- Secretary of Energy notifies State of Nevada of decision to recommend site to the President
- Secretary of Energy submits repository site recommendation to the President

Fiscal Year 2002

- Submit license application to the Nuclear Regulatory Commission for repository construction authorization

**YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
FUNDING REQUIREMENTS**

	Dollars in Millions			
	FY 1996 <i>as enacted</i>	FY 1997 <i>requested</i>	FY 1998 <i>projected</i>	FY 1999 <i>projected</i>
Exploratory Studies Facility Construction/Operations	85	89	88	65
Core Science	54	71	69	67
Engineering Design	35	75	75	69
Performance Assessment	12	19	20	16
Licensing/Suitability	0	2	4	5
NEPA¹	0	5	6	14
Project Management²	64	64	54	53
External Oversight	0	14	14	11
PROJECT TOTAL AVAILABLE	\$250	\$339	\$330	\$300

¹ Activities to be completed under the National Environmental Policy Act.

² Includes funding for the Payments-Equal-to-Taxes and contract close-out costs.

TABLE 4

WASTE ACCEPTANCE, STORAGE, AND TRANSPORTATION PROJECT

BACKGROUND

The December 1994 Program Plan described an approach for the Waste Acceptance, Storage, and Transportation Project that included efforts to develop a multi-purpose canister by 1998 for possible at-reactor storage; to maintain readiness to develop an interim storage facility if a site were designated by the Congress and the authority and resources were provided; and to develop a readiness to accept and transport spent nuclear fuel from reactors to a storage facility whenever such a facility became available. The waste acceptance and transportation capability was to be based on certifying a new high-capacity truck cask and a transportation overpack for the multi-purpose canisters and constructing prototypes by the end of 1998. A fleet of casks or overpacks would be purchased when a firm shipment schedule was available.

Further Presidential and Congressional guidance, together with reduced funding, have led to a reassessment and redirection of the approach outlined in the 1994 Program Plan. The Waste Acceptance, Storage, and Transportation Project's funding level was reduced by 76 percent from \$57 million in Fiscal Year 1995 to \$13.6 million in Fiscal Year 1996. The reduction reflects the Congressional reservation of \$85 million from the Program's total \$400 million appropriation pending legislative authorization to develop an interim storage facility.

The Congress is considering legislation that would direct rapid development of an interim storage facility and designate a specific facility site. The Administration, however, opposes designation of a site and any site-specific facility development work until the completion of a viability assessment of Yucca Mountain as a geologic repository site in 1998.

A REVISED STRATEGY

We have developed a revised strategy that will enable the Program to acquire the capability for waste acceptance, storage, and transportation as rapidly and efficiently as possible, consistent with current guidance from the President and the Congress, and

reflecting the consequences of the reduced program funding level for Fiscal Year 1996. The later years of the schedule are based on an assumption that after completion of the Yucca Mountain viability assessment in 1998, the Program will receive the necessary statutory authority, sufficient funding, and a site designation to initiate work on an interim storage facility in 1999.

Prior to interim storage facility site designation, the Waste Acceptance, Storage, and Transportation Project will establish a blueprint for the development of waste acceptance, storage, and transportation systems. Activities during this period will be directed towards achieving two major near-term objectives.

- Develop a market-driven waste acceptance, storage, and transportation approach that relies on the private sector for implementation.
- Conduct non-site specific design and engineering safety analyses for an interim storage facility to reduce facility licensing time once a site is designated.

After designation of a storage facility site, Project activities will address development of an interim storage facility at the specified site and the acquisition of related waste acceptance, storage, and transportation services. These activities consist of system design and implementation efforts that can occur only after a site has been designated, and thus are contingent on further Presidential and Congressional action that provides statutory authority, funding, and storage facility site designation. Assuming that these Presidential and Congressional actions are completed in 1999, we would award multiple contracts for waste acceptance, storage modules, and transportation services and equipment in the same year and submit our environmental analyses, in compliance with the National Environmental Policy Act, and our license application to the Nuclear Regulatory Commission in 2000. If the Program is given legislative authorization to commence facility construction upon submittal of a license application, as was recently proposed in the Congress, the target date to begin accepting spent fuel at an interim storage facility could be as early as 2002. Activities and milestones planned for the period after site designation are depicted in *Figure 9* on page 67 and described further in *Appendix C*.

In addition to priority activities directly associated with the two major near-term objectives and summarized below, the Project will continue various support activities that will play a significant role in successful implementation of the waste acceptance, storage, and transportation components of the waste management system. These activities are described in *Section 2.2.2*.

2.2.1

**PRIORITY ACTIVITIES TO ACHIEVE
MAJOR NEAR-TERM OBJECTIVES**

DEVELOPING A MARKET-DRIVEN WASTE ACCEPTANCE, STORAGE, AND TRANSPORTATION APPROACH THAT RELIES ON THE PRIVATE SECTOR FOR IMPLEMENTATION

The Program plans to rely upon a competitive private sector procurement to create the necessary national transportation capability to move spent nuclear fuel from locations throughout the United States to a centralized interim storage facility. This capability would also be utilized to transport waste to a permanent disposal facility. We intend to publish a Notice of Expression of Interest in publications such as the *Federal Register*, *Commerce Business Daily*, and trade journals to solicit industry and vendor views on the proposed approach, which is described further in *Appendix C*. We will be prepared to issue a request for proposals and award multiple contracts for equipment and services on a timely basis when the national policy and schedule for near-term management of spent nuclear fuel are resolved. This approach will offer a market stimulus for private sector development of equipment and management capability required for the transportation of spent nuclear fuel.

CONDUCTING NON-SITE SPECIFIC DESIGN AND ENGINEERING SAFETY ANALYSES FOR AN INTERIM STORAGE FACILITY TO REDUCE FACILITY DEVELOPMENT TIME ONCE A SITE IS DESIGNATED

The Program will pursue opportunities to carry out preliminary work relating to the licensing of an interim storage facility in advance of site designation, including development of a facility design based on conservatively determined environmental and design parameters that can accommodate virtually any site, and performance of safety analyses. We will initiate interactions with the Nuclear Regulatory Commission to discuss and evaluate non-site specific safety issues. Siting evaluation factors contained in Nuclear Regulatory Commission regulations (10 CFR Part 72) and other Commission guidance will be used to assist in developing conservative design parameters.

Subject to future funding considerations, the Program will complete a topical safety analysis report for submittal to the Commission. Submittal of the topical safety analysis report and its subsequent review by the Commission, ahead of site designation, will reduce the time required later for preparation of the license application and reduce licensing risks related to design and safety considerations. The report would describe facility design, operations, and supporting systems; demonstrate conformance with the Commission's siting evaluation factors and general design criteria; and present the results of radiological and safety analyses. The report would contain the required analyses and evaluations necessary to demonstrate that operation of the facility would not endanger the health and safety of the public. The Commission will document its review and approval of the topical safety analysis report in a safety evaluation report which, along with the topical safety analysis report, will be referenced in any subsequent interim storage facility license application.

2.2.2

**OTHER ACTIVITIES SUPPORTING
WASTE ACCEPTANCE, STORAGE, AND TRANSPORTATION**

WASTE ACCEPTANCE ACTIVITIES

Waste acceptance activities are those necessary for the Department of Energy to take title to and physical possession of spent nuclear fuel or high-level radioactive waste from owners and generators of these wastes. In addition to the physical transfer of ownership, waste acceptance activities include the planning, preparation, and completion of the procedures and documentation necessary to accomplish the transfer. Waste acceptance is the first step in fulfilling the Department's responsibility to dispose of spent nuclear fuel and high-level radioactive waste. The Program will conduct the following activities to support its waste acceptance responsibility.

Interaction with contract holders. The Program will continue activities in support of the standard contract, codified in 10 CFR Part 961, for acceptance of commercial spent fuel from nuclear utilities. Review and approval of delivery commitment schedules from utilities will continue.

Integration of Federal spent nuclear fuel and defense high-level radioactive waste into program plans. The Program will complete a memorandum of agreement with the Department of Energy's Office of Environmental Management creating a unified system for the acceptance of Federal spent fuel and defense high-level radioactive waste destined for geologic disposal. We will also complete the development of acceptance criteria for these wastes.

Preparing for material control and accounting of accepted waste. The Program will continue interactions with government agencies, utilities, and others to establish safeguards and security requirements for spent nuclear fuel and high-level radioactive waste to be accepted by the Department. Spent fuel verification requirements for utilities will be developed, and mechanisms will be established for documenting and maintaining information on all spent fuel and high-level radioactive waste loaded into sealed canisters. A unified data base system will be developed and implemented in phases. The system will integrate existing data bases and provide a single source of data for common use to support waste acceptance planning and operations, including continued tracking of spent fuel generation, material control and accounting, and spent fuel verification.

STORAGE ACTIVITIES

In addition to planning for the potential development of an interim storage facility and associated services and equipment, the Program's storage support activities will include technology demonstration projects that may benefit one or more areas of the Program, and close-out of activities related to the multi-purpose canister system.

Dry Transfer System. The Spent Nuclear Fuel Dry Transfer System Development and Demonstration Project, conducted under a cooperative agreement with the Electric Power Research Institute, will be continued. The purpose of this project is to demonstrate a low cost system for handling individual spent fuel assemblies in the absence of a spent fuel storage pool. The transfer of spent fuel into a cask or between casks generally takes place under water in storage pools which provide cooling and shielding. Spent fuel storage pools may not be available in the future at some reactor sites, such as reactors that are no longer operating, or at an interim storage facility. In Fiscal Year 1996, the Program will also submit a topical safety analysis report on the Dry Transfer System design to the Nuclear Regulatory Commission for review and approval.

Multi-Purpose Canister System. We will close out efforts related to the development of a multi-purpose canister system. The Department of the Navy, which had been a cooperating agency on the Environmental Impact Statement for the multi-purpose canister system, has become the lead agency and will proceed with the part of the Environmental Impact Statement covering naval spent nuclear fuel container selection. The Program's documentation of its work related to preparing an Environmental Impact Statement and developing designs for the multi-purpose canister system will be archived. The Program will complete as scheduled the first phase of the contract with Westinghouse Electric Corporation for development of a multi-purpose canister design and completion of safety analysis reports.

TRANSPORTATION ACTIVITIES

High-capacity truck cask. Due to funding reductions, the contract with General Atomics to design, develop, certify, and fabricate the GA-4 and GA-9 high-capacity legal-weight truck cask system is being terminated. Cask designs have been completed. To support certification efforts, safety analysis reports were submitted to the Nuclear Regulatory Commission, and a half-scale model of the GA-4 cask design was fabricated and tested.

Obtaining "burnup credit" for cask or canister design. "Burnup" is a measure of the amount of fissionable material in reactor fuel that is used up in the nuclear fission process while the fuel is in a reactor. The fuel burnup process also produces fissionable material and a variety of neutron absorbing materials. The net effect is a decrease in reactivity (the fuel's ability to support a chain reaction) over time. As the fissionable material is depleted in this way and neutron absorbers build up, the reactivity of the fuel declines. Nuclear Regulatory Commission practices for safety calculations for spent fuel storage and transportation technologies use the conservative assumption that the fuel is fresh (with zero burnup) and therefore has the highest possible reactivity.

Burnup credit refers to the concept of taking regulatory credit in required safety calculations for the reductions in spent nuclear fuel reactivity that occur as a result of the usage of fuel in a reactor. Obtaining burnup credit will improve overall system efficiency and may be important to disposal.

The Program will continue to pursue partial (actinide-only) and principal isotope burnup credit (actinide and selected fission products) to support the design of criticality control systems for spent fuel storage, transportation, and disposal packages. Interactions with the Nuclear Regulatory Commission will be pursued on issues related to the partial burnup topical report we issued in May 1995, and on planning experiments to support principal isotope burnup credit. In Fiscal Year 1998, the Program will submit a topical report on principal isotope burnup credit to the Commission.

INSTITUTIONAL ACTIVITIES

Institutional activities of the Waste Acceptance, Storage, and Transportation Project have been reduced significantly in Fiscal Year 1996. These reductions include termination of institutional work on the multi-purpose canister Environmental Impact Statement; funding cuts for all cooperative agreements with State, tribal, regional, and technical organizations; suspension of meetings of the Transportation Coordination Group (a long-standing group that represents a broad range of public agencies and stakeholder groups); and termination or curtailment of various public information activities and products.

