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OFFICE OF
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MANAGEMENT

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The Nuclear Waste Policy Act of 1982 (Public Law 97-425) established the Office of Civilian Radioactive Waste Management (OCRWM) within the U.S. Department of Energy to develop and manage a Federal system for disposing of the spent nuclear fuel from civilian nuclear reactors. The spent fuel is to be permanently emplaced in a deep geologic repository. The Act also provided the President with the option of disposing of defense high-level radioactive wastes in a civilian repository, and in 1985 the President so chose. The Nuclear Waste Policy Amendments Act of 1987 (Title V, Public Law 100-203) directed the Secretary of Energy to characterize only the Yucca Mountain site in Nevada to determine if it is suitable for a repository.

Section 304(c) of the Act requires OCRWM's Director to submit to Congress each year a comprehensive report on the activities and expenditures of the Office. This Annual Report, the 11th submitted, covers the period October 1, 1993 through September 30, 1994.

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Table of Contents

Director's Message	v
Summary	1
Chapter 1 – Yucca Mountain Site Characterization	9
A New Approach to Site Characterization	
Designing and Constructing the Exploratory Studies Facility	
Conducting Surface-Based Testing	
Performance Assessment and Design	
Preparing for Licensing	
Independent Oversight: Interactions with the Nuclear Waste Technical Review Board	
Working with Affected Units of Government	
Protecting the Environment and Human Safety and Health	
International Programs	
Chapter 2 – Waste Acceptance, Storage, and Transportation	33
Addressing Waste-Acceptance Issues	
The Multi-Purpose Canister System	
Interim Storage	
Developing a Transportation System	
Chapter 3 – Management Controls	43
Applying and Verifying Quality Assurance	
Integrating the Waste Management System	
Using Planning To Define and Advance the Program	
Formulating the Budget	
Realigning Our Resources	
Managing Information Resources	
Rebaselining the Program	
Chapter 4 – Working with External Parties	55
Review, Regulation, and Oversight	
Working with Stakeholders	
Chapter 5 – Financial Management	59
Sources of Program Funding	
Expenditures	
Civilian Radioactive Waste Research and Development Account	
Estimating Total-System Life Cycle Costs and Assessing Fee Adequacy	

Appendix A – Financial Statements	63
Appendix B – Key Federal Laws and Regulations	95
Appendix C – Key Fiscal Year 1994 Appearances by OCRWM before Regulators and Oversight Bodies	99
Appendix D – OCRWM Publications, Fiscal Year 1994	103
Appendix E – Selected Publications from Other Organizations, Fiscal Year 1994	105

From the Director

With passage of the Nuclear Waste Policy Act in 1982, following years of debate, Congress signalled its commitment to solving the problem of high-level radioactive waste disposal. In 1987 Congress reaffirmed and focused this commitment by designating Yucca Mountain, in Nevada, as the only site to be evaluated for suitability as a high-level radioactive waste repository. Since then, Congress has continued to make substantial investments in the program it created. With no scientific, technical, or social precedents, the U.S. civilian high-level radioactive waste management program, like waste management programs of other nations, is moving up what has proved to be a very steep learning curve.

Congress's investment has produced a program with considerable strengths, including a developing methodology and regulatory framework for the decision on the integrity of a geologic repository for waste disposal over a period of 10,000 years. This evaluation must rest on agreement within the scientific and oversight communities as to what reasonable standards for safety should be and how compliance with those standards, throughout the 10,000-year period, can be reasonably demonstrated—tasks that sound straightforward but entail extremely complex scientific issues. The evaluation must also ultimately meet the test of general public acceptability.

Other strengths of the U.S. program are the expertise and skill acquired by the individuals and teams working within this multidisciplinary field and the invaluable network of professional relationships that has matured as program managers, scientists, oversight bodies, and stakeholders have tackled and sometimes contested program issues. In particular, close, continuing consultation, both formal and informal, among the Department of Energy, the Nuclear Regulatory Commission, the Commission's Advisory Council on Nuclear Waste, the congressionally created Nuclear Waste Technical Review Board, and the State of Nevada and local governments has significantly advanced the shared understanding of what will be the most complex licensing proceeding the Nuclear Regulatory Commission has ever undertaken.

But despite these assets, the civilian high-level radioactive waste management program has been hampered by schedule delays and controversy. Further, many participants found it difficult to manage a complex scientific program within a regulatory setting. When I became Director in 1993, there was universal agreement on only one thing: The program, as then constituted, was not making adequate progress. What's more, the Department was under increasing pressure from utilities that wanted their spent nuclear fuel removed beginning with the 1998 date set forth in the original Act, and the incomplete policy attention to the inventory of high-level radioactive wastes from the Department's nuclear weapons complex was becoming a more immediate concern. It was clear that "business as usual" was not going to get us to our goal, on time, or within budget.

After considerable consultation and deliberation, we developed a new program approach that meets several vital tests: 1) It can be implemented within the current statutory framework; 2) it aligns our technical workscope and our resources, on a realistic schedule; 3) it is structured in such a way that progress is measurable; and 4) it streamlines the program by phasing and accelerating site characterization activities, permitting us to achieve needed results faster, within available resources, and with substantive stakeholder involvement.

Congress supported our new approach by approving a 37 percent increase in funding for Fiscal Year 1995 over that of Fiscal Year 1994. We interpreted this increase not only as a vote of confidence in our new approach, but as a clear signal that Congress wants us to get on with the job.

We are using most of this funding to advance the scientific studies that will determine whether Yucca Mountain is technically suitable as the nation's first repository. Our tunnel boring machine is now operating, as we construct the underground Exploratory Studies Facility that is at the heart of site characterization. Our surface-

based testing program, augmented by laboratory analyses and sophisticated modeling techniques, continues to produce data that help us refine our understanding of the site's features.

Meanwhile, we have been consulting closely with stakeholders and oversight bodies to forge a working consensus about how our new approach to the evaluation of site suitability should be implemented. And we have taken steps to directly address the issue of expectations surrounding the 1998 waste-acceptance date—a long-standing issue that is growing in urgency as the date approaches, spent fuel inventories mount, and hopes of acquiring a volunteer host for an interim-storage facility fade. In May 1994 we published a Notice of Inquiry in the *Federal Register* soliciting comments on this matter. We are also preparing to respond in 1995 to congressional initiatives which address the waste-acceptance issue.

To ensure our readiness to accept and transport spent fuel, we have begun an environmental impact statement to support a decision whether to proceed with the acquisition of multi-purpose canisters for storage, transportation, and disposal of spent fuel. We believe this standardized system has the potential to minimize waste handling and promote efficiencies throughout the waste management system. We published a

Request for Proposal for design of the canisters in 1994 and will award a contract in 1995.

To strengthen management controls over the program, we have realigned our Headquarters structure and the Yucca Mountain Site Characterization Office. We have also flattened the organization by reducing the number of subordinate offices, changing the ratio of employees to supervisors from three to one, to approximately seven to one. And we have clarified contractor roles, reducing the number of direct program participants by over 40 percent, from 44 to 25.

But while our program approach has changed, our fundamental mission remains the same: to carry out the Federal commitment to safely dispose of spent nuclear fuel and high-level radioactive waste. We know that a great deal is riding on our efforts: Nuclear utilities are not alone in needing permanent disposal capacity; the Federal Government, too, needs the repository, for the permanent disposal of the high-level radioactive wastes from its nuclear weapons complex, and to support a leadership role in the international policy process concerning the custody of nuclear materials.

We are confident that, with the continued support and guidance of Congress, our new approach will enable us to capitalize on our program's strengths to meet these needs.

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

Summary

Fiscal Year 1994 – A Turnaround Year

A New Program Approach

Fiscal Year 1994 was a turnaround year for the Nation's Civilian Radioactive Waste Management Program. A new program approach, supported by Congress through substantially increased funding for Fiscal Year 1995, seeks to align program realities, program resources, and stakeholder expectations on a timetable that will get us to an important milestone in 1998: determination of whether or not the Yucca Mountain site is technically suitable for the nation's first deep geologic repository.

Over the long term, the proposal to develop a multi-purpose canister system would strengthen the waste management system by providing it with the capability of accepting, storing, transporting, and disposing of spent nuclear fuel in a standardized manner, with a minimum of waste handling. And, in the near term, this initiative would enable us to provide, by 1998, multi-purpose canisters that utilities could use for at-reactor dry storage of spent fuel. We are also addressing utilities' need for a sound basis for planning, by responding comments from them and from other parties on key waste-acceptance issues.

Our goal is an up-and-running waste management system—safe, efficient, and delivered on schedule and within budget—that utilities can depend on and in which the public can have confidence.

Characterizing the Yucca Mountain Site

Determining technical site suitability by the end of Fiscal Year 1998

Site characterization is centered on the scientific studies that will yield the data to support the evaluation of technical site suitability. It entails construction of an underground Exploratory Studies Facility that will include about 11 kilometers (6.8 miles) of tunnels and alcoves that will give scientists direct access to the host rock; surface-based testing to probe the physical nature of the site; laboratory tests to analyze the samples obtained from underground and surface testing; and the iterative use of data gathered from studies to develop models to predict how effectively the site will isolate waste over 10,000 years.

The program approach we proposed in 1994 will accelerate and streamline characterization of the Yucca Mountain site by focusing work on tasks essential to evaluating technical site suitability. If the site proves technically suitable, and the environmental impact statement and other considerations support selection of the site, the Secretary of Energy will send a site recommendation report to the President in 2000, submit a license application to the Nuclear Regulatory Commission in 2001, begin repository construction in 2004, and start repository operations in 2010. Studies not essential to the evaluation of technical site suitability, to development of a license application, or to cost-effective repository and waste package designs will be conducted in parallel with the licensing proceeding. These studies will produce additional data for more-detailed design of the repository and to confirm long-term predictions of repository performance. We will continue this confirmatory testing for as long as 100 years after repository loading has begun, a potential 50-year extension beyond the 50-year period stipulated by the Commission's regulations.

This approach not only gains us an earlier determination of technical site suitability; it reduces financial risk. Site characterization is by far the costliest component of the entire program; and, if the site proves unsuitable, an earlier conclusion permits us to terminate all studies sooner rather than many hundreds of millions of dollars later.

We are aware that this approach may carry some risk, in that we will be demonstrating compliance with Nuclear Regulatory Commission regulations using somewhat less data than envisioned in the Department's 1988 Site Characterization Plan. But we believe that by using a combination of conservatively bounded performance assessments and designing the repository to permit a much longer period of confirmatory testing, we can satisfy the Commission's requirements.

One of the most crucial and sensitive decisions we will make is how to evaluate site suitability and—if the site proves suitable—demonstrate regulatory compliance. If the Nuclear Regulatory Commission, oversight bodies, stakeholders, and Congress do not have confidence in the process

by which we conduct our evaluation, a finding of suitability may have little worth. We therefore began in Fiscal Year 1994 a process of close consultation designed to build understanding of and confidence in our approach. In March we briefed Congress on this matter; in May we consulted with stakeholders; and in August we published a *Federal Register* notice announcing the availability of a draft methodology elaborating our approach. We then met several times with stakeholders to consider their views. We believe that employing a peer review process managed by the National Academy of Sciences and providing for substantive stakeholder involvement in our evaluation of technical site suitability can build public confidence in our findings.

Advancing our understanding of the Yucca Mountain site

To implement the new approach to site evaluation, we prioritized and modified plans for the underground and surface-based studies we are conducting, to focus first on those data needed to evaluate the site's suitability and then on those needed for licensing. In April 1994 the first of 70 shipments containing the components of a tunnel boring machine was delivered to the site. By September this 7.6-meter (25-foot) diameter, state-of-practice, 700-ton machine had been assembled and was undergoing rigorous shake-down testing to evaluate its hydraulic and electrical components and its structural integrity. This machine is now excavating the underground Exploratory Studies Facility. Fiscal Year 1994 also saw completion of the first alcove constructed off the starter tunnel for the Exploratory Studies Facility and initiation of testing in the alcove.

For surface-based studies, we began planning to consolidate testing into fewer deep boreholes and to accelerate drilling, instrumenting, and testing by using more drill crews. We finished drilling two boreholes through the proposed repository horizon to provide stratigraphic data and data on rock properties for the Exploratory Studies Facility. Characterization of the unsaturated zone continued with borehole testing. Mapping continued in the Exploratory Studies Facility and on the surface of the site to character-

ize the distribution of geologic units and fractures, and fault connections. Field work, including mapping of trenches and surface outcrops, continued in support of studies of volcanic and seismic hazards.

Advancing licensing, design, and technical studies

In our consultations in Fiscal Year 1994 with the Nuclear Regulatory Commission to resolve complex topical issues related to licensing, we found that our views diverged at several points, and we strove to better conform our approaches to issue resolution. Our two staffs are now linked electronically to promote closer communication.

We continued to develop advanced conceptual designs for the repository and for the waste package that will be emplaced in the repository for permanent disposal, to better define design, total project cost, and procurement and construction schedules. We completed key studies that will contribute to the development of a thermal loading strategy—essentially, the determination of how “hot” the repository should be when it is loaded with heat-emitting spent fuel—a complex issue with significant, system-wide implications, including effects on repository and waste package design.

To leverage our resources by gaining access to other countries’ scientific expertise and their unique research facilities, we continued to pursue research and development work under cooperative, cost-sharing agreements with Sweden, Switzerland, and Canada, with results that directly advanced our site investigations and saved us time and money.

Mobilizing for Waste Acceptance, Storage, and Transportation

Addressing expectations about Federal acceptance of utilities’ spent fuel

As originally enacted, the Nuclear Waste Policy Act of 1982 optimistically set a 1998 date for the start of repository operations, and many utilities have maintained that the contracts the Department signed with them pursuant to the law legally bind us to start accepting their spent fuel in 1998. The Department’s preliminary view is that Congress never intended the Federal Government to accept waste in the absence of a licensed Federal facility constructed under the Act for storing or disposing of it. The absence of a date certain for

Cumulative spent fuel in dry storage by 2010

Federal waste acceptance has hampered the utilities’ ability to plan for the orderly management of their spent fuel inventories. In 1993 the National Association of Regulatory Utility Commissioners opened a more formal dialogue with the Department and stakeholders to move the issue forward. But in 1994, with spent fuel inventories mounting and no clear prospects for an interim storage facility, a number of utilities, States, and public utility commissions filed three lawsuits requesting relief from the Department’s unlikely ability to accept spent fuel in 1998.

To engage utilities and other stakeholders in a dialogue, Secretary O'Leary directed us to publish a Notice of Inquiry in the *Federal Register*. Published in May 1994, the notice invited comments on three issues: 1) whether the Department has a legal obligation to begin accepting spent fuel in 1998, 2) the need for a centralized interim storage facility, and 3) options for using the Nuclear Waste Fund to offset some of the costs utilities will incur by continuing to store spent fuel after 1998. As of October 5, 1994, more than 900 comments had been received. The comment period was extended to December 19, 1994, and approximately 200 additional comments were received. The Department's response to these comments will be published in the *Federal Register* late in the Spring of 1995.

Maintaining support for interim storage siting efforts

Despite continued efforts by the Nuclear Waste Negotiator, Fiscal Year 1994 saw no tangible progress toward a volunteered site for a Federal interim storage facility, and, in its Fiscal Year 1994 Energy and Water Development Appropriations Act, Congress withheld funding for Phase IIb grants for potential volunteer hosts.

We maintained support for the voluntary siting process and retained the capability of employing a Federal interim storage facility in the waste management system, should a site for one become available. The statutory authority for the Office of the Nuclear Waste Negotiator expired in January 1995.

During 1994 the Mescalero Apache Indian Tribe withdrew from the volunteer siting program and began discussions and planning with 33 utilities to reach an agreement to develop a private spent nuclear fuel storage facility on Mescalero lands in New Mexico.

Initiating the development of a multi-purpose canister system

In February 1994 Secretary O'Leary initiated a phased approach to development of a multi-purpose canister system which could both offer utilities temporary spent fuel storage relief and strengthen the capabilities of the Federal waste management system. She directed us to proceed with the design and certification of a multi-purpose canister system for storage, transportation, and disposal of spent fuel. If a decision is made to fabricate and deploy the system, the

schedule we developed would permit us to furnish these canisters to utilities for on-site storage of spent fuel beginning in 1998. The canisters would provide standardization and reduce waste handling throughout the system. A decision of fabrication and deployment would not be made until the designs for the canisters are reviewed by the Nuclear Regulatory Commission and until an environmental impact statement prepared under the National Environmental Policy Act is completed.

To carry out Secretary O'Leary's directive, we approved a conceptual

Multi-purpose canister system

design for a multi-purpose canister-based system and incorporated it into the program baseline. We then issued a Request for Proposal with performance specifications for design and certification. The system would include 75-ton and 125-ton canisters for rail shipment, transfer casks and transportation overpacks, and related equipment that, together, could serve most utilities. Utilities without rail access would be served by trucks carrying new, higher-capacity truck casks. The one or more vendors we select will submit the designs they develop to the Nuclear Regulatory Commission for certification.

We completed system studies that included examination of the impacts of multi-purpose canisters on the waste package and the repository design. On the basis of those studies, we issued a report evaluating the system concept. And we began to prepare for the scoping hearings for an environmental impact statement that will help us decide whether to pursue acquisition of the system.

Because acceptance of this initiative by the utilities and their regulators, oversight bodies, and stakeholders is essential for its success, we consulted with those parties in developing the concept and are continuing to do so as the environmental impact statement process and contract awards proceed. We also began to explore what we could learn through our international activities to advance the multi-purpose canister system initiative.

Preparing to accept defense waste

High-level radioactive waste from defense atomic energy activities is stored at sites throughout the Department's weapons complex and is destined for disposal in a repository. Fiscal Year 1994 saw closer coordination within the Department on the waste-acceptance criteria that will enable the waste management system to accept defense high-level radioactive wastes for disposal in a repository.

Developing transportation readiness

The transportation component of the waste management system will affect more members of the public and more jurisdictions than any other. Because of the visibility and sensitivity of this program component, in Fiscal Year 1994 we

continued extensive consultation with parties within the transportation industry and with Federal, State, and local agencies that regulate, or are likely to be affected by, transportation activities. In June we released a preliminary draft of a comprehensive plan to develop the transportation system. This plan incorporates relevant portions of previous draft planning documents we developed in close consultation with stakeholders. Among the many issues it addresses are routing, emergency notification, transportation risk management, and technical assistance and funding for training of public safety officials for routine shipping and emergency response. Many comments had been received by the October 1, 1994, due date. They are being addressed, and the plan will be revised to reflect their resolution.

We also participated in the Department's Transportation External Coordination Working Group, which is developing uniform, Department-wide policies to ensure safe shipment of radioactive materials. A further step was submitted to the Nuclear Regulatory Commission of safety analysis reports for advanced-technology truck casks. The designs must be certified by the Commission before we can procure the casks.

Strengthening Management Controls

Planning: reality-based, goal-directed

In the fall of 1993, at the direction of Secretary O'Leary, Dr. Daniel A. Dreyfus, the Director of the Office of Civilian Radioactive Waste Management (OCRWM), undertook a comprehensive assessment of the program. He sought the views of Congress and the Administration during deliberations on the Fiscal Year 1995 budget, and he consulted program stakeholders and Department of Energy management. The program's managers and staff then met over several months to assess the program and to formulate a viable strategy that could accommodate these diverse views. From these meetings and subsequent stakeholder feedback emerged a new, more flexible approach to carrying out the program's mission.

The assessment identified significant disparities among the program's plans and schedules, the

resources the program was actually receiving, the work it was actually doing, and stakeholder expectations for results. The new program approach is designed for sharper focus on interim milestones to provide near-term measures of progress, better integration of activities, clearer lines of responsibility and authority for program personnel, and more substantive participation of stakeholders. The new approach will enable us to make significant and measurable progress toward key objectives using the resources we can realistically expect to receive.

Because of the scope of changes encompassed by the new program approach, we developed a program plan to guide our work over the next five years. The plan provides the basis for cost, schedule, and technical baselines for the Yucca Mountain Site Characterization Project; the Waste Acceptance, Storage, and Transportation Project; and the Headquarters management center. We have provided the plan to oversight bodies, stakeholders, and the public.

Putting more resources into scientific studies

In recent years, the Nuclear Waste Technical Review Board urged us to devote more funding to scientific studies at Yucca Mountain. The reasons for past funding patterns were several. Chief among them was that, while the Nuclear Waste Fund consists of ratepayer, not taxpayer, dollars, its disbursements are controlled through the Federal budget process and congressional appropriations. This process resulted in funding at levels lower than our needs. Furthermore, OCRWM's budget must cover substantial nondiscretionary regulatory compliance, quality assurance, and other costs generated by statutory and regulatory mandates. Many of these costs cannot be significantly cut without jeopardizing the integrity of our work and our ability to obtain a license from the Nuclear Regulatory Commission if the Yucca Mountain site proves suitable.

Funding for the program in Fiscal Year 1994 was slightly less than that for Fiscal Year 1993 in constant dollars. However, we shifted Fiscal Year 1994 funds from infrastructure activities to scientific studies at the Yucca Mountain site, increasing funding for work that will support the

evaluation of technical site suitability by \$18 million, to approximately \$260 million.

Streamlining the organization

OCRWM's program spans three centers of activity: overall program management and integration, located in Washington, D.C.; the Waste Acceptance, Storage, and Transportation Project, also located in Washington, D.C.; and the Yucca Mountain Site Characterization Project, located in Las Vegas, Nevada.

While maintaining this configuration, we took measures to better define the functions of staffs in both locales and to integrate their operations. In March 1994 we reorganized the Yucca Mountain Site Characterization Project Office, formalizing and clarifying lines of responsibility and accountability so that the organization is task-oriented and focused on the science and technology efforts that will get us to an early determination of technical site suitability.

We flattened our organization by reducing the number of subordinate offices, thereby improving the ratio of employees to supervisors from three to one to approximately seven to one. To better manage the large number of program participants (including private-sector contractors, the U.S. Geological Survey, and the Department's National Laboratories), we clarified and consolidated contractor roles, reducing the number of direct program participants by over 40 percent, from 44 to 25. We also worked toward better integration of technical, cost, and schedule baselines.

An independent financial and management review of the program, focusing on the Yucca Mountain Site Characterization Project, was begun in Fiscal Year 1994 at the direction of Secretary O'Leary. When findings are presented in Fiscal Year 1995, they will be used to assess the effectiveness of the management changes we have made.

A proposed funding strategy

To fund the civilian portion of OCRWM's program, the Nuclear Waste Policy Act imposed a one-time fee for nuclear waste generated before 1982 and an ongoing fee on nuclear utilities of

1 mill per kilowatt-hour of electricity generated and sold, which is paid into the Nuclear Waste Fund. Although the Nuclear Waste Fund consists of ratepayer, not taxpayer, dollars, its disbursements are controlled through the Federal budget process. Through the end of Fiscal Year 1994 the Fund had accrued revenue of approximately \$10.8 billion, including interest, of which \$4.1 billion had been expended. In addition, Congress directly appropriates funding to cover costs associated with disposal of defense high-level radioactive waste.

In recognition of Congress's intent that the Civilian Radioactive Waste Management Program be self-financing, in 1994 the Administration asked Congress to provide an additional, mandatory appropriation from the Nuclear Waste Fund for Fiscal Year 1995. This would make a larger portion of annual utility fee income directly accessible to the program, providing us with the flexibility to direct funding where it is most needed. This also would ensure continuity of the studies and infrastructure vital to success, by protecting them from the uncertainties of the budget process while preserving congressional control.

Providing Strategic Technical Assistance Abroad

Because of the risks posed by international proliferation of nuclear materials, it is the policy of the United States to help non-nuclear weapon states develop waste management and disposal programs for spent fuel. Further, providing technical assistance may foster the sale of U.S. technology abroad. Accordingly, in Fiscal Year 1994, we met with representatives of China, Japan, Russia, and Thailand to provide them overviews of OCRWM's program. Under broad international agreements on energy technology, we participated in annual technical exchanges with Taiwan and South Korea. And we participated in the Industrial Partnering Program with

the Newly Independent States of the former Soviet Union to foster the conversion of weapons technology to non-weapons applications.

In Conclusion

The events of Fiscal Year 1994 made it a notable year in OCRWM's history. Highlights include formulation of a new program approach; intensive consultation with other parties to build confidence in that approach; the delivery, assembly, and initial testing of the tunnel boring machine that is now digging into Yucca Mountain; steps toward acquisition of a standardized multi-purpose canister system and planning for the accompanying environmental impact statement; and solicitation, through a *Federal Register* notice, of utilities' and other interested parties' recommendations toward resolving key waste-acceptance issues.

These and other activities contributed momentum to a program that has consequences for jurisdictions throughout the country. These jurisdictions are not only those in which high-level nuclear waste management facilities may be located, but also those in which spent fuel from commercial nuclear reactors and defense high-level radioactive wastes are now temporarily stored. Once a repository or an interim storage facility is operating, jurisdictions through which those wastes will be transported will be affected, as well.

Because OCRWM's program is so far-reaching, and by its nature controversial, our interactions with regulators, oversight bodies, and stakeholders are vitally important. Our ability to work together constructively will, to a significant extent, shape the results of the initiatives we undertook in Fiscal Year 1994 and determine whether, by implementing our new program approach, we can make the waste management system that Congress established as national policy a working reality.

Chapter One

Yucca Mountain Site Characterization

The Nuclear Waste Policy Act directs the Secretary of Energy to characterize the Yucca Mountain site in Nevada to determine whether it is suitable for a permanent repository for spent nuclear fuel and high-level radioactive waste. This effort, termed "site characterization," encompasses multidisciplinary, scientific investigations of the site's physical features. Additional studies provide information on socioeconomic and environmental conditions. Study of the site and the natural processes at work in the region is proceeding by way of extensive surface-based testing, supported by laboratory analyses of rock, soil, water, and gas samples. So that scientists can directly observe and test the underground features of the site, an ambitious program of exploration and studies is planned for a large, subterranean laboratory—the Exploratory Studies Facility.

With the data resulting from site characterization, scientists are constructing a three-dimensional, geologic model of the site and are modeling the natural processes occurring at the site that could affect its ability to isolate radioactive waste. Engineers are using this information to design a repository and waste package that, in conjunction with the site's natural features, could meet regulatory performance standards over a period of 10,000 years. The initial decision of whether the site is suitable for a repository will be made by OCRWM's Director.

In Fiscal Year 1994 OCRWM restructured its approach to site suitability evaluation, refocused and accelerated its surface-based testing program, and began excavating the Exploratory Studies Facility. While this major construction effort will not be completed until 1997, testing began in

View of Exploratory Studies Facility

1994 in a portion of the facility that has been excavated, and scientists continued to work close on the heels of the crew that is driving the tunnel boring machine deeper into the site.

A New Approach to Site Characterization

Restructuring our work

At the start of Fiscal Year 1994 the program was still pursuing the strategy set forth in its 1988 Site Characterization Plan. This strategy called for conducting, more or less simultaneously, all work necessary to prepare a license application and to evaluate the site's technical suitability, and for making that evaluation against the Department's siting guidelines only after all information had been accumulated from the site investigations.

But it was becoming increasingly apparent that this strategy was flawed: 1) It had no hope of being funded at levels required to maintain the project schedule; 2) it was not structured to provide ready measures of progress; and 3) if the site proved not to be technically suitable, resources would have been expended needlessly on studies that supported licensing but not the precondition of licensing—a determination that the site is, in fact, technically suitable.

Therefore, in Fiscal Year 1994 OCRWM carefully formulated a new strategy. It, too, relies on the siting guidelines, but it makes a crucial distinction among: 1) tests required to evaluate the site's technical suitability, 2) tests required to support licensing and design, and 3) tests required to confirm the safety of the repository before it is closed. This approach restructures the evaluation of technical site suitability as a step-wise process, conducted over four years, that will enable us to measure progress toward determining site suitability rather than waiting until the conclusion of site characterization. This will also enable us to demonstrate early progress—a factor crucial to the program's credibility.

This approach targets resources in the near term on the scientific investigations and engineering work needed to determine technical site suitability by the end of Fiscal Year 1998. And,

should the site be found suitable, this approach would preserve the schedule for submittal of a license application to the Nuclear Regulatory Commission in 2001, and for operation of the repository in 2010. It has the further benefit of preventing needless expenditures if the site proves unsuitable, and it is achievable within current law.

To meet these milestones, in Fiscal Year 1994 we reevaluated the phasing and scope of our scientific studies in terms of the importance of each study to the application of the siting guidelines. This assessment will continue as we acquire new information from testing and analyses. If the site proves technically suitable, our focus will shift to acquiring additional data and developing the analyses needed to prepare two key documents: the environmental impact statement that must accompany a recommendation to the President and the license application we will submit to the Nuclear Regulatory Commission. To acquire still more confidence in assessments of long-term performance, confirmatory testing will continue, as required by the Commission's regulations, after submittal of the license application and until the repository is closed. Repository design will permit waste retrieval for up to 100 years from the start of waste emplacement, a period twice as long as the 50-year retrieval period required by the Commission.