Core transportation-related institutional activities will be maintained. The Program will continue interactions with stakeholders to plan the implementation of Section 180(c) of the Nuclear Waste Policy Act, which provides for technical and financial assistance to States and Indian Tribes for training public safety officials through whose jurisdictions spent nuclear fuel and high-level waste would be transported. In 1996, we will publish a *Federal Register* Notice of Proposed Policy and Procedures for the implementation of Section 180(c) in which public comments will be solicited. In the following year, the Program will publish a Notice of Final Policy and Procedures to implement Section 180(c) of the Act.

We will also maintain interactions with stakeholders and with other Department offices through the Transportation External Coordination and the Transportation Internal Coordination working groups, and will continue to participate in meetings and briefings held by other parties to identify issues, clarify policy options, and resolve issues wherever possible.

Figure 9 on the following page illustrates 1996-2002 milestones for the Waste Acceptance, Storage, and Transportation Project under the Program's revised strategy. Milestones beyond 1998, which are described further in Appendix C, are contingent on Congressional interim storage facility authorization, funding, and site designation.

WASTE ACCEPTANCE, STORAGE, AND TRANSPORTATION PROJECT MILESTONES¹

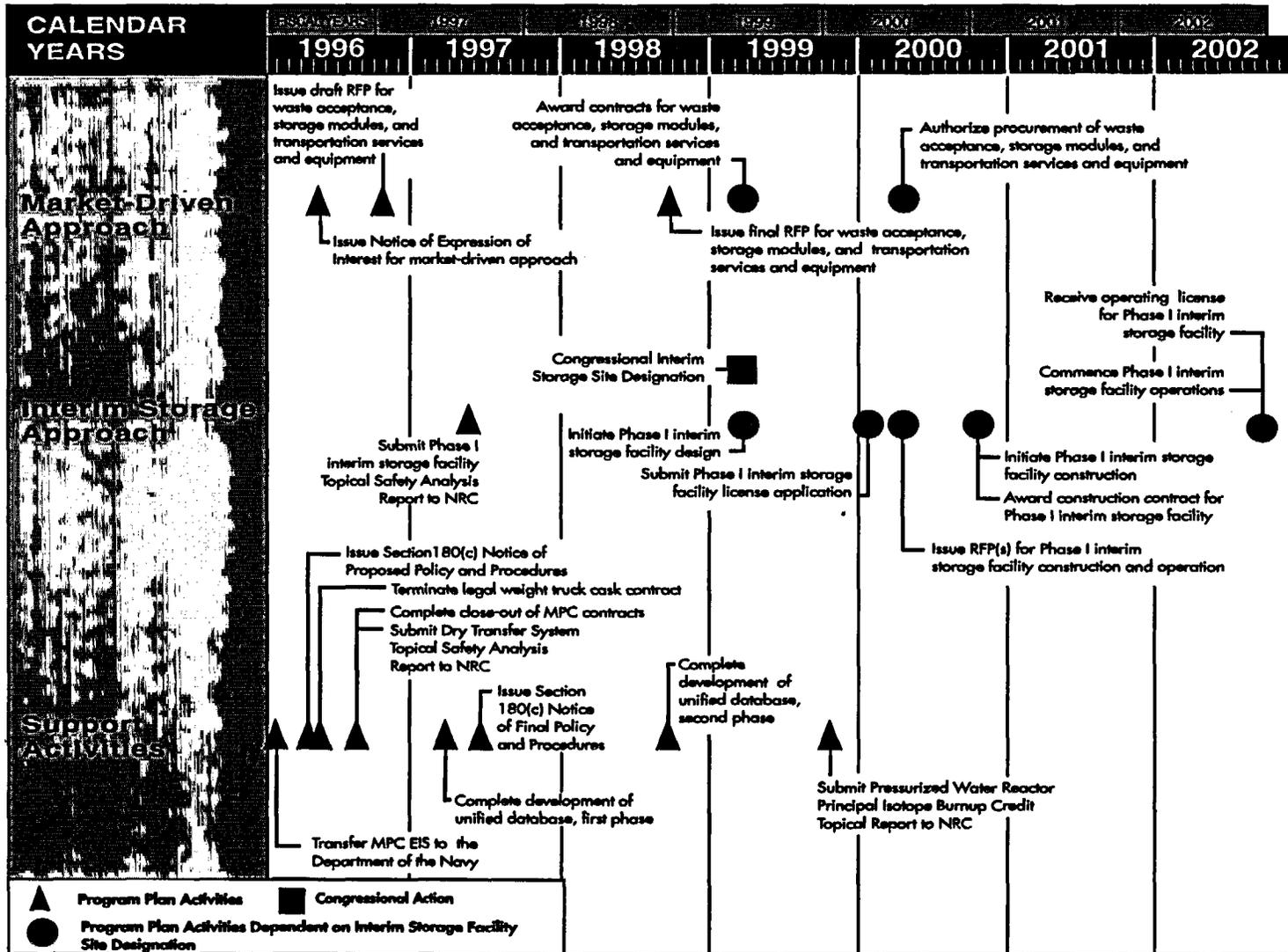


FIGURE 9

¹ Milestones beyond 1998, which are described further in Appendix C, are contingent on Congressional interim storage authorization, funding, and site designation.

2.2.3 **WASTE ACCEPTANCE, STORAGE, AND TRANSPORTATION PROJECT
MILESTONES AND FUNDING REQUIREMENTS**

The 1996-1998 milestones for the Waste Acceptance, Storage, and Transportation Project are listed below and the funding requirements are shown in *Table 5* on page 69. The Fiscal Year 1996 dollars reflect the Program's Congressional appropriation. The Fiscal Year 1997 dollars reflect the Administration's Fiscal Year 1997 budget request, and the Fiscal Year 1998-1999 dollars reflect estimated funding requirements for the revised program strategy.

Fiscal Year 1996

- Transfer preparation of the multi-purpose canister Environmental Impact Statement to the Department of the Navy for naval spent nuclear fuel container selection
- Issue Section 180(c) Notice of Proposed Policy and Procedures
- Issue Notice of Expression of Interest to solicit views on the proposed market-driven waste acceptance, storage, and transportation approach
- Terminate legal-weight truck cask development contract
- Complete multi-purpose canister design and close out contract with Westinghouse Electric Corporation
- Submit Dry Transfer System Topical Safety Analysis Report to the Nuclear Regulatory Commission

Fiscal Year 1997

- Issue draft request for proposals for waste acceptance, storage modules, and transportation services and equipment
- Complete development of first phase of unified data base
- Submit non-site specific interim storage facility Phase I topical safety analysis report to the Nuclear Regulatory Commission
- Issue Section 180(c) Notice of Final Policy and Procedures

Fiscal Year 1998

- Complete development of second phase of unified data base
- Issue final request for proposals for waste acceptance, storage modules, and transportation services and equipment

WASTE ACCEPTANCE, STORAGE, AND TRANSPORTATION PROJECT FUNDING REQUIREMENTS

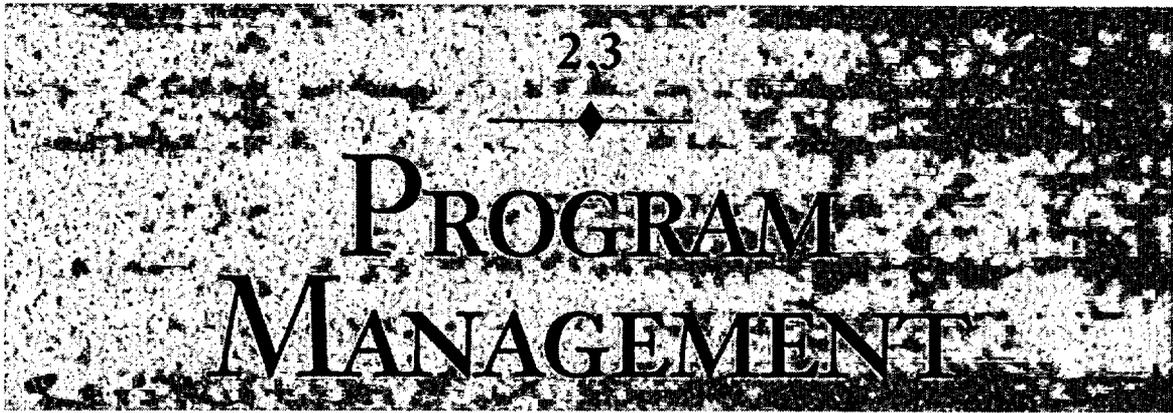
Dollars in Millions				
	FY 1996 <i>as enacted</i>	FY 1997 <i>requested</i>	FY 1998 <i>projected</i>	FY 1999 <i>projected</i>
Spent Fuel Storage	1	2	5	12
Transportation	5	3	94	164
Waste Acceptance	2	3	3	4
MPC Subsystem	2	0	0	0
Project Integration	4	2	3	5
Total Project Available	\$14	\$10	\$105	\$185³
Reserve	85 ¹	--	- 85 ²	---
NET APPROPRIATIONS	\$99	\$10	\$20	\$185

¹ The Energy and Water Development Appropriations Act of 1996 reserved \$85 million which shall be available for obligation and expenditure only for an interim storage facility and only upon enactment of specific statutory authority.

² Release of \$85 million reserve based on the assumption that the Administration will request the release of the reserve for non-site specific interim storage activities in Fiscal Year 1998.

³ Fiscal Year 1999 amounts for the Waste Acceptance, Storage, and Transportation Project assume the enactment of legislation authorizing and siting an interim storage facility and providing appropriate funding arrangements.

TABLE 5



BACKGROUND

The Management Center provides program integration and management support to the Program Director and the two business centers—the Yucca Mountain Site Characterization Project and the Waste Acceptance, Storage, and Transportation Project. The Office of Program Management and Integration, the Office of Human Resources and Administration, and the Office of Quality Assurance constitute the Management Center, which is responsible for program planning and management, technical and regulatory integration, quality assurance, institutional activities, resources and information management, and international waste management activities. This section describes how the Program adjusted these efforts to support its revised program strategy.

The December 1994 Program Plan described a program management approach that emphasized products and progress, better integration of activities, clearer lines of responsibility and authority, and more timely participation of stakeholders in the Program decision-making process. With many of these objectives achieved, the Program has further modified program management activities consistent with its reduced Fiscal Year 1996 funding level and guidance from the President and the Congress.

The funding level for program management activities was reduced by 43 percent from \$90 million in Fiscal Year 1995 to \$51 million in Fiscal Year 1996, representing 16 percent of the total program budget. Nearly 60 percent of the Fiscal Year 1996 program management allocation covers costs that are effectively fixed or externally assessed, such as Federal salaries and Federal office rent.

Program management activities have been reprioritized to support efforts to complete a viability assessment of the Yucca Mountain repository site in 1998 and to support the development and implementation of interim storage strategies. Building upon the management improvements realized during Fiscal Year 1995, the Program will continue to enhance integration throughout all program elements, to address cross-cutting technical issues, and to strengthen the effectiveness of the management tools for baselining and tracking accomplishments and costs. Administrative activities, such as personnel and contract administration, will continue. The reduced funding will require a significant reduction in the Program's interactions with external parties.

2.3.1

PROGRAM PLANNING AND MANAGEMENT

PROGRAM PLANNING

The Management Center will assist the Yucca Mountain Site Characterization Project and the Waste Acceptance, Storage, and Transportation Project in developing the technical, managerial, and institutional strategies needed to accomplish the new targets and milestones under the Program's revised approach. The strategies and objectives of individual project-level activities will be integrated to achieve a consistent articulation of overall program policy, and to ensure that the Program's policy and strategies are consistent with Departmental policy.

The Management Center will also support the Program Director in communicating program policy to key audiences internal and external to the Department of Energy and in articulating the rationale for strategy and plan changes to program stakeholders. Support will be provided for the Program Director's interactions with the Congress and the Office of Management and Budget to explain and justify the revised program approach during the appropriations process. Management Center staff will also support interactions with the Nuclear Waste Technical Review Board, which independently evaluates the Program's technical and scientific activities.