Building acceptance of our approach

For the new strategy to succeed, it must be accepted by OCRWM's regulators, oversight bodies, and stakeholders. In Fiscal Year 1994 we designed an open, step-wise process for evaluating the site's technical suitability that provides for substantive stakeholder involvement at key decision points, and we involved stakeholders in the design of that process, meeting with the State of Nevada and affected units of local government in October and December 1993 and in February and March 1994. In April 1994 we published a Notice of Inquiry in the *Federal Register* soliciting views on this proposed process for site evaluation, then held public meetings on the subject in May and August 1994. We published a notice in the *Federal Register* in August 1994 announcing the availability of a draft description of the technical site suitability evaluation process and inviting

public comment. We used the comments we received to shape the final process, which was presented in two public meetings in December 1994. It was approved by OCRWM's Director in that same month.

The step-wise process requires us to make interim evaluations of the technical suitability of the site using technical basis reports as inputs to assessments of how well the site meets each of the Department's siting guidelines. The technical basis reports will be independently peer-reviewed under the direction of the National Academy of Sciences. Stakeholders will be invited to nominate independent scientists to the review panels, to present technical issues to the panels for consideration, and to observe all public meetings of the panels. The Nuclear Regulatory Commission will also receive the technical basis reports and may choose to comment on them from a licensing perspective, although it will have ample opportunity to review this information within the context of licensing. Based on peer review findings, we will proceed with assessments against the Department's guidelines, or will conduct more tests and analyses, if they are needed.

We will publish draft guideline-compliance assessments in the *Federal Register* for public comment and discuss them at public workshops. Final assessments will include disposition of comments received. On the basis of the final assessments, OCRWM's Director will make final decisions regarding the formal findings required under the Department's siting guidelines.

Developing planning tools and issuing reports

The Program Plan for Fiscal Years 1995 through 2000

The Nuclear Waste Technical Review Board, the Nuclear Regulatory Commission, and other parties have expressed concern about how we will implement our new approach to site characterization and, in particular, about which scientific studies will be modified or deferred. To address these concerns, in Fiscal Year 1994 we began to develop a program plan. The three-volume plan, covering Fiscal Years 1995 through 2000, was released to the Nuclear Regulatory Commission and the public in December 1994.

Volume II of that plan sets forth the goals, activities, schedule milestones, and cost estimates for the Yucca Mountain Site Characterization Project for: 1) work that will support the evaluation of technical site suitability, 2) preparation of an environmental impact statement assessing the environmental and socioeconomic effects of a repository at the site, and 3) preparation of a multi-volume repository license application, thousands of pages in length, that demonstrates that the natural features of the site, together with the repository and waste package, will meet regulatory standards.

Volume II also addresses management functions, including interacting with external parties and ensuring that site characterization activities comply with applicable regulations. It focuses work initially on tests and analyses critical to evaluating the site's technical suitability and on key licensing issues. It presents clear measures of progress, with interim milestones and work products, and clarifies relationships among tasks, work products, and budgets.

Fiscal Year 1995 Project Technical Implementation Plan

While the program plan establishes our overall objectives for both the program and its projects, the Project Technical Implementation Plan for Fiscal Year 1995 is designed to serve as an internal management tool. Developed in Fiscal Year 1994, it is more detailed than the program plan and presents an integrated description of tasks, the rationale for the work supporting each major effort, and the priorities that govern that work. It defines the near-term progress we intend to make, identifies key milestones, and provides a basis for measuring progress toward long-range goals. It also serves as the basis for planning and initiating activities for Fiscal Year 1996.

We are using the technical implementation plan to both monitor progress and coordinate technical tasks. The process of updating the plan will ensure that the work necessary to advance our program approach has been appropriately defined and prioritized.

Specific site investigations proceed according to study plans accepted by the Nuclear Regulatory Commission. In Fiscal Year 1994, as part of our effort to refocus and streamline site characteriza-

Understanding Site Characterization

At the heart of a repository will be an extensive network of underground tunnels and drifts¹, at a depth averaging 305 meters (1,000 feet) below the surface of the earth, occupying an area that could range from many hundreds to several thousand mined acres, depending upon the final design of the facility. In the drifts, waste packages will be emplaced. Most waste will consist of spent fuel from civilian nuclear power plants; the remainder will be wastes from the Department's own defense-related and other activities. The natural and engineered barriers of the repository must isolate the radionuclides that may eventually be released from these wastes over an extended period of time, so they cannot harm human health or the environment.

The institutional path to an operating repository

Because the work of siting and developing a repository involves difficult technical issues and sensitive institutional concerns, Congress structured the nation's path to an operating repository as a chain of decisions to be made by the Secretary of Energy, the President, and the Nuclear Regulatory Commission, under the continuing oversight of Congress, affected units of government, and still other parties, including the public.

The first of those decisions came in 1985, when the President determined that, instead of building a separate repository for the Federal Government's own high-level radioactive wastes and spent fuel, those wastes would be disposed of in the civilian repository.

The second decision came in 1986, when the President approved the Yucca Mountain site as one of three sites recommended by the Secretary for site characterization. In the 1987 Amendments to the Nuclear Waste Policy Act, Congress directed the Secretary to characterize only the Yucca Mountain site in Nevada. If the Secretary finds that the Yucca Mountain site is suitable, the Secretary may recommend it to the President for development as a

repository. Accompanying any recommendation will be an environmental impact statement prepared through a process that provides for significant public involvement.

If the President approves the Secretary's recommendation, the President, in turn, will recommend the site to Congress. The State of Nevada may then disapprove the recommendation, in which case both houses of Congress would have to override the State's action if the repository is to be developed at the Yucca Mountain site. If the recommendation stands, the Secretary will submit an application to the Nuclear Regulatory Commission for authorization to construct the repository. If construction is authorized, and after sufficient construction has been completed to support operations, the Secretary will submit an application to the Commission for authorization to operate the repository. And once operating, the repository will be subject to the continuing oversight of the Commission, up to and including review by the Commission of the Department's application for authorization to permanently close the repository.

The technical path to a determination of site suitability

The question of whether the Yucca Mountain site will prove technically suitable for a repository will turn on data and analyses generated by OCRWM's site characterization program. This brief sketch of a few key issues illustrates the complex nature of site evaluations.

One important reason the site is believed to be potentially suitable is that the water table beneath it is extremely deep and lies below a thick zone of unsaturated rock (that is, the rock's pores are not filled with water). It is within this unsaturated zone that a repository could be housed. The particular rock at the Yucca Mountain site is "tuff," a compacted volcanic ash.

Inevitably, over the course of 10,000 years or longer, the waste package will degrade as a result of corrosion, and the waste form itself may undergo dissolution, eventually leading to the release of radionuclides. Scientists believe that the natural features of the site could partially isolate those

¹ A "tunnel" generally has an opening to the surface at each end; a "drift," which is a secondary passageway connected to one or more tunnels, generally does not.

radionuclides. The question of how well the waste package performs and how well the site would isolate the waste turns largely on the interplay among various factors: the heat emitted by radioactive waste as it decays, the characteristics of the rock within which the repository would be constructed, and the amount and rate of movement of water likely to be present.

At Yucca Mountain, an arid location, groundwater is believed to be the likeliest means by which radionuclides could be transported, and key questions are how long it would take for waste packages to be breached and how long it would take for water to transport radionuclides to the accessible environment. Scientists must therefore project how much water is likely to be present, by what routes it could travel, and how quickly it could travel—over the course of 10,000 years. They must also project how disruptive events like fault movement, volcanoes, and climate changes could affect the site, either by damaging waste packages directly or by creating conditions that accelerate corrosion and the transport of radionuclides.

A factor that further complicates the work of characterizing the site and that could affect its technical suitability is the presence of faults. Faults may provide routes along which water could transport radionuclides; they could affect the structural integrity of the repository; and future movements of the earth could damage the repository. Scientists have already extensively mapped faults at the site and will study them at close range from the underground Exploratory Studies Facility.

Another important variable is how the heat emitted by spent fuel might alter the distribution and behavior of nearby water and alter the chemical and structural nature of the adjacent rock. Because the emplacement of spent fuel will result in at least some local increase in temperature, the question arises: How hot should the repository be? A “hot” repository is expected to evaporate water and retard corrosion; it would increase uncertainty in predictions of how the natural system—specifically, groundwater flow—would perform over a very long time. Other questions must be answered, as well: What durable materials should we use for the waste

package? How much fuel should be placed in a single package? How close together should the packages be? How should they be positioned in the host rock? What must be the areal extent of the repository to accommodate them?

These questions, subsumed under the issue of “thermal loading,” may affect plans for acceptance of spent fuel and the operational characteristics of the repository. (For background on the system-wide effects of thermal loading, see OCRWM’s Fiscal Year 1993 Annual Report.)

Surface-based and underground scientific investigations, supported by laboratory analyses, are producing the data needed to resolve these issues. But to translate data from geological field studies and near-term tests into predictions covering 10,000 years requires a quantitative leap. That leap is made possible by the application of performance assessment, a technique that incorporates the data from field testing into mathematical models of natural processes to model conditions at the site and to determine, iteratively, what levels of certainty those models afford. For their models, scientists must establish the bases for bounding their assumptions about 1) the natural geologic processes at the site, 2) the contact of water with waste packages, 3) the degradation of the waste packages, the dissolution of the waste form, and the transport of radionuclides within the unsaturated rock, and 4) the dilution of radionuclide concentrations in the aquifer below the repository.

The work of resolving these issues is highly complex and the subject of intensive, multidisciplinary, international collaborations. Views diverge not only on major questions such as how hot the repository should be, but on the question of what tests are the right tests, how we can minimize the extent to which tests alter the very conditions we are trying to study, and when we have enough data to terminate each test.

These issues must be resolved in a manner that is cost-effective, that keeps the program on schedule, and that earns the confidence of oversight, regulatory, and other parties, and the general public.

tion activities, we began to assess how we could consolidate work scopes in study plans. For example, we were able to consolidate into one study five planned studies of the effects of tectonic processes and events. This enabled us to eliminate duplication of effort and to reduce the administrative burden of developing the additional plans. For those surface-based studies for which plans have been developed, we began planning to consolidate testing into fewer deep boreholes, and to accelerate drilling, instrumenting, and testing by using more drill crews. These assessments continue, and the results will be used in future revisions to the technical implementation plan and program plan.

Designing and Constructing the Exploratory Studies Facility

The Exploratory Studies Facility is designed to give scientists access to site features that would affect repository design and performance. It will house important thermal, mechanical, and hydrologic tests, and it will provide horizontal access to vertical faults and fractures that cannot be ad-

equately characterized by means of vertical boreholes. The data gathered will contribute both to the evaluation of the site's technical suitability and to the design of the repository and waste package.

Just as important, excavations and underground investigations could identify a condition that could disqualify the site from consideration for a repository.

Fiscal Year 1994 saw dramatic progress in design and construction of the facility.

Designing the Exploratory Studies Facility

As depicted in the Figure below, the Exploratory Studies Facility will essentially consist of a U-shaped tunnel loop that will access the Topopah Spring geologic unit and a second tunnel excavated below the Topopah Spring unit that will access the Calico Hills geologic unit. The proposed repository would be situated within the Topopah Spring unit, and the Calico Hills formation would provide a geochemical barrier to radionuclide migration.

Surface facilities would occupy 28 hectares (70 acres), and the facility will descend to a depth

Exploratory Studies Facility design

of 305 meters (1,000 feet). As part of our efforts to focus site characterization on information we need to evaluate site suitability, in Fiscal Year 1994 we reduced the extent of the Exploratory Studies Facility from the 25.6 kilometers (15.9 miles) of ramps and horizontal tunnels originally planned to about 11 kilometers (6.8 miles) of ramps and horizontal tunnels. Those ramps and tunnels will be excavated by a state-of-practice tunnel boring machine.

The tunnel boring machine at the face of Yucca Mountain

Off the main horizontal tunnel, which will be connected to the surface by ramps at its north and south portals, about 40 alcoves, totalling 3.3 kilometers (2 miles) of drifts will be excavated, using conventional methods. The alcoves will provide access to fault zones and will be used to conduct tests. To reach the Calico Hills unit below the Topopah Spring level, an additional 7.5 kilometers (4.6) miles of ramps and horizontal tunnels will be excavated by a smaller-diameter tunnel boring machine.

To expedite the work of designing the facility, it has been organized under 10 "design packages," each of which governs a segment of the facility. Preparation of the packages is phased to support the schedule for actual construction and, upon completion, designs are being incorporated into the program's technical baseline. The baseline formally documents the technical requirements of the waste management system. (Program baselines are discussed in Chapter 3.)

The Tunnel Boring Machine

The tunnel boring machine, similar to the machine used to excavate the "Chunnel" between France and England, uses the latest technology in a form custom-fabricated to our specifications. For our

purposes, it is superior to conventional drill and blast technology because it minimizes disturbance of the site, which we want to study in as undisturbed a condition as possible. Costing \$16 million, weighing 720 tons, and drawing 3,800 horsepower, it is a complex train containing rock-cutting and removal equipment that will

excavate a tunnel 7.6 meters (25 feet) in diameter, at an estimated maximum rate of 5.3 meters (18 feet) per hour. When completely assembled in Fiscal Year 1995, the train will be longer than a football field (about 140 meters, or 460 feet).

The first car in the train contains a cutter head with 48 discs, each about 0.5 meters (17 inches) in diameter, that pulverize rock, and various shields, rock drills, an operator control cab, and other support equipment. The remainder of the train will provide a platform for other activities including geologic mapping; and for construction-monitoring instruments, rock bolts, pre-cast concrete floor segments that will provide a flat base in the tunnel for rail lines, and electric power equipment; storage areas; and various support facilities for operators.

In Fiscal Year 1994 we completed the design package for the tunnel boring machine launch chamber in the starter tunnel and portions of the design package for the north ramp excavation that supported start-up of the tunnel boring machine and test excavations. We also completed the design package required to excavate the north ramp of the facility from the surface to the Topopah Spring level, and portions of the North Portal Site Preparation and Surface Facilities Package. The latter package includes the change house building (which provides lockers, first-aid, and other support for personnel), shop building, sanitary sewer system, water and power distribution, subsurface waste-water system, compressed air system, stand-by power, site lighting, and electrical grounding. Design and review of the remaining surface facilities will be completed in Fiscal Year 1995. We initiated the design of a portion of the Topopah Spring-level main tunnel late in Fiscal Year 1994.

While a repository constructed at the site would be many times larger than the Exploratory Studies Facility, it would incorporate that facility's ramps and main tunnel. Therefore, the Exploratory Studies Facility must be designed to accommodate various underground repository layouts and transportation concepts. In Fiscal Year 1994 we incorporated an enhanced layout for the Exploratory Studies Facility into the program's baseline design. By limiting tunnel grades to accommodate the rail transport that may be required for large waste packages, the new layout also permits scientists easier access to a major fault system, the Ghost Dance Fault, and it configures the main tunnel and emplacement drifts so they will not cross the fault.

Launching the tunnel boring machine

We accepted the first of what would be 70 truck shipments of the unassembled tunnel boring machine from Construction and Tunneling Services, Inc. of Kent, Washington, on March 29, 1994. By early August, we had finished assembling the forward part of the machine and had begun initial testing of hydraulic systems and preparations to move the machine into the launch chamber. After we moved the machine to the tunnel face, we hooked up its utilities and checked it against the manufacturer's field check-

list. Testing began in September; shakedown operations in November. Adjustments were made to various operating systems such as grippers and laser guidance, and operators were trained and tested. To begin excavation, only the tunnel boring machine itself was placed within the launch chamber. After the initial test phase, the machine advanced 30.7 meters (97 feet) during shakedown operations, at which point operations were halted to attach the remaining cars of the train. The mapping platform was received, assembled, and installed in December 1994, and shakedown operations resumed that same month.

For the initial 305 meters (1,000 feet) of excavation, we will use muck-haulage cars and locomotives to remove muck (rock cuttings); then a conveyor system will be installed for this purpose. We initiated procurement of the conveyor system in Fiscal Year 1994 and expect delivery during the second half of Fiscal Year 1995.

Constructing the Exploratory Studies Facility

Excavation of the 60-meter (200-foot)-long starter tunnel from which the tunnel boring machine was launched was completed using conventional drill and blast technology, and, with start-up of the tunnel boring machine, construction of the Exploratory Studies Facility was under way. Excavation of the first alcove, using conventional blast and drill methods, was completed in February 1994. The alcove was excavated perpendicular to and north of the starter tunnel, extending 34 meters (113 feet) from the centerline of the tunnel. Geochemical tests were begun in it, by means of boreholes drilled horizontally into the alcove walls.

In Fiscal Year 1994 a water line from a borehole to the booster pump station was excavated and installed; a power line to the north portal substation was completed; and the concrete batch plant was constructed, along with an adjacent precast yard to support construction at the north portal pad. The first floor segments for the tunnel were cast late in Fiscal Year 1994. We also installed the water and sewer systems on the north portal pad, constructed a muck-dumping facility, and installed rail from the starter tunnel to the shop and storage yard areas.

Conducting Surface-Based Testing

OCRWM's surface-based testing program encompasses: 1) drilling and well-monitoring programs to evaluate the Yucca Mountain site's geology, geochemistry, and hydrology, 2) surface excavations (trenching) to evaluate seismic hazards from previous geologic disturbances and previous volcanic activity, and 3) geophysical techniques for evaluating subsurface rock properties and the distribution of lithologic units and fractures. Surface-based testing also includes the evaluation of modern regional and paleoclimatic conditions by means of core samples from drilling, pack rat middens, and soil-mapping techniques.

While testing is focused on the Yucca Mountain site, studies are also under way to help us understand physical processes at work on a regional scale.

Highlights of Fiscal Year 1994 activities are presented below; more-detailed information about the site characterization project can be found in OCRWM's semi-annual progress reports to the Nuclear Regulatory Commission and the State of Nevada.

Hydrologic evaluations

For the Yucca Mountain site to be determined suitable for a geologic repository, its geohydrologic setting must be compatible with waste containment and isolation. Several conditions at the site bear on this issue. During Fiscal Year 1994 we continued to gather data on three of these conditions: pneumatic pathways, perched water, and a large hydraulic gradient.

Pneumatic pathways are the pathways through which air naturally flows in and out of the mountain—by which “the mountain breathes.” Because radionuclides could be transported via these pathways, we must characterize them. We do this by drilling boreholes to measure air flow. In Fiscal Year 1994 we pumped air into boreholes to conduct air permeability tests, which help determine how fractures may connect to form routes by which radionuclides could be transported. To help evaluate the exchange of air between the surface and subsurface of the site, we measured temperatures, air pressure, and humidity in boreholes.

To measure water movement through the unsaturated zone, we monitored the starter tunnel and test alcove for perched (standing, not flowing) water; we found none.

Perched water is a localized area of saturation in an unsaturated zone. We did, however, encounter perched water in three boreholes.

While drilling borehole UZ-14, which is located in the unsaturated zone along the extension of the north ramp of the Exploratory Studies Facility, we encountered perched water above the Topopah Spring geologic unit. Perched water was also encountered below the Topopah unit in two nearby boreholes. Our assumption is that south to southwest-erly lateral flow is a more likely mechanism than vertical percolation for producing the perched water we found.

Locations of boreholes at Exploratory Studies Facility

The water table appears to be higher on the northern end of Yucca Mountain than elsewhere. Drawing on hydrologic test data and water-level measurements from a series of boreholes, we continued to characterize this phenomenon, known as the "large hydraulic gradient," northwest of Yucca Mountain to determine its origin. Understanding the gradient is important to predicting how it might change in future climates and thus affect pathways for water and gas transport of radionuclides.

Systematic drilling program

The Systematic Drilling Program is designed to obtain core samples from systematically distributed borehole locations that will yield data from within the repository block. The data will help scientists create the three-dimensional, geologic model of the site and will help engineers design the repository. In pursuit of this information, in Fiscal Year 1994 we cored two drill holes along the main tunnel of the Exploratory Studies Facility. The first, drilled to our target depth of 678 meters (2,223 feet), penetrated approximately 107 meters (350 feet) into the saturated zone. This borehole is located along what will be the main drift of the Exploratory Studies Facility, south of the north ramp. We encountered perched water at about 412 meters (1,353 feet) and suspended drilling at 454 meters (1,489 feet) because of a continuing inflow of water. By lowering a video camera down the borehole, we were able to see water emerging from a fracture near a depth of 412 meters (1,350 feet). Drilling resumed, and we encountered water again at about 549 meters (1,800 feet), the depth of regional groundwater table levels.

The second drill hole reached a depth of 438 meters (1,435 feet), well below the intended depth of the Exploratory Studies Facility main test level, and deep enough to provide data for immediate design requirements. Drilling was suspended until mid-Fiscal Year 1995, when new, double-wall drill pipe will arrive. We completed construction of the drill pad for another drill hole in August 1994 and moved the drill rig to it in September. Drilling began early in Fiscal Year 1995.

Newly acquired borehole data and stratigraphic data were compiled and incorporated into

Preparations for seismic testing

the software database that will be used to generate a three-dimensional model of the underlying geological structural units of the site.

Seismic reflection studies

Seismic reflection methods are used to characterize shallow, intermediate, and deep earth structures by means of seismic waves produced by small explosions or other energy sources. The waves reflect off subsurface rock layers, generating an image of the area that includes the location of faults and changes in rock types. The resulting data will be analyzed and combined with test results from other studies to provide a critical data set for evaluating faults and other subsurface geologic features at and near Yucca Mountain.

Twenty-four shallow boreholes will be drilled along two intersecting lines to obtain seismic reflections along a northwest-southwest and northwest-southeast orientation. We completed the first borehole in August 1994, and two more by the end of the fiscal year. The remainder

were completed in the fall of 1994, and data were gathered during December 1994. Recent advances in the technique enable us to generate data that increase our understanding of the site's subsurface geology.

Tectonic evaluations

To determine the risks posed by possible earthquakes, we are identifying and evaluating faults. Several tests conducted in Fiscal Year 1994 yielded information that helps us better understand the pattern of faulting. We continued developing geologic maps of the Ghost Dance and Sundance Faults. We evaluated slip rates on several faults at the site and estimated recurrence intervals for earthquakes on those faults. During Fiscal Year 1996 these data will be incorporated into an analysis of the probability of seismic hazards at the site.

A vertical seismic profile developed at a depth of 305 meters (1,000 feet) shows that the Ghost Dance Fault is a system of faults in a zone at least several hundred feet wide that extends to a depth of at least 305 meters (1,000 feet). The Exploratory Studies Facility will permit us to study these faults more closely.

Thermal tests

Systems studies to resolve the issue of how "hot" the repository should be are discussed in Chapter 3. To advance these studies, we continued to develop and refine methods for characterizing environmental responses to waste emplaced in the repository and, in particular, to the heat that waste will emit. In Fiscal Year 1994 we prepared for a "heater" test in a block of rock cut from rock similar to that within which the repository would be constructed. Into a block approximately 10 feet on each side, we drilled boreholes for testing permeability, making geophysical measurements of moisture, and obtaining cores to establish baseline conditions. We have insulated the rock from the environment to maintain it in a stable condition. Late in Fiscal Year 1995 we will install heaters inside the rock to determine how the rock might respond to the heat emitted by emplaced waste.

This prototype testing will be used for planning the thermal tests that will be conducted inside the Exploratory Studies Facility. Those tests, in turn,

will be very important for analyzing how thermal, mechanical, and chemical processes operate together in the host rock under thermal loading.

Other findings

Investigations of geophysical and geochemical properties of the site, and of climatology, continued. Geochemical studies advanced our understanding of chemical retardation of radionuclides, increasing confidence in our models. We refined the site-scale model of groundwater transport by including repository heating simulations in the mathematical model. Most of the work needed to assess the transport of neptunium (a radionuclide of concern in meeting regulatory standards for repository performance) has been completed. We also validated our regional climate modeling code and performed analyses that demonstrate reasonable agreement between model results and the present-day climate.

Performance Assessment and Design

Assessing repository performance

At the heart of evaluations of the site's suitability, and of licensing, is the quantitative discipline termed performance assessment, which employs data from geological field studies and from relatively short-term tests to predict how the natural and engineered barriers of a repository system will perform over thousands of years. Performance assessments are conducted for the entire system, as well as for subsystem components, for both the preclosure and postclosure phases of repository operation. Only if there is sufficient assurance that predicted performance will meet the criteria of the Department's siting guidelines and the Nuclear Regulatory Commission's regulations will a repository be licensed. Determining what models to use for these predictions, and how much confidence can be placed in them, is a major component of the site characterization project and the focus of international efforts in which OCRWM participates.

But performance assessment is not reserved for formal calculations. It is also a working tool that supports the development of alternative

designs for the repository and waste package, and that guides field investigations, indicating where we need more data to reduce uncertainties and when we have enough to terminate testing.

During Fiscal Year 1994 OCRWM continued to develop performance assessment models to address specific issues, most notably, an approach to calculating groundwater travel time. We presented this approach to the Nuclear Waste Technical Review Board's Panel on Hydrogeology and Geochemistry in September 1994. While the panel appeared receptive to the approach, it has not yet officially commented on it. We later submitted a written description to Nuclear Regulatory Commission staff and met with them to discuss their concerns. We are now working toward an approach that is more acceptable to them.

If a repository is constructed at the Yucca Mountain site, the Exploratory Studies Facility will be incorporated into it. And while the repository will be far larger than the Exploratory Studies Facility, the features of the latter would become part of the repository and might affect the health and safety of workers and the public. We therefore performed an assessment of the features of the Exploratory Studies Facility, using a risk-based approach to quantify the probabilities and the consequences of credible accidents and other scenarios, and the radiological exposures that could result. The results will improve repository design.

A critical ongoing activity is the validation and verification of calculational models using data from both laboratory and field studies. This work supports refinement of codes in an iterative process that provides defensible estimates of site performance based on available data and conservative assumptions.

Total system performance assessment is the quantitative prediction of how well the repository's natural and engineered barriers will isolate waste, given specific events and processes that may affect system performance. In March 1994 OCRWM published *Total System Performance Assessment - 1993*, the latest biennial report on the subject. The report presents the objectives of, our approach to, assumptions about, and results of the assessment.

Our ability to model performance continues to improve. For example, in this report we were able to include more-detailed predictions of radionuclide releases from various conceptual models of waste package degradation. We presented this information to the Nuclear Waste Technical Review Board and the Nuclear Regulatory Commission staffs for their review. They accepted our general approach and offered suggestions for more-detailed models.

We continued to define frameworks for integrating field and laboratory testing with modelling of natural processes for performance assessments. Laboratory and field experiments are providing useful and important information on aqueous flow through fractures, the effects of scaling data upward from small samples to the site-wide model, and site geochemistry. Integration will also more closely link total system performance assessment iterations and ongoing site characterization activities, indicating what kinds of data we need and when we need them.

Program participants who are expert in performance assessment participated in a number of international forums related to geologic disposal, to share and to gather information. These activities are discussed in more detail in the international programs section of this chapter.

Designing the waste package and the repository

An application for a license to construct a repository must present detailed designs for the repository and the waste package. OCRWM is developing advanced conceptual designs in order to better define design, total project cost, and procurement and construction schedules. The advanced conceptual design for the waste package is scheduled for completion in late Fiscal Year 1995; for the repository, in Fiscal Year 1996.

In Fiscal Year 1994 we issued the first in a series of three summary reports documenting work on advanced conceptual designs, the *Initial Summary Report for Repository/Waste Package Advanced Conceptual Design*. An interim summary report and a final summary report are planned for Fiscal Years 1996 and 1997, respectively.

As described in other chapters of this Annual Report, work on waste package and repository design was integrated with design of the multi-purpose canister system.

Designing the waste package

Waste emplaced in the repository will be contained in waste packages fabricated to exacting standards and intended to serve as the principal engineered barrier to radionuclide migration. OCRWM's goal is to develop a robust waste package that has a mean lifetime well in excess of 1,000 years and that will be compatible with the multi-purpose canisters we propose to use for the storage, transport, and disposal of spent fuel. The waste package would be fabricated of two or more materials having different, but complementary, corrosion-resistant properties.

The work of designing the waste package includes evaluating alternative design concepts; mechanical and thermal requirements; and materials testing, including long-term corrosion tests. For waste package design, the Fiscal Year 1994 report cited above documents studies and evaluations of such key concepts as multiple barriers, waste configuration options, multiple types of spent fuel, spent fuel cladding life, thermal responses of waste packages and multi-purpose canisters, and performance assessment. Fiscal Year 1994 evaluations of alternative design concepts and the development of design features provided valuable input to other work. For example, as mentioned above, waste package analysis and repository design indicated that the slope of ramps into the Exploratory Studies Facility should be limited to accommodate rail transport of large waste packages.

Designing the repository

Work on repository design has been constrained because we have allocated limited resources to higher priorities—primarily, work that supports evaluation of site suitability. Because the Exploratory Studies Facility would have to be integrated into a repository, the work of designing the repository and the Exploratory Studies Facility must be coordinated. To support evaluation and integration of these two designs, we conducted analyses to define areas within the repository block best-suited for waste emplacement. We also continued studies of thermal loading, as described in Chapter 3.

Subsurface repository design focused on key issues that could affect the total amount of waste to be emplaced. Because we propose to use waste packages with large disposal overpacks to accommodate large multi-purpose canisters, for ease of handling we plan to emplace the waste packages in drifts off the tunnels rather than in smaller boreholes. Because the selection of large waste packages emplaced in drifts affects other design features, we evaluated waste-handling procedures and equipment, spatial configuration (how the area within the repository block can best be used), service utilities including ventilation, and interfaces between the repository and storage and transportation functions.