BASELINE MANAGEMENT

Program cost, schedule, and workscope baselines are used to measure contractor and participant performance in order to ensure that the appropriate work is performed on schedule and within budget. We will continue to refine the baseline management process that has been established to ensure that the baselines are clearly defined and integrated, and that changes are appropriately controlled. Program progress is regularly assessed in accordance with the milestones, baselines, and work defined by the planning process.

In Fiscal Year 1995, program baselines were revised to represent the work effort necessary to achieve the milestones in the 1994 program approach. Further revisions to the baselines in Fiscal Year 1996 will reflect the redirection made necessary by the Fiscal Year 1996 appropriation and guidance from the President and the Congress. The impact of baseline changes will be identified and evaluated.

INTEGRATED MANAGEMENT PLANNING

We are improving our contractor management systems through the establishment of a single, integrated, and more efficient way of doing business for all program elements and participants. This new approach will be documented in the Office of Civilian Radioactive Waste Management Integrated Management Plan which will establish high-level management system policy and requirements.

2.3.2

TECHNICAL INTEGRATION

Technical integration ensures that the Program's technical elements and activities are integrated into a system that is safe, efficient, reliable, and cost-effective. The Management Center will support the Yucca Mountain viability assessment, the market-driven waste acceptance, storage, and transportation approach, and non-site specific interim storage efforts by focusing on the identification and timely coordinated resolution of cross-cutting technical issues. Such issues that potentially impact multiple program elements must be identified and resolved on schedules consistent with the business centers' needs for the information.

NEAR-TERM POLICY DEVELOPMENT AND INTEGRATION ISSUES

Waste canister options. As a result of Fiscal Year 1996 appropriations actions, the Program will not pursue further development of a multi-purpose canister system for transporting and disposing of spent fuel. We do, however, recognize the benefits to be derived from standardization of equipment and the desirability of encouraging designs which are suitable for later transport or use at a Federal facility. Therefore, the Program will evaluate the impacts on the Federal program of alternative canister options that may be developed and utilized under a market-driven waste acceptance and transportation strategy. The technical integration evaluations will focus on the most effective approaches to integrate the near-term requirements for the timely availability of storage and transportation systems utilizing current technology with the evolving waste package designs that satisfy the requirements of the disposal system.

Disposal of other Department-owned radioactive materials. The Program will continue to evaluate the impact of accepting Department-owned spent nuclear fuel and high-level radioactive waste into the civilian radioactive waste management system. The Program is working with the Department of Energy's Office of Environmental Management, the current custodians for these materials, to ensure that the materials planned for disposal in a geologic repository meet the statutory and regulatory requirements for geologic disposal. The Program will also continue to interact with other Department of Energy programs in the evaluation of other waste materials, such as weapons-useable fissile material that may be declared surplus to national defense needs, for which decisions regarding ultimate disposition have not yet been made.

REGULATORY AND PERFORMANCE REQUIREMENTS

The Program's regulatory and performance requirements have been identified and interpreted in the various levels of Program and Project requirements documents. During Fiscal Year 1996, the Management Center will incorporate requirements for Department-owned spent fuel into the Program's requirements documents structure. The existing suite of program requirements documents will be streamlined to eliminate redundancy and ensure that the Program can respond to future changes in policy and direction in an efficient and effective manner.

Building on the regulatory and performance requirements, the Program has developed a technical baseline that includes design packages, drawings, and analyses, and provides traceability to key requirements. Using the technical baseline as a tool, reviews will be conducted to evaluate how well the system design meets regulatory and performance requirements and to ensure that the interfaces among Program elements are identified and controlled.

2.3.3

REGULATORY INTEGRATION

The Management Center will focus on three principal areas of regulatory integration: plans and strategies for compliance with applicable statutes and regulations; continued consultations with the Nuclear Regulatory Commission regarding the repository and non-site specific interim storage concepts; and reexamination of and possible modifications to the regulatory structure that guides the licensing of the repository.

COMPLIANCE WITH STATUTES AND REGULATIONS

The Management Center will continue to assist the Yucca Mountain Site Characterization Project in developing strategies and plans for compliance with environmental, safety, and health requirements, and will help to ensure that Project activities are consistent with Departmental policy and with environmental impact statements completed or being prepared by other Department of Energy programs. Pending regulatory changes will be analyzed to assist the Program in complying with new requirements. As part of the policy development process, the Program will participate in interagency working groups and review and comment on draft Department of Energy orders and directives. Finally, to maintain policy consistency within the Department, the Program will continue to interact with and provide Project data to other Departmental offices on environmental, safety, and health issues.

CONSULTATIONS WITH THE NUCLEAR REGULATORY COMMISSION

The Program will continue consultations with the Nuclear Regulatory Commission to improve mutual understanding of the critical technical issues surrounding the repository program and the activities required to resolve them, and to ensure that the Commission remains informed of the Program's technical work and evaluations.

To support the objectives of the Waste Acceptance, Storage, and Transportation Project, the Management Center will continue technical discussions with Commission staff on non-site specific issues associated with interim storage. These discussions are expected to increase if and when the Program is authorized to develop an interim storage facility.

UPDATING THE REGULATORY FRAMEWORK FOR A REPOSITORY AT YUCCA MOUNTAIN

The Management Center will work with the Yucca Mountain Site Characterization Project to identify areas where revisions to the regulatory framework for a geologic repository are needed to reflect the progress made in site characterization and the policy change to characterize only one site. The Management Center will help develop revisions to the Department's siting guidelines (10 CFR Part 960) and support interactions with the Nuclear Regulatory Commission and Environmental Protection Agency on revisions to the Program's regulatory framework.

2.3.4

QUALITY ASSURANCE

The Program maintains a mandatory quality assurance program to identify and ensure implementation of requirements that protect the health and safety of the public, workers, and the environment. The quality assurance program must meet Nuclear Regulatory Commission requirements. Extensive development and review of technical and implementing documentation, as well as effective implementation of the requirements, will be necessary to ensure the soundness of our data and engineering, and to support eventual licensing of our facilities by the Commission. Through quality assurance audits, the quality assurance program will independently verify that the various designs being developed and scientific activities performed incorporate the necessary regulatory requirements.

In Fiscal Year 1996, quality assurance audits will be performed and surveillance conducted regarding work on the viability assessment for the Yucca Mountain site and on the design and construction of the Exploratory Studies Facility. A recently developed program-wide system will be implemented for identifying and correcting conditions detrimental to quality and for performing trend evaluation. The Program will also continue the OCRWM Concerns Program, which provides a vehicle for employees to confidentially identify program concerns and to obtain resolution.

2.3.5

INSTITUTIONAL ACTIVITIES

The Nuclear Waste Policy Act establishes public participation as a key component in program activities. The Program will continue its coordination with institutions, organizations, government agencies, and individuals representing a variety of interests. Direct financial support for cooperative agreements will continue at a significantly reduced level. To respond to reduced funding levels, Fiscal Year 1996 funding for the Program's cooperative agreements were reduced to one-third of Fiscal Year 1995 levels; and funding for educational programs was reduced by 34 percent. Participation in national meetings and conferences and the production of education and information materials such

as videos, photographs, and fact sheets will be reduced. Other public information activities such as traveling exhibits and utility information center outreach will be terminated. The OCRWM National Information Center will provide minimum essential public information services and products. Its primary communications medium will be the OCRWM Home Page. Users can access the system on the World Wide Web at "http://www.rw.doe.gov". The *Office of Civilian Radioactive Waste Management Bulletin* will be published semiannually rather than quarterly.

The provision of financial assistance to stakeholders needing assistance to travel to program meetings will be suspended pending future budget decisions. The Program will continue to announce pending decisions in the *Federal Register*; release draft documents, as appropriate, for external review and comment; review and respond to comments in a timely manner; and provide public comment periods at all public meetings.

2.3.6

RESOURCES MANAGEMENT

FEDERAL HUMAN RESOURCES

The Management Center is responsible for recruiting, training, developing, evaluating performance, and providing appropriate recognition for the Program's Federal staff and for establishing a work place environment that supports the Program's goals and objectives. The Program has responded to the Secretary of Energy's goal of reducing the Department workforce during the next five years. Total Program Federal staffing levels, at 228 full-time equivalent staff at the end of Fiscal Year 1995, will fall to 217 by the end of Fiscal Year 1996.

To aid in increasing the capabilities of Federal staff, the Program is implementing a career development program tailored to individual employee needs. During Fiscal Year 1996, the Program will continue this initiative, and concentrate on the execution of total quality guidelines, temporary assignments, mentorships, and other personnel development initiatives. In Fiscal Year 1996, as the Program's staffing is being reduced, a new assessment of the qualifications, skills, and abilities required to accomplish mission objectives will be made, and a plan will be developed for retraining employees in areas where the appropriate complement of technical, programmatic, and administrative staff is lacking. The Program will also continue to reform its employee performance evaluation and recognition program in Fiscal Year 1996. *Figure 10* on the following page presents the Program's Federal organization.

**OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
FEDERAL ORGANIZATION**

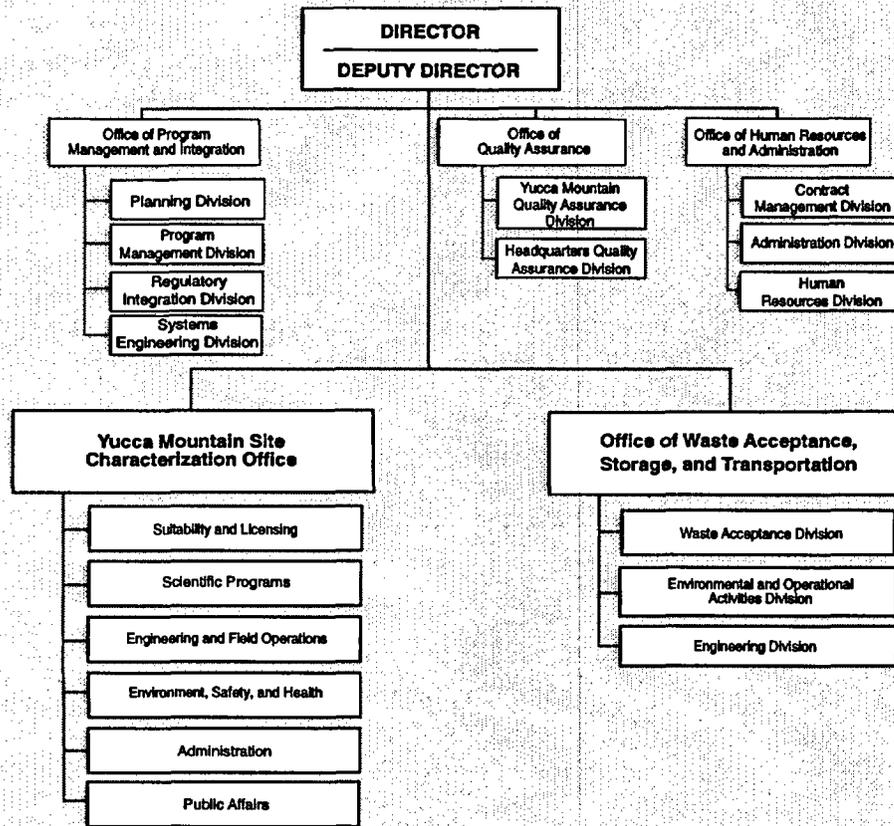


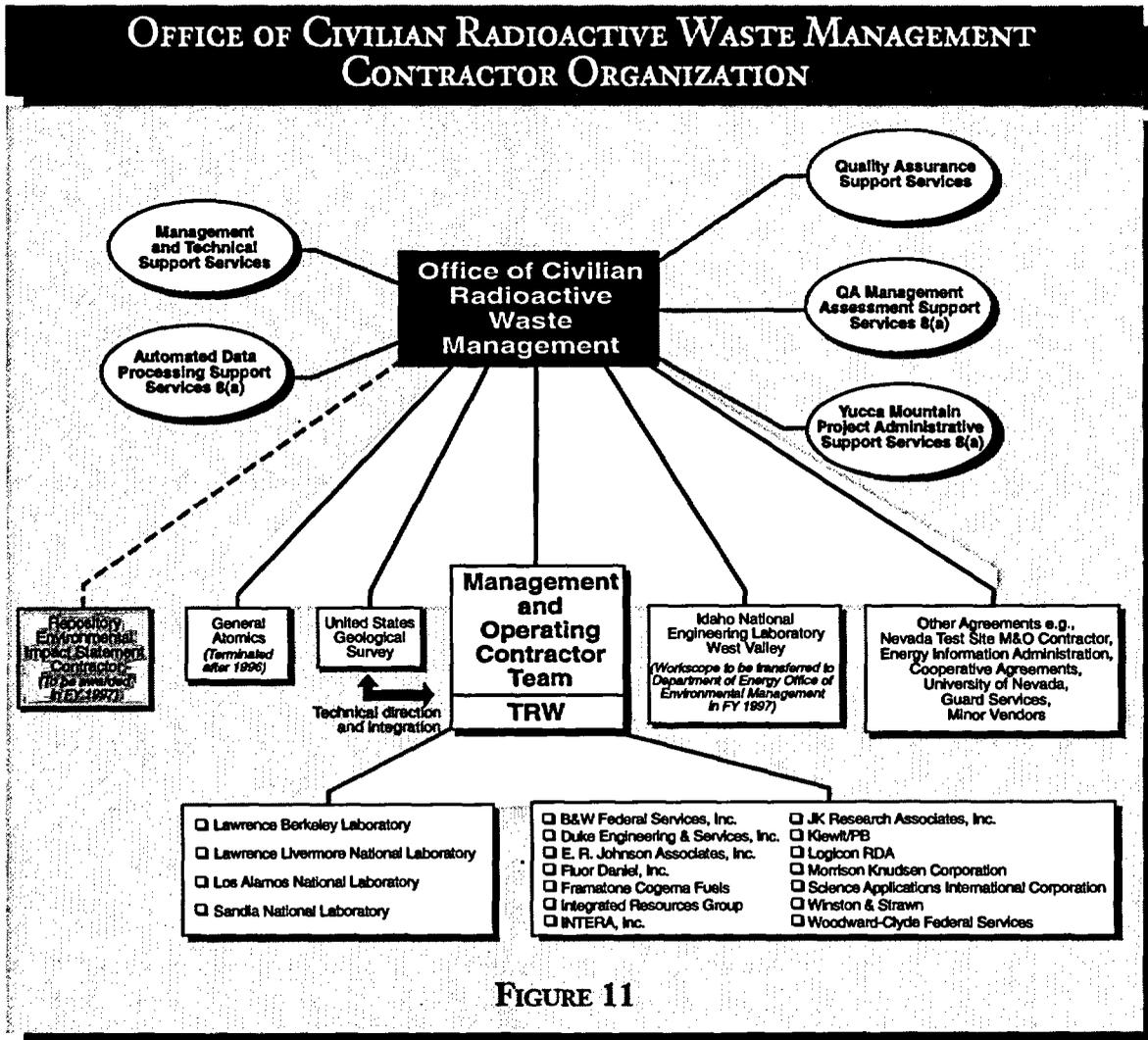
FIGURE 10

CONTRACTOR RESOURCES

In response to the Fiscal Year 1996 funding reductions, the Program has had to significantly reduce its contractor workforce. The Program had already reduced the work scope of its support services contractors under the Department of Energy's Strategic Alignment Initiative. Payments to support services contractors will be reduced by about 30 percent from Fiscal Year 1995 to Fiscal Year 1996. By the end of Fiscal Year 1996, the Program's management and operating contractor will reduce its staffing by almost 50 percent from Fiscal Year 1995 levels.

To improve efficiency, the Program has consolidated the contractor support provided by the Department of Energy national laboratories under the direction of the Program's management and operating contractor.

The Program is taking steps to establish a single technical and management support services contractor to improve the integration of activities between headquarters operations in Washington, D.C., and the Yucca Mountain Site Characterization Project in Las Vegas, Nevada. The Program plans to award a single contract by early Fiscal



Year 1997 to consolidate these services. *Figure 11* presents the Program’s contractor organization.

INFORMATION RESOURCES

The strategic application of information technology contributes to the accomplishment of the Program’s mission by providing integrated information systems, solutions, and services that enhance the productivity of our human resources, drive business process improvement efforts, reduce overall program costs, and support the Administration’s “reinventing government” initiative through such efforts as coordinating the Program’s utilization of the Internet.

In Fiscal Year 1996, primary emphasis will be placed on program-wide information management planning and integration, mission-critical support for business and management centers, and essential productivity enhancements which, in light of current

budgetary and resource constraints, have assumed increased importance. The Program will:

- Develop a program-wide information management multi-year plan which will outline specific information management actions to support the revised program objectives.
- Initiate the development of a program-wide information architecture to ensure integration and integrity of technical, regulatory, management, and financial data.
- Make business process improvement a top information management priority, beginning with the identification and elimination of duplicative and overlapping information systems.
- Develop an approach to meeting program-wide records processing requirements in support of the Program's licensing schedule.

FINANCIAL RESOURCES

Activities associated with financial management of the Nuclear Waste Fund include management of the Fund's investment portfolio and development and monthly implementation of appropriate investment strategies. In the past year, the Nuclear Waste Fund has outperformed the intermediate-term Treasury Bond Fund index. The Program's financial statements on the Fund will continue to be audited annually by an independent certified public accounting firm.

The Program will conduct fee adequacy analyses to determine whether fees being paid by waste generating sources are sufficient to fund the Program throughout its entire life cycle. The Fiscal Year 1996 analysis will be based, in part, on the 1995 *Analysis of the Total System Life Cycle Cost of the Civilian Radioactive Waste Management Program*. In Fiscal Year 1997, the 1995 total system life cycle cost estimate will be updated.

2.3.7

INTERNATIONAL WASTE MANAGEMENT ACTIVITIES

The Program's international waste management activities involve cooperation with other countries and international organizations to exchange information and develop consensus on common issues. During Fiscal Year 1996, the Program will continue to participate in bilateral agreements with Canada, Sweden, Switzerland, France, Japan, and Spain to support the exchange of waste management information. The Program will continue limited interactions with the International Atomic Energy Agency and Nuclear Energy Agency. Due to funding constraints, the Program has terminated cooperative research agreements with Sweden, Switzerland, and Canada to develop information and technology relevant to the characterization of a potential geologic repository at Yucca Mountain. Financial support for international cooperative science and technology programs is expected to be minimal in future years.

2.3.8

**PROGRAM MANAGEMENT
MILESTONES AND FUNDING REQUIREMENTS**

Program management activities contribute to accomplishing the milestone objectives for the Yucca Mountain Site Characterization Project and the Waste Acceptance, Storage, and Transportation Project (described in *Sections 2.1.5*, page 58, and *2.2.3*, page 68, respectively). Many milestones specific to program management are either annual requirements or activities related to effective implementation of the Program. The 1996-1999 Program Management milestones are listed below and the funding requirements are shown in *Table 6* on the following page. The Fiscal Year 1996 dollars reflect the Program's Congressional appropriation, the Fiscal Year 1997 dollars reflect the Administration's Fiscal Year 1997 budget request, and the Fiscal Year 1998-1999 dollars reflect out-year funding requirements for the revised program strategy.

Fiscal Years 1996 - 1999

- Modify the Program's cost, schedule, and workscope baselines, work breakdown structure, schedule networks, and bases of estimates to reflect the revised program strategy
- Increase staff capability through the continued implementation of the career development program and the development of a process for retraining employees to meet current and future job requirements
- Conduct fee adequacy analysis and publish the report
- Develop and submit to the Congress an annual report on activities and expenditures of the Office of Civilian Radioactive Waste Management during the previous fiscal year (*annual requirement of the Nuclear Waste Policy Act of 1982*)
- Prepare and submit to the Office of Management and Budget, through the Department of Energy's Chief Financial Officer, the Program's audited financial statements
- Award consolidated technical and management support services contract
- Complete *Fiscal Year 1997 Total System Life Cycle Cost Report*
- Develop an integrated information management multi-year plan to support the revised program strategy.

PROGRAM MANAGEMENT FUNDING REQUIREMENTS

	Dollars in Millions			
	FY 1996 <i>as enacted</i>	FY 1997 <i>requested</i>	FY 1998 <i>projected</i>	FY 1999 <i>projected</i>
Quality Assurance	5	2	2	2
Program Management	7	8	8	8
Human Resources Management	10	10	9	9
Program Management Subtotal	\$22	\$20	\$19	\$19
Program Direction ¹	29	31	31	31
PROGRAM MANAGEMENT TOTAL AVAILABLE	\$51	\$51	\$50	\$50

¹ Includes Federal salaries, benefits, travel, and other related costs.

TABLE 6

3

APPENDICES

Section 3, Appendices, presents additional information on program changes and background information on the program.

- *Appendix A: Evolution of the Civilian Radioactive Waste Management Program*
- *Appendix B: 1994 Program Plan Long-Term Objectives, Fiscal Year 1995 Milestones, and Fiscal Year 1995 Accomplishments*
- *Appendix C: Site-Specific Waste Acceptance, Storage, and Transportation Strategy*
- *Appendix D: Resources*
- *Appendix E: Glossary*

APPENDIX A

EVOLUTION OF THE CIVILIAN RADIOACTIVE WASTE MANAGEMENT PROGRAM

Appendix A describes the genesis of this Nation's efforts to resolve the radioactive waste management problem, the development of an international consensus on geologic disposal, the key provisions of and revisions to the Nuclear Waste Policy Act of 1982, and the oversight and system components of the Civilian Radioactive Waste Management Program.

DEVELOPMENT OF RADIOACTIVE WASTE MANAGEMENT POLICY

UNITED STATES' EFFORTS BEGIN

The strategy of geologic disposal for the long-term isolation of spent nuclear fuel and high-level radioactive waste dates back several decades. In the mid-1950s, the National Academy of Sciences considered the disposal of defense-related high-level radioactive waste. In 1957, the Academy concluded that radioactive wastes could be disposed of safely in a variety of geologic media within the United States. The Academy noted, however, the technical and institutional uncertainties involved in implementing a geologic repository strategy, and assumed that significant research would be necessary and substantial costs incurred before a final conclusion could be reached on the feasibility, reliability, and safety of geologic disposal. At the same time, the nationwide screening for suitable repository sites began and continued through the early 1980s.

INTERNATIONAL CONSENSUS ON GEOLOGIC DISPOSAL

In parallel with the evolution of the United States' policy, geologic disposal also emerged as the international community's consensus strategy for managing the permanent disposal of highly radioactive wastes.

In 1985, the Nuclear Energy Agency of the Organization of Economic Cooperation and Development, an international organization of 23 countries (including the United States) cooperating in the development of peaceful uses of nuclear energy, reported a high degree of confidence worldwide that disposal systems in deep geologic structures

can be designed and operated safely to assure long-term isolation of spent nuclear fuel or high-level radioactive waste. In 1995, the Nuclear Energy Agency reaffirmed the international consensus in its report *The Environmental and Ethical Basis of Geologic Disposal: A Collective Opinion of the Radioactive Waste Management Committee of the OECD*. The Agency asserted that:

“ . . . our responsibilities to future generations are better discharged by a strategy of final disposal than by reliance on stores which require surveillance, bequeath long-term responsibilities of care, and may in due course be neglected by future societies whose structural stability should not be presumed.”

NUCLEAR WASTE POLICY ACT OF 1982

In 1982, Congress passed the Nuclear Waste Policy Act, which established the Office of Civilian Radioactive Waste Management within the Department of Energy. The Act adopted geologic disposal as the Nation's long-term strategy for the safe isolation of radioactive waste and confirmed the Federal Government's responsibility for managing and disposing of commercial spent nuclear fuel. The Act directed the Department to identify three potential sites for the first repository and to conduct a multi-year evaluation, known as site characterization, of each of the three sites. This provision was later amended to terminate site characterization at all sites except the Yucca Mountain site in Nevada.