Preparing for Licensing

To construct, operate, and permanently close a repository, we must receive approvals from the Nuclear Regulatory Commission in the form of authorization to construct the repository, a license to operate the repository, and a subsequent license amendment to close the repository. OCRWM's new program approach includes a more incremental approach to licensing. We will be using somewhat more limited data in the license application that supports construction authorization, but we will subject the data to appropriately conservative or bounding analyses in making long-term projections of repository performance.

If construction is authorized, OCRWM will conduct the performance confirmation testing required by the Commission's regulations and will conduct any further studies that the Commission requires or OCRWM proposes, if they are needed to resolve issues that arise during licensing. The additional data acquired will be used to refine bounding analyses and to develop more cost-effective repository and waste package designs. We will continue to sequence site testing and repository and waste package design so that testing and analysis continue to support design. This testing will continue through the construction and operation of the repository until its closure, to confirm its safe operation.

Because the Department's siting guidelines and the Commission's regulations are necessarily

similar, preparations for licensing build directly on evaluations of the site's technical suitability.

Prelicensing interactions

Only if the Yucca Mountain site is determined to be suitable for a repository and approved by the President will we apply for a license. However, OCRWM began some years ago to carefully prepare for licensing. Not only has the Department never been a party to a licensing process, that process will be the first of its kind and is likely to be the most complex that the Commission has ever managed, involving potentially difficult technical issues and millions of pages of documentation.

To make the licensing process more efficient, we continued in Fiscal Year 1994 to work informally to align the expectations of the Department and of the Commission by identifying and clarifying technical and regulatory issues. To obtain guidance and comment from the Commission on the many issues raised by site characterization, we continued to rely upon an issue resolution process. As part of this process, we prepare annotated outlines to structure the development of the license application, following the guidance provided in the Commission's draft Format and Content Regulatory Guide. As site characterization progresses, we update these iterative and evolving annotated outlines and the Commission reviews them. We also develop topical reports on selected issues which, if accepted by the Commission's staff, can be referenced in the annotated outlines and subsequent license application.

In November 1993 OCRWM submitted Revision 3 of the license application annotated outline. The outline contained an updated description of the site and summarized and referenced our topical report on erosion. We plan to submit the next iteration in Fiscal Year 1995. It will contain a draft licensing strategy for our new program approach and will be issued as a Department document for the first time.

During Fiscal Year 1994 we interacted with the Commission on several key licensing issues:

- Substantially complete containment. We must demonstrate that the repository will substantially contain wastes for a period of 300 to 1,000
- years after it is closed. To meet this regulatory standard, we proposed a new performance-goal-based approach that would employ a waste package designed to have a mean lifetime well in excess of 1,000 years, with a failure rate of less than 1 percent of containers in the first 1,000 years. Although the Commission's staff has generally agreed with our approach, we held a Technical Exchange in December 1994 to discuss design criteria for long-term waste package performance. While the Commission reiterated its agreement that our approach is reasonable, it expects us to provide reasonable assurance that our new performance goal will limit the radionuclides released to a small fraction of the total inventory present.
- Seismic hazards. We prepared the first topical report on a methodology to assess fault displacement and vibratory ground motion hazards and submitted it to the Commission staff; they have accepted it for review. We also prepared the second annotated outline for a topical report on seismic design and are now holding discussions with the Commission staff about the terms of their acceptance of the proposed subject matter of this report for review.
- Extreme erosion. In response to questions from the Commission about our topical report on this subject, we are preparing a 100-page submittal presenting a broader discussion that will demonstrate the absence of extreme erosion at the site.
- Groundwater travel time. We presented a new approach to the crucial problem of calculating groundwater travel time. While Commission staff found our approach technically sound, they want more information about our methodology for analyzing the level of uncertainty associated with our calculation. We are working jointly to clarify the interpretation of the regulatory standard.

As required by law, the Commission reviewed the comprehensive Site Characterization Plan we issued in 1988, and it has been reviewing the study plans we have developed pursuant to that plan. As of the end of Calendar Year 1994, it had accepted 56 study plans.

Both the Department's own evaluation of site suitability and its demonstration of compliance

with the Commission's overall system performance objective include assessing compliance with repository disposal standards promulgated by the Environmental Protection Agency. In the Energy Policy Act of 1992, Congress declared that the standard for radioactive waste disposal does not apply to the Yucca Mountain site, and it directed the Environmental Protection Agency to develop a new one. The revision is to reflect recommendations from the National Academy of Sciences on whether a health-based standard—that is, a standard based on radiation doses to individual members of the public resulting from releases to the accessible environment—will provide reasonable protection of health and safety. The old standard for long-term (10,000 years) protection was based on measures of releases of radioactivity rather than measures of doses to individuals. We expect that the new standard will be available by the time we are ready to evaluate the site's suitability and that conforming changes to the Nuclear Regulatory Commission's regulations will be complete by the date we plan to submit a license application if the site is found suitable.

Developing the Licensing Support System

The Commission and the Department are coordinating efforts to define the functional and technical requirements for an electronic technology-based Licensing Support System (LSS) intended to simplify the task of managing the huge quantities of data involved in the licensing proceeding. A third party, yet to be determined, will operate the system under the oversight of the Commission's LSS Administrator.

During Fiscal Year 1994, with the Commission's agreement, we assumed lead responsibility for designing the system and for procuring the computer hardware and loading data into the system. We chartered a working group to re-examine the fundamental requirements for an LSS to ensure that it is compatible with our new program approach. The group will also ensure that the design of the LSS incorporates new and emerging technologies that can make the system even more useful, enhance its performance, reduce its cost, and accelerate its development. Throughout the year, we worked with the Commission's LSS Administrator and the Advi-

sory Review Panel on the Licensing Support System to keep them informed of the efforts of the working group. The panel includes representatives from the Department, the Commission, and stakeholders. Our working group's report, now under internal review, will be made available to the public in Fiscal Year 1995.

Reporting our progress

As required by the Nuclear Waste Policy Act, OCRWM submits progress reports on site characterization to the Nuclear Regulatory Commission and the State of Nevada twice a year. Each report summarizes site characterization work begun, in progress, and completed during the reporting period; documents changes to our plans; and cites technical reports and research products published. During Fiscal Year 1994, we issued a report for April 1, 1993 - September 30, 1993 (Report 9) and a report for October 1, 1993 - March 31, 1994 (Report 10). Report 11, covering the period April 1, 1994 - September 30, 1994, was published in March 1995. Progress Reports 10 and 11 discuss the development and implementation of the new program approach.

Independent Oversight: Interactions with the Nuclear Waste Technical Review Board

In 1987 Congress created the Nuclear Waste Technical Review Board to exercise independent oversight of the scientific and technical aspects of OCRWM's program. Board members, among the nation's foremost scientists and engineers, are nominated by the National Academy of Sciences and appointed by the President. To facilitate its review, the Board is divided into seven panels that focus on specific areas.

The Board holds public meetings with program participants, representatives from the Nuclear Regulatory Commission, the National Laboratories, other Federal agencies, the State of Nevada, affected units of local government, and other invited guests. At these meetings, the Board gathers the information from which it formulates the conclusions and recommendations presented

in its formal reports to Congress and the Secretary of Energy. These meetings constitute an open—and important—forum in which the program's stakeholders can observe and contribute to the technical evaluation of OCRWM's program. During Fiscal Year 1994, the Board held four formal meetings:

- In October 1993 OCRWM staff reported to the Board on progress in the testing program and engaged in detailed discussions of the drilling program and the integration of surface-based and sub-surface testing at the Yucca Mountain site.
- In January 1994 the report of the Secretary of Energy's Advisory Board on Public Trust and Confidence and the report of OCRWM's Task Force on Alternative Program Strategy were the subject of the meeting, which also provided the first opportunity for Dr. Daniel Dreyfus, OCRWM's Director, to present his plans and goals for the program to the Board. OCRWM staff presented the results of the Total System Performance Assessment completed during Fiscal Year 1993, as well.
- In April 1994 OCRWM staff presented updates on the proposed program approach, construction of the Exploratory Studies Facility, repository and waste package design, and studies of the unsaturated zone at the Yucca Mountain site.
- In July 1994 the Board discussed OCRWM's transportation program and heard from representatives of the Department of Transportation, the American Association of Railroads, and program participants. OCRWM staff discussed how radionuclides might be transported through the natural barriers of a repository.

The Board also held a number of panel meetings and workshops during the year:

- In November 1993 OCRWM staff reported on multi-purpose canister design and integration to a joint meeting of the Panels on the Engineered Barrier System, and Transportation and Systems. Representatives of the Nuclear Regulatory Commission, the National Association of Regulatory Utility Commissioners, State and local governments, and public interest groups participated.
- In March 1994 OCRWM staff presented an approach to probabilistic risk assessment of volcanic and seismic hazards to the Board's Panel on Structural Geology and Geoengineering. Expert consultants and representatives from the Nuclear Regulatory Commission and the State of Nevada also participated.
- In March 1994 the Panel on the Engineered Barrier System reviewed OCRWM's work to develop the waste package, including design and materials and corrosion testing.
- In March 1994 representatives from OCRWM's Yucca Mountain Site Characterization Office discussed the requirements for the environmental impact statement for the repository with the Board's Panel on the Environment and Public Health. Other participants included the Department of Energy's Office of General Counsel, the Council on Environmental Quality, and the State of Nevada.
- In June 1994 the Panel on Structural Geology and Geoengineering reviewed the status of design and construction of the Exploratory Studies Facility in light of OCRWM's proposed program approach.
- In September 1994 the Panel on Hydrogeology and Geochemistry discussed how groundwater travel time should be calculated.

The conclusions and recommendations that resulted from these panel discussions were presented in the Board's most recent annual report, issued in March 1995.

During Fiscal Year 1994 the Board issued three reports:

- *The Report to the U.S. Congress and the U.S. Secretary of Energy on Underground Exploration and Testing at Yucca Mountain*, October 1993, addressed design and construction of the Exploratory Studies Facility, how the facility could be integrated into the testing program, and management of these activities. In its April 1994 response, the Department stated that it would be considering the Board's detailed recommendations as each relevant construction

package was being developed. The Department rejected the Board's recommendation for an off-site thermal testing facility, for budgetary reasons. The Department acknowledged the Board's concerns about project management, noting that many of them were already being addressed, and that they would be further examined by the Secretary's independent financial and management review of the Yucca Mountain Site Characterization Office. The Board is likely to gauge the effectiveness of the Department's actions in further reports.

- The *Letter Report to Congress and the Secretary of Energy*, issued in February 1994, reiterated the Board's recommendation for an independent review of OCRWM that it had made in its *Special Report* of March 1993. The Board also urged OCRWM to maintain the momentum it had gained in its site characterization program and involve stakeholders more actively in decision-making. In its September 1994 response, the Department noted that a new management team had reorganized both Headquarters and field elements and had restructured contractor support. The Department also agreed to consider the need for wider management review after the effectiveness of these initial steps had been evaluated, and it concurred with the recommendations concerning momentum and stakeholder involvement.
- The Board's tenth report to Congress and the Secretary, covering the period January to December 1993 and issued in May 1994, summarized the Board's activities during Calendar Year 1993 and included 22 specific technical recommendations on a variety of topics. OCRWM reviewed them and issued its response in December 1994.

Overall, many of the Board's comments and recommendations have led to significant changes in OCRWM's program and have helped shape the new program approach.

Working with Affected Units of Government

The Nuclear Waste Policy Act explicitly authorizes the State of Nevada to obtain information

about and exercise oversight of OCRWM's site characterization program and to receive funding, in the form of grants from the Nuclear Waste Fund, to exercise that authority. The Act provides similar authority to "affected" units of local government. Nye County, in which the Yucca Mountain site is located, is defined as affected by the statute. In addition, the Act authorizes the Secretary of Energy to designate other, contiguous, units of local government as affected. Currently, nine are so designated: Churchill, Clark, Esmeralda, Eureka, Lander, Lincoln, Mineral, and White Pine counties in Nevada and Inyo County in California.

Formal and informal interactions

OCRWM staff members interact with representatives of the State of Nevada and affected units of local government both informally and formally. Informally, our staffs consult frequently by phone and in meetings. More formally, we host quarterly meetings to discuss issues of mutual concern. For greater efficiency and cost-effectiveness, we videoconference a portion of these meetings so that OCRWM staff at Headquarters can participate directly and respond immediately to concerns. The four meetings conducted during Fiscal Year 1994 covered a range of topics, among them: 1) the implementation of the new program approach, 2) planning for preparation of the environmental impact statement for the multi-purpose canister system initiative (described in Chapter 2), and 3) studies of rail access to the Yucca Mountain site. We also participate in quarterly State, Tribal, and Local Government Coordination Group Meetings, which are hosted by the affected units of government on a rotating basis.

We have implemented four protocol agreements with Nye and Lincoln counties to facilitate our interactions. In July 1994 we signed a protocol with Nye County covering its on-site representation during site characterization, an oversight function authorized by the statute. The protocol defines Nye County's authority to conduct its own site characterization analysis and to independently verify our findings.

OCRWM's Yucca Mountain Site Characterization Project conducts extensive public informa-

tion activities throughout the year. These efforts, described in Chapter 4, serve not only Nevada residents, but a larger public.

Funding

For Fiscal Year 1994 Congress appropriated \$5.5 million for the State of Nevada, \$7.0 million for affected units of local government, and \$3.7 million for the University of Nevada system to fund oversight activities. The State of Nevada and affected units of local government used these funds to gather and distribute information about the program, to monitor our scientific investigations and analyze our findings, and to participate in forums provided by the Nuclear Regulatory Commission, the Nuclear Waste Technical Review Board, national and international conferences, and other bodies. The funding also supports Nye County's independent site investigations and its on-site representative.

In addition, the Act provides for payments-equal-to-taxes (PETT) to affected units of government in an amount equal to what would have been received had the State or affected unit of government been authorized to tax program activities and operation of program facilities. After prolonged negotiations over what the appropriate level of PETT payments should be, in Fiscal Year 1994 we made PETT payments of \$204,517 to the State of Nevada and \$4.4 million to Nye County. Because the Department maintains air and seismic monitoring stations within their jurisdictions, we made PETT payments to the following counties: \$81,648 to Clark County; \$2,028 to Esmeralda County; \$4,209 to Lincoln County; and \$14,331 to Inyo County.

Protecting the Environment and Human Safety and Health

Planning—and assessing the results

The Secretary of Energy requires the preparation and implementation of Environment, Safety and Health Management Plans to reduce risks to workers, the public, and the environment. OCRWM published its plan for Fiscal Years 1996 through 2000 in September 1994. Central to it is

the establishment of risk-based priorities that guide the allocation of limited resources. Its primary environment, safety, and health objectives are to:

- Provide the program with a decision-making framework and decision-support tools to define consistently the scope, priorities, and funding for specific activities related to environment, safety, and health. This means making the best use of our resources to reduce risks, as well as ensuring that the Yucca Mountain Site Characterization Project and the multi-purpose canister initiative fully comply with applicable laws and regulations.
- Support the budget decision-making process, by delineating program-wide strategies and activities to reduce and manage risks; and provide schedules and cost estimates for achieving objectives.