Following site characterization, the Secretary of Energy may decide to recommend a site for development as a repository. If the President accepts the Secretary's recommendation, the Act directs the President to submit a recommendation of the site to Congress. The site designation becomes effective 60 days after the President's recommendation, unless in the interim a notice of disapproval is submitted by the Governor and legislature of the State in which the site is located, or by the governing body of an Indian tribe on whose reservation the site is located. If such a notice is submitted, the site would be disapproved unless within 90 days of the submittal Congress passes a resolution of siting approval. If the President recommends a site and it is not disapproved, the Act directs the Department to submit an application to the Nuclear Regulatory Commission for a license authorizing repository construction. If the application is approved and construction proceeds, the Act requires the Department to apply to the Commission for additional licensing authority to begin accepting waste into the repository, and ultimately to close the facility permanently when waste emplacement is completed.

The Act limits the quantity of waste to be stored in the first repository to 70,000 metric tons of heavy metal until a second repository is in operation. The Act provides for the disposal of defense-related high-level radioactive waste, contingent upon a Presidential determination that such waste could be disposed of in a geologic repository along with commercial waste. In 1985, the President found no basis to conclude that a defense-only repository was required, and therefore, under provisions of the Act, the

Department is to proceed with plans and actions to dispose of defense waste with commercial spent nuclear fuel in a single repository.

The Act directs that activities associated with the management and disposal of civilian spent fuel conducted under the Act be funded through a fee on the commercial generation of nuclear power. The fee was set initially at 1.0 mil per kilowatt-hour, to be deposited into the Nuclear Waste Fund. The Secretary of Energy is directed to review the fee amount annually to determine its adequacy to meet Federal Government costs of managing civilian spent fuel, and to propose adjustments as needed to ensure full cost recovery. Costs associated with the disposal of high-level radioactive waste from defense activities are to be paid by the Federal Government.

The Act authorized the Secretary to enter into contracts with utilities for the acceptance and disposal of spent nuclear fuel. These contracts, which came to be known as the *Standard Contracts for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste* (10 CFR Part 961), were promulgated through rulemaking and provide that the Department will:

- take title to the spent nuclear fuel as expeditiously as practicable following commencement of operation of a repository, and
- in return for the payment of fees, beginning not later than January 31, 1998, dispose of such spent nuclear fuel.¹

The Act directed the Department of Energy to study the need for and feasibility of a monitored retrievable storage facility for the purpose of storing nuclear waste on an interim basis prior to disposing of it permanently in an underground repository and to submit to Congress a site-specific proposal for such a facility. It also required the Federal Government to transport spent nuclear fuel to a Federal storage facility, utilizing private industry to the fullest extent possible.

The Act defines certain units of government as “affected” because of their jurisdiction over the site of a proposed geologic repository or monitored retrievable storage facility, and permits the Secretary of Energy to designate additional units of local government as “affected” because of their proximity to such sites. It requires the Department to provide financial assistance to support participation of parties with “affected” status.

The Department was directed to issue general guidelines for the recommendation of sites for repositories, which were finalized in December 1984 as *General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories* (10 CFR Part 960), and to characterize multiple sites for possible development of a geologic repository. The Department selected nine sites to study as candidates for the first repository. In May 1986, the Secretary nominated five sites as suitable for the first repository, and recommended

¹ In May 1995, the Department published a finding that it has no legal obligation under the Act or the Standard Contract to begin disposal of spent nuclear fuel by January 31, 1998 in the absence of a repository or interim storage facility constructed under the Nuclear Waste Policy Act, as amended.

three of the sites to the President for approval for site characterization. The President approved three sites: Yucca Mountain, Nevada; Deaf Smith County, Texas; and the Hanford Site, Washington. The Department also began the process of identifying sites for a second repository.

NUCLEAR WASTE POLICY AMENDMENTS ACT OF 1987

Motivated in part by concern about program costs, Congress reassessed the need to characterize three potential repository sites. Through passage of the Nuclear Waste Policy Amendments Act of 1987, Congress redirected the Department to focus its site characterization activities only at Yucca Mountain, Nevada, and report on the need for a second repository on or after January 1, 2007 but no later than January 1, 2010.

The Department's proposal to locate a monitored retrievable storage facility at a site at Clinch River in Oak Ridge, Tennessee, with two alternative sites in Tennessee, was nullified in the Amendments Act. Congress directed that the need for a monitored retrievable storage facility be examined by a commission before the Department could proceed and restricted the Department's ability to site and develop such a facility by prohibiting:

- selection of a monitored retrievable storage facility site until the Secretary of Energy recommends for Presidential approval a site for development as a repository;
- selection of a site within the State of Nevada; and
- commencing facility construction until the Nuclear Regulatory Commission issues a license for the construction of a repository.

The Amendments Act established the Office of the Nuclear Waste Negotiator to seek a volunteer host site for a repository or monitored retrievable storage facility and also expanded external oversight of the Department of Energy by establishing the Nuclear Waste Technical Review Board, authorizing on-site oversight representatives of host jurisdictions, and providing for increased local government participation.

Finally, the Amendments Act required that packages for transport be certified by the Nuclear Regulatory Commission, and that the Department provide technical assistance and funds to States to train transportation public safety officials.

EXTERNAL OVERSIGHT AND REGULATION

Recognizing the far-reaching implications of national radioactive waste management policy, Congress mandated that oversight and regulation of the Department's civilian radioactive waste management activities be provided by a number of external organizations.

The Nuclear Regulatory Commission was made responsible for overseeing the safety of the Civilian Radioactive Waste Management System through its process of licensing waste management facilities and certifying other system components, such as waste containers. The Nuclear Waste Technical Review Board was directed to evaluate the technical and scientific validity of program activities. The Environmental Protection Agency was charged with promulgating generally applicable standards for protection of the general environment from off-site releases from radioactive material in repositories.

Additionally, the National Academy of Sciences has provided analysis and recommendations regarding waste management system issues at various times, sometimes at specific Congressional direction. For example, the Energy Policy Act of 1992 directed the Environmental Protection Agency to contract with the Academy for a study to provide recommendations on standards for protection of the public from the radioactive waste that might be disposed of in a geologic repository at the Yucca Mountain site. A special Academy committee completed its report, and the Environmental Protection Agency is currently developing revised regulations in light of the committee's recommendations.

The Nuclear Waste Policy Act also gave specific rights to the State of Nevada and affected units of local government to oversee the development of the system. Since its inception, the Program has also solicited external expertise and opinion through its own initiatives, and has sought the involvement of a broad range of stakeholders, including State and local officials, nuclear utilities and their regulators, environmental groups, labor unions, and the general public to contribute to its decision-making process.

CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM

As directed by the Nuclear Waste Policy Act, as amended, the Department of Energy's Civilian Radioactive Waste Management Program initiated the development of a waste management system consisting of three components: a geologic repository for permanent disposal of spent nuclear fuel and high-level radioactive waste; a monitored retrievable storage facility for temporary waste storage (if Congress approves the Department's proposal for the construction of such a facility or facilities); and a system for transporting the waste from commercial reactor sites to the temporary and permanent facilities. *Figure 12* on the following page illustrates the waste management system as contemplated in the Act.

**CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM
AS ORIGINALLY ENVISIONED**

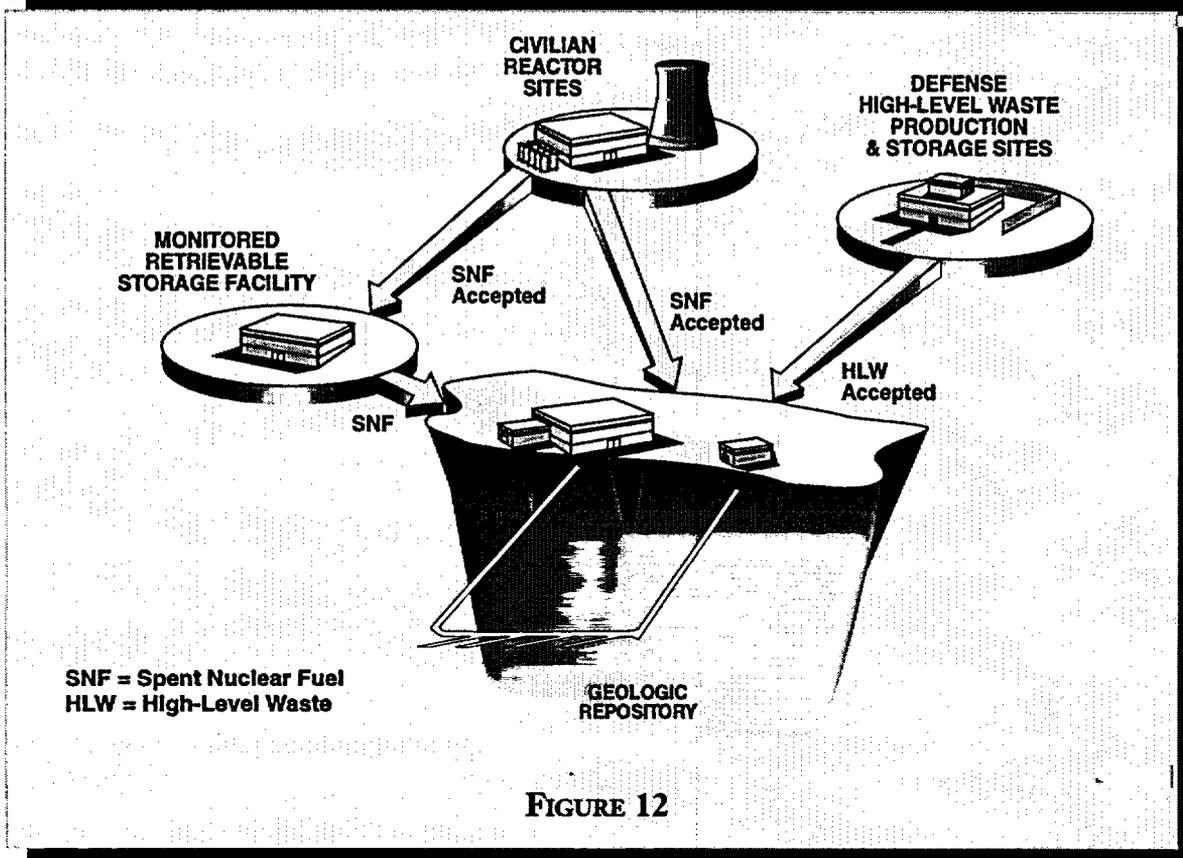


FIGURE 12

GEOLOGIC REPOSITORY

The strategic endpoint of the Civilian Radioactive Waste Management System is the emplacement of spent nuclear fuel and high-level radioactive waste in special packages in a deep geologic repository to isolate the waste for at least tens of thousands of years. The waste isolation performance of the repository will rely on multiple barriers, both natural and engineered. The natural barrier will be the rock formations of the repository site. The principal engineered barrier will be the waste package, which consists of the waste form, a disposal container, and any supplemental barriers such as backfill surrounding the waste package. Waste emplacement activities at the repository will incorporate multiple back-up safety systems and equipment to protect workers and the public.

MONITORED RETRIEVABLE STORAGE FACILITY

Congress directed that a proposal be developed for the construction of one or more facilities for the monitored retrievable storage of spent fuel. As originally conceived, a monitored retrievable storage facility was to be deployed to provide back-up storage only if development of a geologic repository were significantly delayed. The facility

would duplicate the spent fuel receiving and consolidating functions of the repository, and would be phased out of operation when the repository was in operation and had significantly reduced the backlog of spent fuel at the reactors. The facility would include a building with equipment for spent nuclear fuel reception, inspection, disassembly, and consolidation into storage packages; a large storage yard; and the necessary support facilities.

After a subsequent reassessment of the monitored retrievable storage concept, the Department concluded that the facility should be deployed as an integral part of the waste management system, with expanded capabilities, rather than serve as a back-up to be constructed only in case of repository development delays.

The Department's current strategy for implementing a near-term interim storage program, if and when interim storage authorization is enacted, is for a less-complex facility to be developed and licensed in two phases. The first phase of the facility would be limited to the receipt and storage of spent nuclear fuel in sealed canisters or casks, and could thus be brought into operation relatively quickly. The second phase of the facility, which would require more time to develop, would include the capability to receive uncanistered spent fuel assemblies and transfer them to sealed canisters for on-site storage. Phased development would facilitate timely implementation of the interim storage facility.