Self-assessment programs help us integrate environment, safety, and health objectives and requirements into planning. During Fiscal Year 1994 OCRWM's line organizations formally measured their progress in implementing self-assessment programs in environment, safety and health, and safeguards and security. Their assessments were compiled in the *1994 OCRWM Environment, Safety and Health Annual Report* as part of a lessons-learned program. A self-assessment team will conduct independent appraisals to verify that necessary corrective actions are effective.

Although responsibilities for protecting the environment, safety, and health span the entire program, the focus is now the Yucca Mountain site, where a wide range of tests and a major construction project involving drilling, blasting, and tunneling are under way. To ensure that all activities comply with Federal, State, and local laws, careful planning and monitoring are essential.

Ensuring environmental compliance

Monitoring air, water, and soil

At the Yucca Mountain site, protecting air and water quality, controlling toxic substances, and preventing pollution are currently OCRWM's chief environmental concerns. Scientists and engineers conduct extensive air-sampling to assess the impacts of site characterization on air

quality. They also use air samples to model pathways by which humans might be exposed to radionuclides resulting from past nuclear testing and to establish background levels of radiation in the ambient air. In Fiscal Year 1994, under a State air quality permit, scientists collected and analyzed ambient air samples for particulate matter and measured and recorded ambient air temperatures and wind speeds and directions. As required by the permit, we submitted quarterly ambient air monitoring reports to the State that quantify radioactive particles and ambient radon in the samples taken. Concentrations measured have been well below the conditions established in the permit.

Ambient air samples are also analyzed for radionuclides. Engineers and health physicists use 22 continuous air samplers that are measured weekly for radionuclide concentrations. To date, the only activities that may have influenced background concentrations of radionuclides have been traffic and surface-disturbing functions, such as trenching and drilling. Radon concentrations in ambient air samples have been well below acceptable levels.

To determine the impacts of site characterization on water quality and quantity, we continued to collect and analyze surface and groundwater samples. In accordance with a comprehensive groundwater monitoring plan implemented under a State water appropriation permit, we measured and documented natural fluctuations in groundwater levels and spring flows, measuring water levels or discharges at 36 wells and 5 springs in the region. The wells are located to maximize the detection of impacts on groundwater caused by pumping at the Yucca Mountain site. Provisional data indicate that fluctuations in water levels have been minimal.

In Fiscal Year 1994 we continued to develop a long-term, water-quality monitoring network to provide quarterly and annual sampling data from several sites. Sample analyses will be evaluated, along with information maintained by the U.S. Geological Survey, to define background conditions and to identify potential candidate wells or springs for inclusion in this network.

The Radiological Monitoring Program is designed to collect water samples from both

surface and groundwater (drinking water and monitoring well) locations. By measuring ionizing radiation in these samples, we can identify variations in natural levels of radiation at different locations and establish background levels of radiation in the water at the site. When the program is fully implemented, at least 50 monitoring wells will be available for sampling. Samples will be processed annually.

We analyze soil samples to determine background levels of radionuclides and to assess possible redistribution or deposition of radionuclides due to site characterization. Samples are collected annually from several locations in and around the site.

Monitoring living things

To determine the concentration of radionuclides in plants and animals at the site, tissue specimens are collected from two species of small mammals and several plant species, and the specimens are analyzed. During Fiscal Year 1994 Merriam's kangaroo rats and long-tailed pocket mice were collected twice from seven locations. Samples of 11 plant species representing deer forage and 10 representing cattle forage were harvested and analyzed. The results of analyses will establish the background levels of radiation in these plants and animals.

Because the Mojave Desert tortoise is classified as a threatened species by the U.S. Fish and Wildlife Service, we must take extra precautions to minimize the impacts site characterization could have on the tortoises. Toward this end, we compared three sample tortoise populations, each exposed to a different level of impact, using data generated by the following parameters: tortoise survival and reproduction; movements; habitat use; behavior; health as indicated by growth, blood profiles, exposure to respiratory tract disease; and diet and food preference. To date, 411 tortoises have been marked with numbers painted on their shells. Currently, 114 tortoises are fitted with radio transmitters; they are tracked at various intervals. We also record roadway sightings and mortalities, evaluate the effects of ground motion caused by blasting and seismic reflection studies on the tortoises and their burrows, and determine whether site characterization provides significantly more nesting and roosting sites for local ravens, a species known to

prey on young tortoises. Ground motion appears to have no detectable effect on the tortoises; the raven population was somewhat higher in the project area than in the control area.

Protecting archaeological resources and historic sites

OCRWM's site characterization activities must comply with the National Historic Preservation Act. Therefore, before we start any work that might disturb archeological resources or historic sites, we survey the site to identify archeological and historic resources and to assess whether the work planned might harm them. If harm is likely, work plans are modified accordingly and the sites are revisited after work has begun to ensure that those resources and sites are adequately protected.

During Fiscal Year 1994 researchers reviewed 28 work plans to determine potential impacts on archeological resources and historic sites. Artifacts such as pottery shards, projectile tips, and rock cairns have been documented at 11 locations.

A number of surveys were conducted in the vicinity of the South Portal of the Exploratory Studies Facility to determine types and numbers of historical resources and to complete the sample survey of the Yucca Mountain project area as a whole before more extensive work begins. As a result of the surveys, 79 new archaeological sites were identified, evaluated, and recorded.

Twenty-nine of the sites have been fully documented, and permanent mapping reference points have been recorded and field labeling stakes installed. We recorded information about each site and its artifacts, mapped and analyzed the artifacts, took photographs, and evaluated site conditions. At eight sites, we established and mapped archaeological study plots so that the movement and loss of artifacts can be evaluated more accurately. In the last year, project activities have had minimal effect on archaeological resources and historic sites; only one site has been affected.

Other environmental activities

To effectively manage wastes generated by site characterization, we established an accumulation area to segregate and provide temporary storage

for wastes before they are transported off-site for treatment and/or disposal. This area is not subject to permitting under the Resource Conservation and Recovery Act, as it is used for temporary storage for fewer than 90 days.

Comprehensive environmental audits were conducted to determine the compliance status of several contractors working on the Yucca Mountain Site Characterization Project. Included were OCRWM's management and operating contractor, the technical and management support services contractors, and the Lawrence Livermore National Laboratory. No major deficiencies were identified, and corrective actions have been taken or are under way to address the minor findings of these audits.

Focused audits were also conducted during Fiscal Year 1994. They addressed air quality permit compliance, environmental readiness for tunnel boring machine activities, and waste management operations and procedures at the site.

To comply with the National Environmental Protection Act, in Fiscal Year 1994 OCRWM developed a proposed schedule for preparing the environmental impact statement that would accompany a license application for a repository. A Notice of Intent to prepare the statement would be issued in mid-1995, and planning for inter-agency coordination and public involvement would begin.

Protecting human safety and health

In accordance with the Department of Energy's health and safety requirements, OCRWM carries out a safety program that includes emergency response capability, medical services, industrial hygiene, and transportation safety. During Fiscal Year 1994 the major participants in safety and health activities at the Yucca Mountain Project were merged into a single organization with responsibility for all activities at the site. This merger will eliminate duplication of functions and ensure that uniform safety standards are in place among all site contractors.

This unified safety and health team played a key role in ensuring that start-up of the tunnel boring machine was safe and on schedule, by conducting an operational readiness review.

Team members also updated Departmental safety and health plans and procedures to reflect the importance of protecting workers during tunneling operations. No serious injuries or accidents occurred during start-up or during subsequent operation of the machine and supporting construction activities.

During Fiscal Year 1994 safety and health surveillances were conducted at the site by our safety and health team. There were no major findings, and all problems identified have been corrected.

International Programs

Benefits to the United States

OCRWM has been active in the international waste management community for many years, through U.S. membership in international organizations involved in waste management and disposal and through bilateral information-exchange agreements and subordinated cooperative research agreements with several countries. The substantial benefits from international activities include:

- Access to expertise abroad, in the form of information and insights that help us plan and execute our work in technical and other areas.
- Resource leveraging and technology transfer, through cooperative projects that give us access to unique facilities abroad. This enables us to share costs and save time developing and prototyping instrumentation and analytical techniques that we can use to

characterize the Yucca Mountain site and to train our technical staff.

- A forum for developing consensus among the international scientific community on difficult common issues, which helps build public confidence in the work we are doing at home.

International participation and partners

The United States maintains bilateral information exchange agreements with Canada, Sweden, Switzerland, Spain, and Japan and, under these umbrella agreements, subordinated cooperative agreements with Canada, Sweden, and Switzerland.

The United States is a member of the International Atomic Energy Agency (IAEA) and the Nuclear Energy Agency, which is part of the Organization for Economic Cooperation and Development, and we participate in their radioactive waste management activities. The United States also participates in activities sponsored by the Commission of the European Communities, and we monitor waste management programs abroad to identify developments pertinent to our own program.

Leveraging resources through research agreements

In the past year we held regular information-exchange meetings with our bilateral agreement partners and had exploratory discussions with Spain and Japan, recent bilateral agreement partners, with the intent of identifying areas for cooperative projects. We also met with representatives of the French waste management program to explore the possibility of developing a bilateral agreement. Further discussions with these countries are anticipated.

Our five-year cooperative projects with Canada, Sweden, and Switzerland, initiated in 1991-92, all relate directly to site characterization and repository development and involve investigators from OCRWM's program. The Canadian agreement consists of eight technical tasks cover-

ing the dissolution of spent fuel and the properties of materials that could be used to seal the repository, laboratory and field tracer testing, instrumentation testing, performance assessment, and a natural analogue study of a deep uranium deposit. The agreement with Switzerland covers five technical tasks involving characterizing groundwater movement in fractured rocks, seismic tomography, developing and prototyping borehole-logging instrumentation, and radionuclide sorption testing. The agreement with Sweden covers five tasks involving studies on excavation effects, groundwater flow and age dating, geochemical modeling, and observation of how testing and construction are coordinated in the underground Hard Rock Laboratory being constructed in Sweden.

This last task is particularly relevant to challenges we face in constructing and performing testing in the Exploratory Studies Facility. At the International High-Level Radioactive Waste Management Conference held in May 1994, a day-long session was devoted to presentations of what we have learned from these cooperative projects and how we are applying it at the Yucca Mountain site.

The many other examples of cost-effective technology transfer to the United States in Fiscal Year 1994 include application at the Yucca Mountain site of techniques for seismic imaging to identify and characterize fracture zones. Developed under the Swiss agreement, these techniques reduced the need for more expensive surface-based drilling. The movement of groundwater and gases through fractured rocks is a prime hydrologic issue at potential repository sites in a number of countries, and collaborative work under the Swiss and Swedish agreements advanced efforts to understand and model the hydrologic setting at Yucca Mountain.

Under the Canadian agreement we used that country's unique facilities to prototype the instrumentation and analytical techniques we will use in tracer tests that measure groundwater movement and contaminant transport. The benefits were improved reliability of instrumentation, and savings of several hundred thousand dollars and about one year of time. We also used Canadian facilities to test instrumentation for sampling

groundwater and measuring rock stress. By using Canada's high-temperature thermodynamics laboratory, we generated data we can use to evaluate sealing materials under conditions similar to those predicted for the Yucca Mountain site. By conducting studies on dissolution rates and the behavior of uranium oxide, the major component of spent fuel, we improved our ability to predict the behavior of spent fuel at the Yucca Mountain site. To complement our laboratory-scale studies, we prepared a large block of rock from the Yucca Mountain site for shipment to the unique large-block test laboratory in Canada, where tests will determine the rate at which the rock retards radionuclide migration.

Natural analogue studies offer the only opportunity to examine the behavior over long time periods of natural processes we expect in a geologic repository. In Fiscal Year 1994 we hosted a meeting of the Natural Analogue Working Group sponsored by the Commission of the European Communities. The Group is developing consensus on how to apply natural analogue studies in assessing the safety of repositories, an effort that complements the natural analogue studies we are conducting with Canada and New Zealand.

Advancing the science of performance assessment

A challenge facing all countries planning geologic disposal is how to use data from relatively short-term testing to make reliable long-term predictions of repository performance. During Fiscal Year 1994 we participated in meetings of two complementary groups that are working to advance these techniques: the Performance Assessment Advisory Group sponsored by the Nuclear Energy Agency and the Coordinating Group on Site Evaluation and Design of Experiments for Radioactive Waste Disposal. These exchanges offered us valuable opportunities to obtain informal peer review of our studies and to improve our techniques and assessments.

We also participated in the GEOVAL '94 Symposium that presented the results of the INTRAVAL Project, an international collaborative effort to test approaches and techniques for combining laboratory and field test data with mathematical modeling to defensibly predict

performance of the natural and engineered barriers of a repository. Through the sponsorship of the Nuclear Energy Agency, a follow-on to the INTRAVAL Project, called GEOTRAP, will continue this thrust. Because the area is key to the successful licensing of a repository, we are maintaining significant involvement in it.

Other activities included the Nuclear Energy Agency Thermochemical Data Base Project, the Commission of European Communities-sponsored CHEMVAL geochemical code comparison exercises, workshops on geochemistry and groundwater flow and transport under the Swedish cooperative agreement, and verification exercises using Canada's performance assessment code.

Establishing consensus and sharing U.S. expertise

In Fiscal Year 1994 OCRWM supported International Atomic Energy Agency (IAEA) efforts to develop consensus documents on spent nuclear fuel and high-level radioactive waste management and disposal. We continued to participate in the Radioactive Waste Safety Series Program, which produces consensus documents on safety fundamentals, standards, practices, and guides for a broad range of waste management subjects. We helped develop a technical guide to multi-purpose canisters. We also continued information exchange activities on spent fuel storage under the third phase of the IAEA BEFAST (Behavior of Spent Fuel in Extended Storage) Program, and we continued work on a related spent fuel behavior project at the Idaho National Engineering Laboratory. This project will help us better assess the characteristics of spent fuel and cask material in

long-term dry storage. We will present the results of this work in annual reports and will share the information with other countries through the BEFAST program.

We participated in a Nuclear Energy Agency workshop that initiated efforts to develop an international consensus position on the environmental and ethical aspects of disposing of long-lived radioactive waste. The position taken will be similar in intent to previous statements expressing international consensus that geologic disposal is the preferred method for waste disposal and that, if properly applied, techniques for assessing the safety of geologic disposal are scientifically defensible. These position statements endorse the fundamental soundness of the approaches to radioactive waste disposal taken by the United States and other countries.

Because of the risks posed by international proliferation of nuclear materials, it is the policy of the United States to help non-nuclear weapons states develop waste management and disposal programs for spent fuel. Further, providing technical assistance may foster the sale of U.S. technology abroad. Accordingly, in Fiscal Year 1994 we met with representatives of China, Japan, Russia, and Thailand to provide overviews of the OCRWM program. Under broad international agreements on energy technology, we participated along with other Federal programs in annual technical exchanges with Taiwan and South Korea. And we participated in the Industrial Partnering Program with the Newly Independent States of the former Soviet Union to foster the conversion of weapons technology to non-weapons applications.

Chapter Two

Waste Acceptance, Storage, and Transportation

The functions encompassed by OCRWM's Waste Acceptance, Storage, and Transportation Project are those necessary to attain a state of readiness to accept, store, and transport waste to Federal waste management facilities. The near-term focus of the project is to: 1) contribute to the timely resolution of issues concerning the start of waste acceptance and arrangements for interim storage of civilian spent fuel, 2) provide a multi-purpose canister system by 1998 for at-reactor storage of spent fuel, 3) maintain readiness to develop an interim storage facility, 4) develop the technical and institutional capability to remove spent fuel from commercial reactor sites and transport it to a Federal waste facility constructed under the Act, and 5) contribute to resolution of issues concerning disposal of the Department's own nuclear wastes. These functions are detailed in OCRWM's program plan, Volume III.

This chapter reports on the Department's Fiscal Year 1994 initiative to address utilities' expectations about the start of waste acceptance, its initiative to develop a multi-purpose canister system, events related to interim storage, and progress toward development of a nationwide transportation system.

Addressing Waste-Acceptance Issues

Addressing utilities' expectations about the start of waste acceptance

The Nuclear Waste Policy Act provides a comprehensive framework for disposal of commercial spent nuclear fuel and high-level radioactive waste. The Act requires the owners and generators of these wastes to pay fees into the Nuclear Waste Fund, and it authorizes the Secretary of Energy to enter into contracts with these parties for the acceptance and disposal of the wastes. Accordingly, the Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste, promulgated as a Federal regulation, requires that services to be provided by the Department begin "after commencement of facility operations, not later than January 31, 1998."

Multi-purpose canister ready for rail shipment

When the Standard Contract was promulgated, all parties envisioned that the Department would be ready to start accepting spent fuel at an operating repository by January 31, 1998. But the estimated start date for the repository is now 2010. While the Nuclear Waste Policy Amendments Act of 1987 chartered a Nuclear Waste Negotiator to seek a willing host for an interim storage facility, to date no volunteered site has materialized. And while the Amendments Act authorized the Secretary of Energy to designate a site for such a facility, the Secretary chose to rely on the voluntary siting process. Further, the Amendments Act links the development of an interim storage facility to the schedule for repository development.

Utilities' problems, utilities' perspectives

The fuel widely used in commercial nuclear reactors in this country consists of uranium dioxide pellets encased in rods that are bundled into assemblies. Emitting both radioactivity and considerable heat by the time they reach the end of their useful life in a reactor, these assemblies are stored at reactor sites in specially designed pools of water licensed under Nuclear Regulatory Commission regulations. At many reactor sites, spent fuel inventories are approaching the maximum capacity of the spent fuel storage pools. While some additional capacity has been gained by modifying the storage racks in the fuel storage pools to accommodate additional fuel assemblies, projections indicate that the pools at 22 reactor sites will be completely filled before the end of 1998, and the number will continue to grow.

One storage option is to construct dry storage facilities at reactor sites. The first of these began to operate in 1986, and additional facilities have been put into operation since. Dry storage offers the advantage of being passive, while pool storage requires more active maintenance. In fact, the Nuclear Regulatory Commission, while affirming the safety of pool storage, has stated its preference for dry storage.

OCRWM has helped utilities develop dry storage technologies through cooperative demonstration projects. And, as requested by Congress in the Conference Report on the Energy and Water Development Appropriations Act for Fiscal Year 1991, the Department is conducting an

ongoing demonstration project with the Electric Power Research Institute and the Sacramento Municipal Utility District to demonstrate the application of dual-purpose casks that can be used for both storage and transportation and also to develop dry spent fuel transfer technology. The final results of this demonstration project, scheduled for completion in 1998, will benefit both utilities and the Federal waste management system.

However, additional storage, wet or dry, involves additional cost. Many utilities believe they should not bear this added cost because they have already incurred costs, in the form of payments made into the Nuclear Waste Fund, in the expectation that the Federal Government would begin removing their spent fuel in 1998. And uncertainties about the start of waste acceptance complicate utilities' plans for managing their growing inventories of spent fuel. Adding on-site storage capacity may require authorization by the Nuclear Regulatory Commission and State public utility agencies, and thus create an opportunity for intervention by parties who want to halt the generation of nuclear power, or otherwise oppose such storage plans. Further, plants that shut down must continue to operate and maintain spent fuel storage pools, which extends the time nuclear materials are on site and thus increases the utilities' total costs.

Departmental Notice of Inquiry

To address utilities' concerns, the Secretary decided to explore them in a public forum. On May 25, 1994 the Department published a Notice of Inquiry in the *Federal Register* inviting comment on:

- The Department's preliminary view that, in the absence of an operational repository or other facility constructed under the Act, it does not have a statutory obligation to accept spent nuclear fuel.
- The need for an interim away-from-reactor storage facility prior to repository operations.
- Options for offsetting, through use of the Nuclear Waste Fund, a portion of the financial burden that may be incurred by utilities in continuing to store spent fuel at reactor sites beyond 1998. One option might be provision

by the Department of multi-purpose canisters for at-reactor storage.

In June 1994, shortly after the notice was published, 14 utilities and 27 State agencies filed suit in the U.S. Court of Appeals for the District of Columbia Circuit seeking a declaration that the Department is obligated under the Nuclear Waste Policy Act to begin accepting spent fuel by January 31, 1998. The litigants are also seeking a court order directing that the Department develop a program, with appropriate milestones, to begin accepting spent fuel by 1998, and that their future payments into the Nuclear Waste Fund be placed in a supervised escrow fund. Two similar suits have been filed by a group of States and State agencies and by another utility. The three suits have been consolidated; the court has not yet issued an opinion.

As of October 5, 1994, more than 900 comments on the Notice of Inquiry had been received, and the comment period was extended to December 19, 1994. In total, more than 1,100 responses were received, most of which focus on the 1998 date for waste acceptance and the need for interim storage. These comments are being reviewed and the Department will issue a response in the *Federal Register* late in the Spring of 1995.

Waste-acceptance criteria

To ensure physical compatibility between various waste forms and the Federal waste management system, waste-acceptance criteria are needed. The Standard Contract established these criteria for commercial spent fuel. For the wastes owned by the Department, criteria are still being developed. Fiscal Year 1994 saw advances in this task on several fronts.

The Department's large inventory of high-level radioactive wastes results from a 40-year period in which the Department and its predecessor agencies produced and reprocessed nuclear materials for defense applications and promoted the development of commercial nuclear power. These wastes are in temporary storage at the Savannah River site in South Carolina, at the Hanford site in Washington, and at the Idaho National Engineering Laboratory. In addition,

decisions to terminate reprocessing of spent nuclear fuel have left the Department with a substantial inventory of spent fuel and other reactor-irradiated materials that require safe storage and may require permanent disposal in a repository.

At the Savannah River site, the high-level wastes will be encapsulated through vitrification at the Defense Waste Processing Facility, producing approximately 5,500 canisters of glass waste, all destined for a repository. OCRWM and the Department's Office of Environmental Management have been working for several years to produce waste-acceptance specifications to ensure, as far as possible, that waste forms produced will be acceptable for disposal in a repository. Partially as a result of these efforts, the Defense Waste Processing Facility began cold (non-radioactive) operations in Fiscal Year 1994. OCRWM continued to participate in the independent Glass Waste Acceptance Technical Review Group, which reviews data from waste-qualification runs being conducted at the Savannah River facility. The facility is scheduled to begin full-scale radioactive glass production in January 1996. Wastes will be stored at the Savannah River site until they are accepted for repository disposal.

In Fiscal Year 1994, OCRWM also continued to provide technical support to the Department's West Valley Demonstration Project, where a small quantity of spent nuclear fuel and commercial high-level radioactive waste is stored, and OCRWM concurred in the Waste Form Compliance Plans published by both Savannah River and West Valley.

At Hanford and Idaho, similar processing is planned for high-level wastes now in storage. However, at these sites, the processes for encapsulating the wastes and the resulting waste characteristics are much less well defined, as are the ultimate volumes of waste that will require disposal. OCRWM and the Office of Environmental Management have begun a cooperative effort to develop waste-acceptance criteria and specifications for these wastes.

The Department's spent nuclear fuel, in storage at a number of sites, results from a wide range of activities and is physically configured in a number of distinct forms, in a broad range of

degraded conditions. The Office of Environmental Management is conducting a comprehensive program, the National Spent Nuclear Fuel Program, to ensure safe long-term management of these wastes. It is estimated that approximately 2,700 metric tons heavy metal¹ of the Department's spent fuel may require repository disposal.

Although the first repository's total capacity is statutorily capped at 70,000 metric tons heavy metal, the total quantity of wastes destined for repository disposal exceeds this amount, and it is a planning assumption that there will eventually be a second repository. The planning basis for the first repository had been that 7,000 metric tons heavy metal (approximately 10 percent of its capacity) would be allocated to defense high-level waste in vitrified form. In 1994 OCRWM and the Office of Environmental Management agreed that a portion of this allocation could be used to dispose of some of the Department's spent fuel in the first repository, with the remainder of the spent fuel and the additional vitrified waste to be maintained in safe storage pending a decision on a second repository, a decision currently scheduled for the period 2007-2010.

OCRWM and the Office of Environmental Management's National Spent Nuclear Fuel Program Office established a joint internal steering group to focus on issues related to acceptance, transportation, and disposal of the Department's spent fuel and other nuclear materials irradiated in the Department's reactors, and to formulate, for management consideration, the criteria the Department's wastes will have to meet to be accepted for disposal in a repository.

In Fiscal Year 1994 OCRWM participated in the review of a Preliminary Waste Acceptance Criteria document produced by the Office of Environmental Management for the spent fuel and high-level waste at the Idaho National Engineering Laboratory. We are preparing a preliminary waste form criteria report on the Department's spent fuel which the Steering Group will use to establish consistent criteria for providing the data about defense wastes that we must include in the repository license application.

The Multi-Purpose Canister System

Departmental initiatives

A major initiative in Fiscal Year 1994 was the Secretary's proposal of a phased approach for the development of a multi-purpose canister-based system for storage, transport, and disposal of commercial spent fuel. Replacing or supplement-

¹ A metric ton of heavy metal, also termed a metric ton of uranium (MTU), is a unit of measure that expresses the mass of spent fuel in metric tons (each ton being equivalent to 2,204.6 pounds), considering only the radioactive heavy-metal content and treating it as if it were uranium.

ing existing technologies and ready for use by 1998, this system would provide standardized canisters that would be loaded with spent fuel at reactor sites, permanently sealed, and then used for all spent fuel storage, transportation, and disposal functions.

The canisters' large capacities would minimize the number of shipments; correspondingly, their size and weight would dictate that they be shipped by rail. The Department would furnish these canisters to reactors accessible by rail, which includes most reactors. To tailor the canister to the specific type of fuel used at each reactor, four types of canisters would be developed. Two versions of a large canister in a transport overpack would meet the weight limit of a 125-ton crane hook and would hold either 21 or 40 spent fuel assemblies, depending on the reactor design. The large canister could serve most of the reactors with rail access. Two versions of a small canister in a transport overpack would meet a 75-ton weight limit and would hold either 12 or 24 assemblies. The small canister could serve a smaller number of reactors. The system we envision could use up to 12,000 canisters and 75 rail transportation overpacks.

At least four reactors are without rail access or could not accommodate multi-purpose canisters without making major modifications to their facilities or to their rail spurs. They would be served by trucks carrying advanced technology, legal-weight truck casks. Truck casks are discussed below. In addition to these reactors, still others would require some modification to their facilities or rail spurs before they could accommodate either size multi-purpose canister. These reactors would use either multi-purpose canisters or truck casks, depending on the degree of plant or rail spur modification the utilities ultimately chose to make.

As a major Federal action, this initiative requires preparation of an environmental impact statement under the National Environmental Policy Act. The findings in the statement will contribute to the Department's final decision, scheduled for 1996, on whether to procure and deploy the multi-purpose canister system. If the system is deployed, the design of its components will have to be certified by the Nuclear Regulatory

Commission as meeting all requirements for storage and transportation, and the Department will have to obtain a license from the Commission to use the canisters and associated equipment. The Department proposes to make the canisters available for use by any utility that wants them.

On June 3, 1994, we approved release of a Request for Proposal for design and, as an option, certification and fabrication of both sizes of the canister, a prototype transportation overpack for each, and welding and handling equipment. Initial technical and cost proposals were received early in Fiscal Year 1995; contracts are to be awarded late in the spring of 1995. Following development of the vendors' designs, we will select a range of reasonable design alternatives for submittal by the vendors to the Nuclear Regulatory Commission for certification. No decision to fabricate or deploy the multi-purpose canister system will be made until the Nuclear Regulatory Commission reviews the designs, and an environmental impact statement is completed.

System concept and benefits

The decision to initiate design and certification of the multi-purpose canister system rested on extensive systems studies conducted over many years. (They are summarized in Chapter 3.) In September 1994 we issued a report, the *Multi-Purpose Canister System Evaluation, A Systems Engineering Approach*, that summarizes the results of those studies and presents the evaluations supporting the decision to proceed.

These evaluations found that a multi-purpose canister system could provide several benefits to the waste management system, and to utilities: 1) Because utilities employ a variety of fuel sizes and configurations, the canister would largely standardize the interface between reactors and the Federal waste management system; 2) furnished to utilities, the canisters would reduce the proliferation of at-reactor dry-storage designs, and could help meet storage needs, beginning in 1998, and partially offset storage costs; 3) the Department would gain the capability of accepting and transporting spent fuel from reactor sites by 1998 if an interim storage facility became available by that date; 4) a single canister that could be used for storage, transportation, and

disposal would reduce the handling of individual spent fuel assemblies throughout the system, could reduce costs, and would reduce the amount of low-level waste generated; and 5) the multi-purpose canisters' large capacity would reduce the total number of shipments required.

Because the multi-purpose canister is intended for final disposal, its design must take into account conditions within the repository so that, together with other engineered barriers and the natural features of the site, it can contribute to the repository's ability to isolate waste. The issue of "thermal loading," discussed in Chapters 1 and 3, affects and will be affected by the design of the multi-purpose canister. Regulatory standards for permanent disposal are not yet finalized, but OCRWM has determined that, if the canisters were to require modification to meet final stan-

dards, the cost of modifications would fall within an acceptable range of financial risk.