TRANSPORTATION SUB-SYSTEM

The Civilian Radioactive Waste Management System also includes the development of a transportation sub-system to provide waste acceptance at reactor sites and shipment to an interim storage facility or directly to a repository. Under previous plans, development of the transportation sub-system had been paced to support waste receipt at a geologic repository. Those plans had included development through Federal contracts of special casks for truck, rail, and barge shipment of waste.

Under the sub-system now envisioned, multiple contracts would be awarded to competing contractors to arrange waste shipments; acquire, maintain, and inspect equipment; plan and schedule operations; and train personnel. Transportation routes would be identified following the selection of interim storage and repository sites, and the technical assistance and funds would be provided to States for training public safety officials of local governments and Indian tribes through whose jurisdiction waste will be shipped.

Shipments will be made by truck, rail, or barge, or a combination of these modes. From an interim storage facility, the spent nuclear fuel will be transported on dedicated trains to the repository. In vitrified form, defense-related high-level radioactive waste is planned to be shipped by rail directly from storage sites to the repository. The planned schedule, activities, and products have been redirected under the revised Program Plan, as described in *Section 2.2* and *Appendix C*.

APPENDIX B

1994 PROGRAM PLAN LONG-TERM OBJECTIVES, FY95 MILESTONES AND FY95 ACCOMPLISHMENTS

The left column of the following table presents the major objectives and associated milestones of the program approach, as stated in the December 1994 Program Plan and in subsequent testimony before Congressional committees. The column on the right describes the Program's accomplishments in support of the major objectives and associated milestones.

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT	
1994 PROGRAM PLAN LONG-TERM OBJECTIVES AND FY 1995 MILESTONES	FY 1995 ACCOMPLISHMENTS
<p><i>Objective: Evaluate technical suitability of Yucca Mountain site by 1998 for development as a geologic repository</i></p> <ul style="list-style-type: none"> • Develop Exploratory Studies Facility <ul style="list-style-type: none"> - Complete testing and begin operation of tunnel boring machine - Complete construction of three underground testing alcoves off main tunnel - Accept delivery of conveyer system for tunnel boring machine to remove rock cutting • Finalize site suitability evaluation process in cooperative effort with stakeholders, advisory groups • Continue surface-based testing: drill one deep unsaturated-zone borehole and two other boreholes to provide additional information on rock characteristics • Complete technical basis report and assess compliance with guidelines for surface processes, including erosion, surface characteristics, and preclosure hydrology; make recommendation to the Director regarding readiness to make higher-level findings 	<ul style="list-style-type: none"> - Done; as of April 25, 1996, the tunnel boring machine was 4,914 meters (16,122 feet) into Yucca Mountain, more than 1,211 meters (3,974 feet) ahead of schedule; more than 60 percent of the five-mile tunnel completed. - Three underground testing alcoves completed and studies underway - Done; conveyor system fully operational • Done • Done • Report completed; assessment and recommendation deferred

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

1994 PROGRAM PLAN LONG-TERM OBJECTIVES AND FY 1995 MILESTONES	FY 1995 ACCOMPLISHMENTS
<p>Objective: If site found suitable, deliver a statutory site recommendation report and Environmental Impact Statement to the President in 2000</p> <ul style="list-style-type: none"> • Issue Environmental Impact Statement Notice of Intent • Conduct public scoping meetings • Collect and categorize all public comments received, and develop proposed responses • Develop annotated outline for Draft Environmental Impact Statement 	<ul style="list-style-type: none"> • Done • Conducted 15 scoping meetings across the country • Comments from nearly 1,000 individuals and organizations collected; categorization and development of proposed responses deferred • Deferred
<p>Objective: Submit a license application to the Nuclear Regulatory Commission in 2001</p> <ul style="list-style-type: none"> • Complete Total System Performance Assessment-1995 • Complete revision of License Application Annotated Outline and issue as Department document • Submit two Site Characterization Progress Reports to the Nuclear Regulatory Commission • Submit responses to Nuclear Regulatory Commission review of report on extreme erosion • Submit second of three reports on seismic hazards assessment methodology • Complete reviews of Advanced Conceptual Design for repository surface and underground facilities • Complete conceptual design and initiate Title I design for the waste package • Refine draft strategy for waste containment and isolation and complete more advanced evaluation of the predicted performance of the repository system 	<ul style="list-style-type: none"> • Done • Done • Done • Done • Completed in October 1995 • Reviews completed in early FY 1996; report completed in March 1996 • Conceptual design report completed in March 1996 • Underway; to be completed in FY 1996

**WASTE ACCEPTANCE, STORAGE, AND
TRANSPORTATION PROJECT**

1994 PROGRAM PLAN LONG-TERM OBJECTIVES AND FY 1995 MILESTONES	FY 1995 ACCOMPLISHMENTS
<p><i>Objective: Resolve waste acceptance contractual issues</i></p> <ul style="list-style-type: none"> • Issue report summarizing responses to May 1994 Notice of Inquiry on waste acceptance issues 	<ul style="list-style-type: none"> • Issued report summarizing 1,100 public comments; also issued final interpretation of waste acceptance obligation, concluding that Department has no legal obligation to begin disposal of spent nuclear fuel by January 31, 1998 in the absence of a repository or other facility constructed under the Nuclear Waste Policy Act
<p><i>Objective: Ensure availability of multi-purpose canisters in 1998</i></p> <ul style="list-style-type: none"> • Award one or more contracts for the design and certification of the multi-purpose canister system • Develop Draft Environmental Impact Statement for the multi-purpose canister system 	<ul style="list-style-type: none"> • One contract awarded to Westinghouse Electric Corporation by the Management and Operating Contractor • Completed scoping meetings and initiated analysis of public comments; preliminary draft developed; further effort to be completed by the Department of the Navy

WASTE ACCEPTANCE, STORAGE, AND TRANSPORTATION PROJECT

1994 PROGRAM PLAN LONG-TERM OBJECTIVES AND FY 1995 MILESTONES	FY 1995 ACCOMPLISHMENTS
<p><i>Objective: Develop technical and institutional capability for acceptance and transportation of spent nuclear fuel by 1998</i></p> <ul style="list-style-type: none"> • Issue Safeguards and Security Plan • Issue the Safeguards and Security Model • Issue the Spent Nuclear Fuel Verification Plan • Submit topical report on partial spent fuel burnup credit to Nuclear Regulatory Commission 	<ul style="list-style-type: none"> • Done • Replaced with Integrated Safeguards and Security Requirements Analysis; completed and due to be issued in FY 1996 • Plan completed; currently under revision because of adjustments needed due to budget cuts. To be issued in FY 1996 • Done
<ul style="list-style-type: none"> • Submit subsequent topical report on additional burnup credit based on additional testing and data gathering • Develop draft route selection guidance for spent fuel shipments and share with stakeholders 	<ul style="list-style-type: none"> • Deferred due to budget constraints • Not done; Program concluded existing Federal regulations are sufficient
<ul style="list-style-type: none"> • Complete fabrication of high-capacity legal-weight truck cask half-scale model and begin testing to verify cask design analysis • Issue Notice of Proposed Policy and Procedures on implementation of Section 180(c) regarding technical assistance and funding for public safety officials 	<ul style="list-style-type: none"> • Model fabricated and testing completed • Issued two Notices of Inquiry to solicit public comments on implementation of Section 180(c); Notice of Proposed Policy and Procedures to be issued in FY 1996

PROGRAM MANAGEMENT

1994 PROGRAM PLAN LONG-TERM OBJECTIVES AND FY 1995 MILESTONES	FY 1995 ACCOMPLISHMENTS
<p><i>Objective: Achieve better integration of activities, clearer lines of responsibility and authority for program personnel, and sharper focus on products and progress</i></p> <ul style="list-style-type: none"> • Complete consolidation of major program participants under technical direction of Management and Operating Contractor • Improve program integration by updating program management documents as follows: <ul style="list-style-type: none"> - Systems Engineering Management Plan - Program Management Systems Manual - Information Resources Management Multi-Year Program Plan - Baseline Management Plan • Revise and update the following plans and baselines consistent with the 1994 Program Plans 	<ul style="list-style-type: none"> • Refocused the budget to support 1994 Program Plan priorities; allocated increased funds for scientific and technical work at Yucca Mountain while holding overhead costs relatively flat • Done
<ul style="list-style-type: none"> - Total System Life Cycle Cost - National Environmental Policy Act Compliance Strategy - Civilian Radioactive Waste Management System Requirements Document - Cost and Schedule Baselines - Program Work Breakdown Structure - Strategic Plan - Program Plan 	<ul style="list-style-type: none"> - Done - Done - Done; now undergoing further revision - Done - Done - Held strategic planning workshops; deferred pending program replanning to conform to budget action - Done; published December 1994.
<ul style="list-style-type: none"> • Develop the following new plans: <ul style="list-style-type: none"> - Complete preparation of Total System Description - Test and Evaluation Management Plan - Quality Assurance Transition Plan - Public Participation Plan 	<ul style="list-style-type: none"> - In development - Done - Done - Deferred

PROGRAM MANAGEMENT

1994 PROGRAM PLAN LONG-TERM OBJECTIVES AND FY 1995 MILESTONES	FY 1995 ACCOMPLISHMENTS
<ul style="list-style-type: none"> • Complete initial consolidation of quality assurance procedures • Provide integrated on-line automated configuration information system • Initiate information management architecture project through pilot test at Headquarters 	<ul style="list-style-type: none"> • Done • In development • Project underway
<p><i>Objective: Expand stakeholder and public participation in program decision-making</i></p> <ul style="list-style-type: none"> • Implement collaborative process for stakeholder/customer involvement, including review of comments on the draft plans 	<ul style="list-style-type: none"> • Conducted numerous public meetings on a variety of program topics, and participated in formal interactions with representatives from oversight bodies, State and local governments, industry groups, and the general public
<p><i>Objective: Participate in key deliberations regarding disposal of the Department's radioactive materials</i></p>	<ul style="list-style-type: none"> • Worked with other Departmental offices to establish a process for qualifying waste forms, including defense high-level waste, Department-owned spent nuclear fuel, and miscellaneous waste

APPENDIX C

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SITE-SPECIFIC
WASTE ACCEPTANCE, STORAGE, AND
TRANSPORTATION STRATEGY

INTRODUCTION

Section 2.2 of the Program Plan, Revision 1, describes activities to acquire the capability for waste acceptance, storage, and transportation, which will be conducted prior to interim storage facility site designation under the Program's revised strategy. This appendix describes the waste acceptance, interim storage, and transportation activities currently planned to begin once a facility site is designated.

PLANNING ASSUMPTIONS

Plans for activities following interim storage facility site designation are based on the following assumptions:

- The \$85 million reserved in the Energy and Water Development Appropriations Act of 1996 will be requested by the Administration and will be made available in Fiscal Year 1998 appropriations for non-site specific activities.
- Legislation designating an interim storage site will be enacted approximately six months after the 1998 completion of the Yucca Mountain viability assessment.
- Site-specific work on a Federal interim storage facility will be initiated with Fiscal Year 1999 funding.
- Design, licensing, and construction will take approximately three and one-half years following designation of a site for interim storage, assuming the necessary funding is provided to develop a topical safety analysis report and conduct related design and analysis work.
- Interim storage facility legislation will be enacted which:
 - authorizes implementation in two phases to facilitate the earliest possible acceptance of waste;
 - requires separate environmental reports for each phase of construction;

- allows construction of an interim storage facility to begin as soon as the license application is submitted; and
- directs the Nuclear Regulatory Commission to develop an Environmental Impact Statement for the interim storage facility, based on an environmental report submitted with the license application.
- The interim storage facility will be designed, licensed, constructed, and brought into operation using best commercial practices, and in accordance with the Nuclear Regulatory Commission regulation *Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste* (10 CFR Part 72) and other applicable regulations.
- An interim storage facility environmental report and license application will be submitted to the Nuclear Regulatory Commission in 2000.
- The Federal interim storage facility will begin receiving spent fuel deliveries from the waste acceptance, storage, and transportation contractors in 2002.

KEY PLANNING ELEMENTS

WASTE ACCEPTANCE, STORAGE, AND TRANSPORTATION

Competitive procurement for waste acceptance, storage, and transportation services

The Program is contemplating carrying out its waste acceptance, storage, and transportation functions using a market-driven approach that relies on competitive contracts with the private sector for implementation. Under this initiative, contractors will perform their functions consistent with the *Standard Contract (Article IV.B)* by accepting spent fuel at Purchasers' sites on behalf of the Department and delivering it to a Department facility. Contractors would be compensated based on performance of these services and would accept financial risk. Contractors will be encouraged to use innovative approaches to improve efficiency, to solve problems, to overcome obstacles to performance, and to lower costs.

Multiple Awards: It is envisioned that this will be the first of several similar future procurements covering waste acceptance, storage modules, and transportation services and equipment to be provided over several decades. For the purpose of establishing and sustaining viable competition, the Department is contemplating awarding multiple fixed-price type contracts. One approach under consideration is to divide the country into regions. (For example, the four Nuclear Regulatory Commission regions might be used.) Under this approach, one contractor would provide waste acceptance and transportation services to all Purchasers in a given region for the duration of the contract period. Selected contractors would be responsible to provide waste acceptance and transportation services to all Purchasers with allocations in the Department's *Accep-*

tance Priority Ranking and Annual Capacity Report within their respective service regions. To preserve competition and encourage industrial capability within the market place, no single offerer would be awarded more than a portion of the work.

Scope of Services: Contractors will be responsible to accept spent fuel on behalf of the Department as identified in the *Acceptance Priority Ranking and the Annual Capacity Report* at Purchasers' facilities and deliver it to a Federal facility (either a repository or an interim storage facility). Contractors would be responsible to provide all transportation casks and equipment suitable for use at Purchasers' sites, accept spent fuel for shipment as an agent of the Department, and deliver the spent fuel and compatible storage systems to the Department facility. Initially, spent fuel delivered to the facility would be canistered before arrival at the facility. At some point in the service period, the facility license may be amended to allow handling of uncanistered spent fuel, and the contractor may be required to transition to delivery of uncanistered spent fuel.

Transportation and storage would be carried out using commercially available equipment in compliance with applicable Nuclear Regulatory Commission and Department of Transportation regulations, Department of Energy acceptance criteria, and standard commercial practices. Contractors would provide service in accordance with the *Acceptance Priority Ranking and Annual Capacity Report*; however, contractors might, with Purchaser agreement and notification to the Department, alter the order of acceptance to achieve efficiency of operation or to lower costs. Contractors would also be responsible for any intermodal transport required, including heavy haul, whether from the Purchasers' sites or to the Federal receiving facility.

Schedule: Schedule specifics would be addressed in the solicitation. For planning purposes, it is expected that a Federal facility could be in operation to receive spent nuclear fuel within three and one-half years of Congressional direction and contractors could be expected to begin developing service arrangements with Purchasers two to three years before spent nuclear fuel shipment.

Technical assistance and funding

Approximately three years before the start of waste acceptance and transportation operations, the Program would begin providing technical assistance and funding for training public safety officials in emergency response and safe transport procedures, as required under Section 180(c) of the Nuclear Waste Policy Act, as amended. *Section 2.2.2* provides an expanded discussion of this requirement.

INTERIM STORAGE

The development of an interim storage facility would include environmental, design, licensing, and construction activities. Development of the facility would be accelerated by licensing and constructing the facility in two phases:

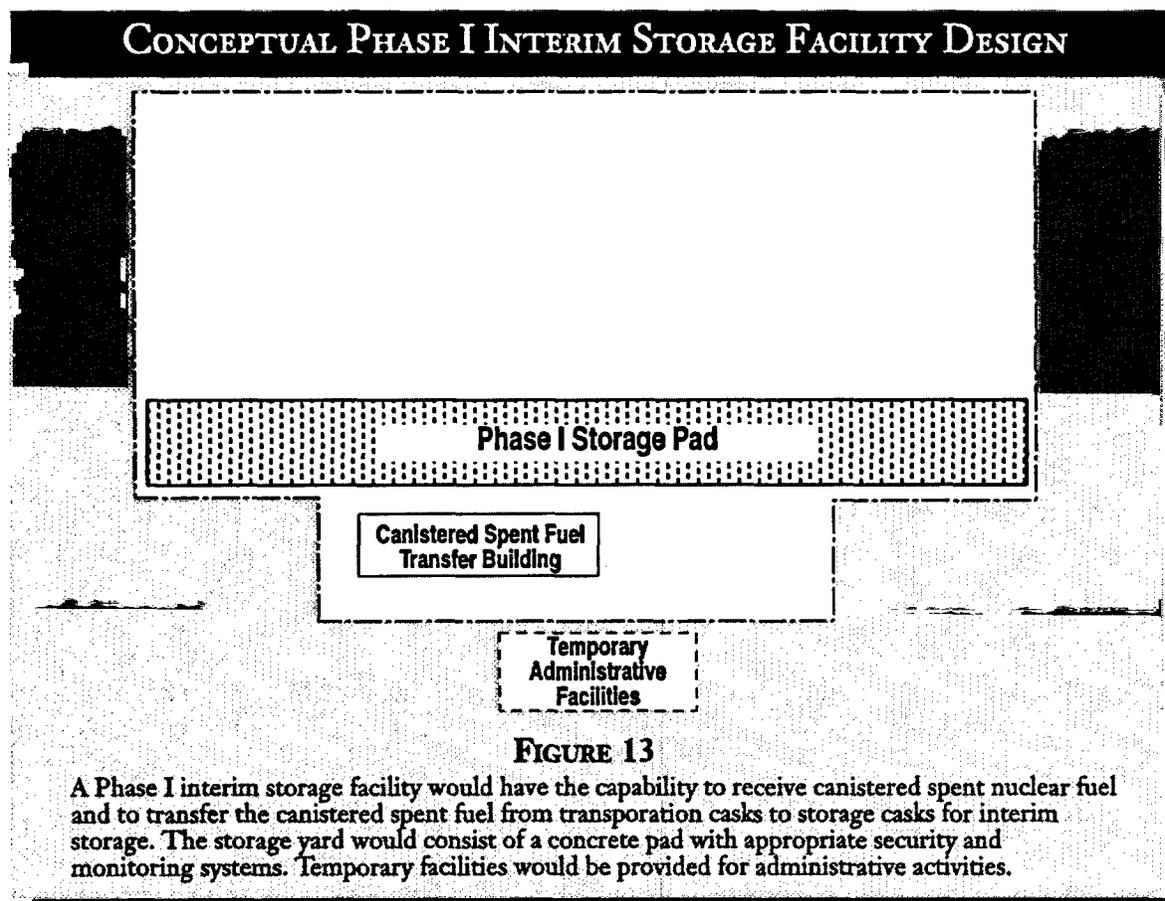
- **Phase I** operations would be limited to the acceptance of spent nuclear fuel in canisters suitable for transportation and storage. Operations in this phase would not

require the construction of spent fuel-handling facilities, which would be deferred to Phase II.

- Phase II operations would include acceptance of uncanistered spent nuclear fuel that would be transferred from transportation casks to storage casks for storage on site at the interim storage facility.

Following the designation of a site, the Program would perform a detailed site investigation and develop an environmental report to be submitted to the Nuclear Regulatory Commission as a part of the Phase I license application. The environmental report would provide the basis for an Environmental Impact Statement to be prepared by the Commission. Site-specific activities, including site-specific facility design and preparation of the Phase I license application, would begin following the enactment of legislation designating a site. These activities would draw on the non-site specific work conducted under the first stage of the strategy before site designation. The Program would also develop and issue request(s) for proposals for facility construction and operation.

Following submission of the license application, the Program would complete final procurement and construction design and award a contract or contracts for constructing and operating Phase I of the facility. Upon issuance of an Environmental Impact Statement, a Record of Decision on the Environmental Impact Statement, and an interim storage facility operating license by the Nuclear Regulatory Commission, the Phase I facility would begin accepting canistered spent fuel. Spent fuel acceptance and



interim storage facility operations are expected to commence approximately four years after a site is designated.

Phase II development would proceed concurrently with Phase I development and operations, and would follow the same general process, but would take about two years longer due to the requirements of designing, licensing, and constructing a facility to handle uncanistered spent nuclear fuel. Under the assumed timetable, the Phase II license application would be submitted to the Nuclear Regulatory Commission an estimated six months before the Phase I license is granted. Transportation and receipt of uncanistered spent nuclear fuel would commence when the Nuclear Regulatory Commission issues the Phase II license. *Figures 13* (on the preceding page) and *14* (on this page) present a preliminary concept of Phase I and Phase II interim storage facilities.

CONCEPTUAL PHASE II INTERIM STORAGE FACILITY DESIGN

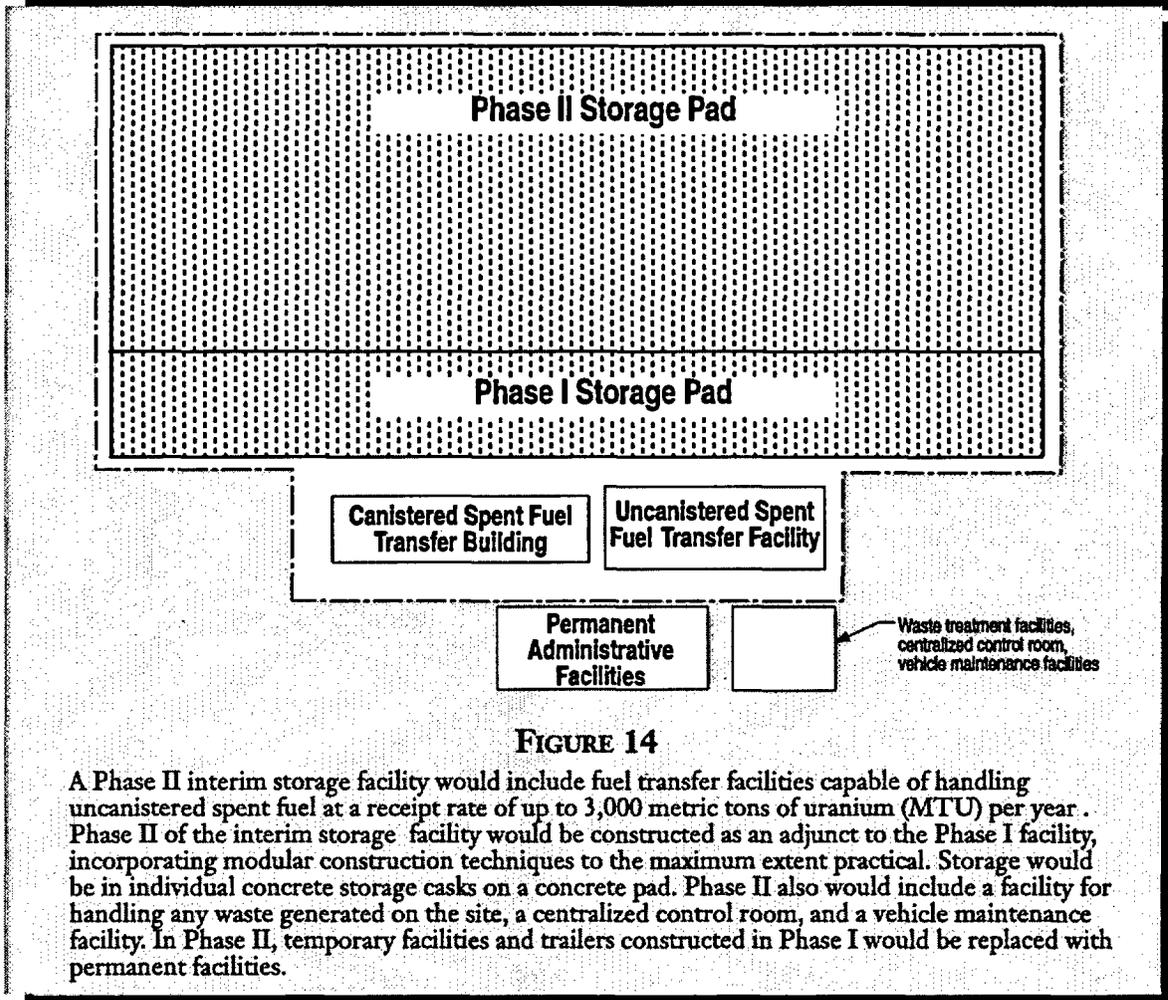


FIGURE 14

A Phase II interim storage facility would include fuel transfer facilities capable of handling uncanistered spent fuel at a receipt rate of up to 3,000 metric tons of uranium (MTU) per year. Phase II of the interim storage facility would be constructed as an adjunct to the Phase I facility, incorporating modular construction techniques to the maximum extent practical. Storage would be in individual concrete storage casks on a concrete pad. Phase II also would include a facility for handling any waste generated on the site, a centralized control room, and a vehicle maintenance facility. In Phase II, temporary facilities and trailers constructed in Phase I would be replaced with permanent facilities.

MILESTONES

The following waste acceptance, storage, and transportation milestones are contingent on Congressional interim storage authorization, funding, and facility site designation.

Fiscal Year 1999

- Begin investigations at the interim storage facility site
- Initiate site-specific interim storage facility design
- Begin interim storage facility Phase I license application
- Award multiple contracts for waste acceptance, storage modules, and transportation services and equipment; authorize contractors to initiate the waste acceptance, storage, and transportation planning phase of the contract

Fiscal Year 2000

- Begin providing technical assistance and funding to States for emergency preparedness and safe transport training under Section 180(c) of the Nuclear Waste Policy Act
- Submit Pressurized Water Reactor Principal Isotope (Full) Burnup Credit Topical Report to the Nuclear Regulatory Commission
- Complete interim storage facility Phase I Environmental Report
- Submit interim storage facility Phase I license application to the Nuclear Regulatory Commission
- Issue request(s) for proposals for Phase I interim storage facility construction and operation
- Authorize contractor procurement of waste acceptance, storage modules, and transportation services and equipment

Fiscal Year 2001

- Award contract(s) and initiate interim storage facility Phase I construction and preparations for operations
- Begin interim storage facility Phase II license application

Fiscal Year 2002

- Submit interim storage facility Phase II license application to the Nuclear Regulatory Commission
- Issue request for proposals for interim storage facility Phase II construction
- Receive interim storage facility Phase I operating license

CIVILIAN RADIOACTIVE WASTE MANAGEMENT PROGRAM PLAN, REVISION 1

- Authorize contractors to proceed with the operations phase of the waste acceptance, storage modules, and transportation services and equipment contracts
- Commence interim storage facility operations and begin receiving canistered spent nuclear fuel at interim storage facility

Fiscal Year 2003

- Award contract(s) and begin construction of interim storage facility Phase II

APPENDIX D

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APPENDIX E

GLOSSARY

Actinides are a set of 14 radioactive heavy metals, from thorium to lawrencium in the periodic chart of elements.

Advanced Conceptual Design refers to the final part of the conceptual design phase for the repository, including engineered barriers and the waste package. It is intended to develop possible solutions to all identified design-related licensing issues and to develop design requirements for the technical baseline. This phase will explore limited design alternatives and will establish and refine the design criteria and concepts to be finalized in the later design phases that will support licensing and construction.

Burnup refers to the reduction of fissionable material in the nuclear fuel that is used up during the nuclear fission process in a reactor. As the fissionable material is depleted, the ability of the fuel to sustain a chain reaction (reactivity) declines.

Burnup credit refers to a strategy being considered for effective reduction in calculated spent nuclear fuel reactivity in multi-purpose canisters and transportation casks. The strategy considers the burnup of fuel instead of using fresh fuel assumptions in establishing criticality control measures and the design of the appropriate spent nuclear fuel geometry and neutron-absorbing material that must be utilized in spent nuclear fuel loading. Burnup credit is one of the licensing issues that may be addressed in obtaining certificates of compliance for transportation casks.

Criticality control refers to the suite of measures taken to maintain nuclear fuel, including spent nuclear fuel, in a subcritical condition during storage, transportation and disposal, so that no self-sustaining nuclear chain reaction can occur. Subcriticality is assured by loading spent fuel in specific configurations that meet certain requirements related to fuel age, enrichment, and reduction in nuclear fuel reactivity through burnup.

Contract holders refer to owners and generators of spent nuclear fuel who have contracted with the Department of Energy for acceptance and disposal of the spent fuel under provisions of the Nuclear Waste Policy Act.

Defense high-level nuclear waste refers to high-level waste generated in the course of national defense activities.

Drift is a horizontal or near-horizontal passageway in a mine.

Dry transfer refers to moving spent nuclear fuel into a container or between containers in the absence of a spent fuel storage pool; transfer is generally conducted in pools, where the water provides cooling and radiation shielding.

Energy Policy Act (42 USC 1251 et seq.) refers to comprehensive energy legislation enacted by Congress in 1992. Section 801 of the Act directed the Environmental Protection Agency to contract with the National Academy of Sciences to provide “findings and recommendations on reasonable standards...that would govern the long-term performance of a repository at the Yucca Mountain site.” Section 802 of the Act extended the term of the Nuclear Waste Negotiator. Section 803 of the Act instructed the Department of Energy to evaluate whether its current programs and plans are adequate to deal with additional volumes or categories of nuclear waste that might be generated by nuclear power plants newly licensed after October 1992.

Engineered barrier refers to a manmade component of a disposal system designed to prevent the releases of radionuclides from the underground facility. This term includes the waste form, the waste package, materials placed over and around the waste packages, and barriers used to seal penetrations directed into and within the underground facility.

Environmental Assessment refers to a public document for which a Federal agency is responsible that serves to provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact.

Environmental Impact Statement refers to a detailed written statement to support a decision to proceed with major Federal actions affecting the quality of the human environment. Required by the National Environmental Policy Act (NEPA), the environmental impact statement describes: the environmental impact of the proposed action; any adverse environmental effects which cannot be avoided should the proposal be implemented; alternatives to the proposed action (*although the Nuclear Waste Policy Act, as amended, precludes consideration of certain alternatives*); the relationship between local short-term uses of man’s environment and the maintenance and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. Preparation of an environmental impact statement requires a public process that includes public meetings, reviews, and comments, as well as agency responses to the public comments.

Environmental Report is a document, similar in content to an environmental impact statement, required of facility license applicants for submission to the Nuclear Regulatory Commission. The document, while it does not involve the public process required in an environmental impact statement, serves to provide information necessary to prepare an Environmental Impact Statement by the Commission.

Evapotranspiration is the loss of water from the land to the atmosphere through transpiration of plants and evaporation from the soil.

Exploratory Studies Facility refers to a facility constructed for the purpose of performing underground studies during repository site characterization.

Geologic repository refers to a system for the disposal of radioactive waste in excavated geologic media, including surface and subsurface areas of operation and the adjacent portion of the natural setting.

Ground water refers to all subsurface water as distinct from surface water.

High-level radioactive waste refers to: (1) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and (2) other highly radioactive material that the Nuclear Regulatory Commission, consistent with existing law, determines requires permanent isolation. The Civilian Radioactive Waste Management System will accept only solidified high-level waste.

Information management architecture refers to the conceptual framework that guides the building of an efficient, effective, and flexible information infrastructure. The architecture provides the blueprint upon which all information, data, and information systems are defined, organized, developed, accessed, maintained, and managed for the Program.

Institutional activities refer to activities involving stakeholders and the public, and includes participation in program decision making, program information dissemination, and program funding to State and local governments and stakeholder groups.

Interim storage facility is a facility for acceptance of spent nuclear fuel and high-level nuclear waste from owners and generators for temporary storage prior to permanent disposal in a repository. See also *monitored retrievable storage facility*.

License application is a document submitted to the Nuclear Regulatory Commission containing general information and a safety analysis for either a geologic repository or an interim storage facility. A license is required to receive, possess and dispose of spent nuclear fuel and high-level radioactive waste.

Licensing Support System refers to an electronic information retrieval and distribution system to support the licensing process, as required by the Nuclear Regulatory Commission in 10 CFR Part 2, Subpart J. This system must be certified by the Commission at least six months before the Department submits a repository license application. The Department has worked with the Commission and the Commission-sponsored stakeholder group to develop an acceptable system that will be used for document discovery by all participants in the repository licensing hearings.

tractors, Department of Energy laboratories, and the United States Geologic Survey, engaged in the performance of such services.

Quality assurance refers to all of the planned and systematic actions necessary to provide adequate confidence that a structure, system, or component is constructed according to plans and specifications and will perform satisfactorily. The Program has established a rigorous quality assurance program which is required and overseen by the Nuclear Regulatory Commission. Establishment and execution of the quality assurance program is intended to protect the health and safety of the public and workers, and the environment. Compliance with the quality assurance program enables us to collect and maintain qualified, traceable data that can be used and considered valid by the Commission and other oversight bodies during program execution and licensing proceedings.

Reactivity is a measure of a nuclear system's potential to self-sustain a nuclear chain reaction.

Spent nuclear fuel refers to fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by re-processing.

Stakeholders refer to individuals or organizations who have an important, ongoing interest in the Program and service quality of the Office of Civilian Radioactive Waste Management.

Storage cask refers to a waste receptacle designed to hold safely one or more spent-fuel assemblies during storage at a reactor site, an interim storage facility, or a repository.

Strategic Alignment Initiative refers to the second phase of Secretary of Energy Hazel O'Leary's five-year Strategic Plan. The Plan was developed in Fiscal Year 1995 to enhance the Department of Energy's performance of core missions while reducing costs. The Strategic Alignment Initiative is a package of organizational, legislative and cost-cutting actions, including downsizing, privatization and management restructuring throughout the Department of Energy.

Strategic System refers to a Department of Energy designation under which the Program will be managed as a single integrated entity rather than as separate independent projects.

Thermal loading refers to how application of heat to a system is distributed in space, and is usually measured in terms of watt density. The thermal loading for a repository is the "watts-per-acre" produced by the radioactive waste in the disposal area.

Topical safety analysis report refers to a document submitted for review and approval to the Nuclear Regulatory Commission prior to a license application for a radioactive waste management facility, containing analyses and evaluations addressing the potential impact of the facility on public health and safety.

Total system life cycle cost refers to the cost estimate which reflects the most current assumptions for system components and operational procedures for the Civilian Radioactive Waste Management System. The Nuclear Waste Policy Act of 1982 requires the Secretary of Energy to annually review the 1.0 mil per kilowatt-hour fee, paid by nuclear utilities for the disposal of spent nuclear fuel, to determine its adequacy for offsetting the estimated costs of the Program. The total system life cycle cost analysis is prepared to document the estimated Program cost and is a necessary component of the fee adequacy analysis.

Transportation and storage system refers to equipment for the acceptance, transportation, and interim storage of spent nuclear fuel.

Utilities refer to commercial entities which provide electricity to users for a fee. Utilities collect money that goes into the Nuclear Waste Fund, if the utility company generates power using nuclear reactors.

Viability assessment refers to the Program's assessment of the prospects for geologic disposal at the Yucca Mountain site, based on repository and waste package designs, a total system performance assessment, a license application plan, and repository cost and schedule estimates.

Waste acceptance refers to the processes necessary for the Department of Energy to take title to and physical possession of spent nuclear fuel or high-level nuclear waste from owners and generators of these wastes.

Waste canister refers to a metallic or nonmetallic container enclosing the waste form.

Waste form refers to radioactive waste materials and any encapsulating or stabilizing matrix. Examples include used nuclear power reactor fuel elements and borosilicate glass "logs" containing radioactive materials.

Waste package refers to the waste form and any containers, shielding, packing, and other absorbent materials immediately surrounding an individual waste container.

Water table refers to an underground boundary below which the rock interstices are filled with water and above which the interstices are not filled with water.

Weapons-usable fissile material refers to the highly enriched uranium and plutonium that can be used in the production of nuclear weapons.

10 CFR Part 2 refers to the Nuclear Regulatory Commission regulation, titled "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders," that governs the conduct of the Commission's licensing proceedings. Subpart J of 10 CFR Part 2, titled "Procedures Applicable to Proceedings for the Issuance of Licenses for the Receipt of High-Level Radioactive Waste at a Geologic Repository," contains specific requirements for the repository licensing process. These include requirements for the

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Accession No. HQ0•19960314•0001