Stakeholder involvement

In developing the multi-purpose canister system, OCRWM has sought the views of stakeholders and worked to address their concerns. In November 1993 we conducted the second of two public workshops to solicit public comment on the conceptual design of a multi-purpose canister. (The first workshop was held in July 1993.) More than 100 stakeholders attended this two-day session and discussed conceptual design, possible implementing strategies, and future stakeholder involvement in the process of developing the initiative. Results of this workshop were documented in a report to participants issued in December 1993. We also met with and received

Physical Design of the System

The system we propose would employ sealed metal canisters that could hold multiple spent nuclear fuel assemblies. At reactor sites the canisters would be loaded with spent fuel assemblies; welded shut; and then stored, transported, and disposed of without repackaging or further handling of the bare assemblies. Each canister would consist of a cylindrical shell with two lids, a spent fuel basket, and a shield plug. The basket would provide structural support for the spent fuel assemblies and a path for the transfer of the heat generated by the fuel into the canister shell. The basket also would provide geometric stability for the fuel assemblies to ensure that the fuel remains subcritical—that is, not capable of resulting in a nuclear reaction.

The cylindrical shell would provide structural support for the fuel basket. During storage, the cylindrical shell and the inner lid would act as a primary containment boundary

preventing
release of
radioactive
material.
For trans-

port, the canister
would be placed inside a
rail transportation overpack that
would provide radiation shielding and
radioactive-material containment during
normal handling and transportation and would
protect the canister in the event of an accident.

At the repository the multi-purpose canister would enter a waste-handling building where it would be unloaded from its transportation overpack and could be placed in a disposal overpack that would be welded shut. The sealed disposal overpack and the multi-purpose canister would together constitute the waste package and would meet the regulatory requirements for disposal.

In addition to the canisters, rail transportation overpacks, and welding equipment called for in the Request for Proposal, the system would include specialized handling equipment, transfer casks to shield the canisters while they are being loaded into on-site storage casks, storage casks for sealed canisters, and associated equipment.

comments from organizations representing utilities. Our interactions with stakeholders, their specific concerns, and our response to their concerns are detailed in the *Multi-Purpose Canister System Evaluation Report* cited above.

We discussed the concept with the Nuclear Waste Technical Review Board and the Nuclear Regulatory Commission, as well.

Compliance with the National Environmental Policy Act

In Fiscal Year 1994 OCRWM began planning for preparation of the environmental impact statement that will support the decision whether to procure and deploy this system. In accordance with Council on Environmental Quality regulations and the Department's implementing procedures, the statement will evaluate the potential environmental impacts of both the multi-purpose canister system and reasonable alternative storage and transport systems, using a combination of scenarios for manufacturing, handling, storage, and transportation involving at-reactor storage, hypothetical interim storage facilities, and surface operations facilities at the repository.

Among the subjects to be addressed are: the impacts on public and worker safety and health; the potential risks to communities along representative transportation routes; the possibility of accidents; the environmental effects of multi-purpose canister storage at reactor sites, at hypothetical interim storage facilities, and at the surface operations facilities of a repository; pollution prevention and management of wastes generated; socioeconomic effects; and environmental justice issues.

The environmental impact statement will not address impacts associated with specific interim storage or repository sites. These impacts will be examined in subsequent environmental impact statements, as appropriate.

Parties with an interest in this initiative include other Federal agencies, Indian Tribal organizations, State and local government agencies, public interest groups, equipment manufacturers, transportation interests, industry and

utility organizations, regulators, and the general public. OCRWM began the formal scoping process for preparation of the environmental impact statement with publication of a Notice of Intent in the *Federal Register* on October 25, 1994, announcing three public scoping meetings to be held early in Fiscal Year 1995.

Interim Storage

The concept of an interim storage facility for utilities' spent fuel has long been viewed as a desirable feature of the waste management system. Such a facility would enable the Federal Government to accept some quantity of spent fuel from utilities in advance of the start of repository operations, thus reducing their inventories. It would facilitate the scheduling of waste shipments to the repository. And, by serving as a staging and lag-storage area, it would provide greater flexibility in the waste management system.

Although the Department's proposal for siting a monitored retrievable storage facility in Oak Ridge, Tennessee, in the mid-1980s, was annulled by the Nuclear Waste Policy Amendments Act of 1987, the Act authorized siting, construction, and operation of a storage facility as an integral part of the Federal waste management system. The Act gave the Secretary the authority to survey and evaluate sites for a storage facility and then designate one. The Act also created the Office of the Nuclear Waste Negotiator to seek a State or Indian Tribe willing to volunteer a technically suitable site, under reasonable terms to be approved by Congress. Out of concern that an interim facility not become a de facto repository, Congress linked the schedule for starting its construction to the authorization for construction of a repository and limited the amount of spent fuel that could be stored in it. Slippage of the repository schedule now will not permit operation of an interim storage facility by 1998.

In light of the difficulty of imposing a site on an unwilling host and recognizing that the statutory schedule linkages would not permit the start of storage operations by 1998, the Secretary chose to rely upon the voluntary siting process and the hope that, if a site were volunteered and

if it were approved by Congress, Congress would advance the start date for interim storage operations. As the Negotiator pursued his mission, OCRWM provided technical support to him and proceeded with the conceptual design of an interim storage facility.

After numerous expressions of initial interest, the field of potential hosts narrowed sharply. In August 1993 two Indian Tribes, the Mescalero Apache Tribe of New Mexico and the Skull Valley Band of Goshutes in Utah, had applied for grants under the final phase of the financial assistance program for this siting effort. However, in the Fiscal Year 1994 budget, Congress prohibited award of Phase IIb grants. Nonetheless, the Nuclear Waste Negotiator continued his efforts. On November 10, 1994, the Goshutes signed an agreement with the Negotiator to develop a framework for negotiations. Cooperative agreements were also entered into with the University of Utah to study transportation and socioeconomic impacts of an interim storage facility and with Tooele County, Utah, for impact studies. These studies were concluded early in 1995.

During 1994 the Mescalero Apache Tribe withdrew from the volunteer siting program. The Tribal Council initiated discussions and planning with a consortium of 33 utilities, led by Northern States Power Company of Minnesota, for a joint venture to design, construct, and operate a private interim storage facility on Mescalero lands in New Mexico. In a referendum in January 1995 on a joint venture agreement, the full Tribe voted against continuing with the project. However, the full Tribe reversed its position in March 1995 and negotiations to finalize an agreement resumed.

The Fiscal Year 1995 budget does not provide funding to OCRWM for activities related to interim storage. Although Congress appropriated \$1 million for Fiscal Year 1995 to fund the Nuclear Waste Negotiator, the statutory authority for the Office of the Negotiator expired in January 1995. Because it was clear that the voluntary siting process could not meet the January 1998 target date for waste acceptance, the Department's May 25, 1994 Notice of Inquiry sought comment on options that might be pursued for interim

storage of spent fuel. We will publish our response to the comments received on the Notice of Inquiry late in the Spring of 1995.

Developing a Transportation System

The Department of Energy has safely transported high-level radioactive and hazardous wastes for many years, but OCRWM's spent fuel shipments will be more numerous and visible—affecting more localities, along more transportation corridors—than any previous shipping campaign. OCRWM has therefore been consulting closely with many parties in developing its nationwide transportation system. These consultations concern both physical and operating components, and institutional infrastructures involving local, State, regional, national, and Tribal authorities.

The work of developing a nationwide transportation system encompasses many tasks. We must procure the equipment necessary to make shipments, obtain maintenance facilities and services for shipping casks and equipment, define operating procedures for and train the personnel who will be operating the system, determine specific shipping modes for each reactor site, designate shipping routes, and provide technical assistance and funding for training of public safety officials along transportation routes.

Planning for safe transportation

Since the mid-1980s OCRWM's Transportation Coordination Group, which enjoys strong stakeholder participation, has addressed many of the issues related to development of the transportation system. In June 1994 we issued a preliminary draft OCRWM Transportation Plan for review and comment. This document provides an overview of OCRWM's national transportation program and focuses on the development of an operational transportation system. Stakeholder comments are being considered and incorporated into the document as appropriate. When the revised document is distributed in 1995, it will supersede the Transportation Institutional Plan and the Transportation Business Plan, both issued in 1986. The Transportation Plan will be updated annually.

A Department-wide Transportation External Coordination Working Group provides coordination within the Department and with other levels of government and stakeholders on issues related to transportation safety and emergency preparedness for shipment of radioactive materials. Co-chaired by OCRWM and the Department's Office of Environmental Management, the group develops task plans that define a course of action for each issue identified. In Fiscal Year 1994 task plans were developed to address several issues. One plan outlined further work to implement the provisions of Section 180(c) of the Nuclear Waste Policy Act, under which the Department will provide technical assistance and funding to States and Indian Tribes for training of public safety officials in routine transportation matters and emergency response. The officials are those in jurisdictions through which spent nuclear fuel or high-level radioactive waste will be transported to a repository or an interim storage facility.

Other plans addressed revision of a directory of State agencies involved with the transportation of radioactive material to facilitate route selection, shipping notification, and enhanced emergency-response activities; compilation of an extensive glossary of terms to develop a common understanding of transportation-related terminology;

and development of procedures to notify Indian Tribes of spent fuel shipments.

If the Department deploys a multi-purpose canister system, most reactors will be served by rail; those not accessible by rail will be served by truck. Rail shipments will be made in dedicated trains routed over rail lines that pass through, or near, large urban areas; truck shipments will be routed over highways used by the general public. No regulations currently govern the selection of rail routes; highway route selection is governed by Department of Transportation regulations, and multiple potential routes may be identified under them. OCRWM and the Office of Environmental Management are jointly developing a Department-wide routing guidance document to provide consistency in the selection of routes and the guidance needed in instances in which no regulations apply. A draft of this document is being prepared and a *Federal Register* notice will announce its availability for review and comment.

In Fiscal Year 1994 OCRWM began preparing a *Federal Register* Notice of Inquiry soliciting comments on implementation of Section 180(c). It was issued on January 3, 1995; issue of a final policy is scheduled for mid-1997. We intend to provide this assistance within three to five years before the start of waste shipments—providing

Legal-weight truck shipping casks

enough lead time to allow adequate preparation, but not so much that staff turnover erases the benefits of training.

Procuring equipment

Rail cars needed to ship multi-purpose canisters would be developed as part of the procurement of the multi-purpose canister system. For highway transport, OCRWM has been engaged since 1988 in the procurement of designs of higher-capacity, legal-weight, advanced technology truck cask systems. Larger cask capacity will reduce the total number of truck shipments we must make.

As directed by the Act, we are relying on private industry to design and fabricate these casks. The cask manufacturer is responsible for obtaining Nuclear Regulatory Commission certification of cask designs. The contractor who is developing the designs is General Atomics, of San Diego, California. The two designs, termed "GA-4" and "GA-9" ("GA" stands for "General Atomics," the cask designer), accommodate up to four bare spent fuel assemblies from a pressurized water reactor and up to nine from a boiling water reactor, respectively. In July 1994 General Atomics submitted a Safety Analysis Report to the Nuclear Regulatory Commission to obtain a Certificate of Compliance for the GA-9 cask; in August it submitted a Safety Analysis Report for the GA-4 cask. We expect that the Commission will approve the designs by September 1996.

During Fiscal Year 1994 endurance testing was conducted on the legal-weight trailer for the GA-9 truck cask; approximately half of the 240,000-equivalent test miles were completed,

at the Allied Signals Automation Proving Grounds in Indiana.

Cooperative agreements

OCRWM has entered into 10 cooperative agreements with State, Tribal, and other organizations. These agreements (listed in Chapter 4) support their involvement in transportation and interim storage issues. The 10th of these agreements was executed in 1994, with the Council of State Governments/Eastern Regional Conference, to facilitate communication with the 10 northeastern States represented by the Conference. With this agreement, all regions of the 48 contiguous States are represented.

The Commercial Vehicle Safety Alliance, an association of 48 States, territories, and provinces, administers and enforces motor carrier safety laws in the United States, Canada, and Mexico. Under a cooperative agreement with the Department, the Alliance developed uniform inspection procedures for vehicles and drivers and a radiation survey for radioactive waste shipments. The Alliance has developed a training curriculum for State inspectors and is conducting a pilot study to verify the validity of the inspection procedures and make changes as necessary. On May 19, 1994, the Department started shipping cesium-137 capsules from Colorado to the Hanford site in Washington State, under the Department's cesium capsule recovery program. The Alliance is to inspect each cesium shipment. By the end of September 1994 seven shipments had been inspected. The procedures developed for these shipments can be used for OCRWM's shipments of spent fuel and should reduce the number of inspections required en route.

Chapter Three

Management Controls

Managing a controversial scientific program of the scope and complexity of OCRWM's, within a Federal setting that involves regulatory compliance and extensive oversight, calls for considerable managerial expertise. Accordingly, in Fiscal Year 1994 OCRWM adopted not only more aggressive programmatic strategies—for early evaluation of the suitability of the Yucca Mountain site and development of multi-purpose canisters—but more aggressive management strategies to sharpen the tools needed to carry out the program approach. These management strategies call for:

- Clearer focus on work products and progress.
- Tighter integration of related tasks.
- Clearer lines of responsibility and authority for our personnel.
- More opportunities for timely participation by stakeholders in our decision process.

The benefits these strategies can deliver are substantial. By more realistically aligning work plans and resources, we will gain more realistic schedules and a greater ability to measure progress against plans. And by clarifying our own staff's responsibilities and involving stakeholders early on, we will be able to make sounder decisions that are more widely understood.

The following pages summarize the management functions that must be performed to advance the program, and they highlight the progress we made in Fiscal Year 1994 toward performing those functions more effectively.

Applying and Verifying Quality Assurance

To obtain licenses for OCRWM facilities and equipment, all work that could affect the near- and long-term radiological safety of the waste management system must be performed under stringent quality assurance standards, to the satisfaction of the Nuclear Regulatory Commission. This work includes studies conducted for site characterization; design, construction, and operation of the Exploratory Studies Facility, the repository, and any interim storage facilities; and design, fabrication, procurement, and operation of a multi-purpose canister system and transportation casks. Beyond licensing concerns, our commitment to performing all safety-related work in compliance with quality assurance requirements is intended to protect the health and safety of workers and the public, and to protect the environment.

The Director of OCRWM's Office of Quality Assurance reports directly to OCRWM's Director. The Office of Quality Assurance is independent of all other OCRWM organizations. To develop a quality assurance program appropriate for OCRWM's unique waste management system, the office had to adapt programs used by the nuclear industry. Its innovative approach to this task has produced a program of considerable sophistication that is being studied by the Department's Waste Isolation Pilot Plant and by the International Atomic Energy Agency for use by its member states.

Most notable about the approach is the manner in which numerous and complex nuclear quality assurance requirements, criteria, and

guidance from multiple sources have been synthesized into a single, usable document—the Quality Assurance Requirements and Description Document—that is specifically tailored to OCRWM's program. This enables us to exercise tighter control of safety-related activities, while at the same time reducing paperwork. By contrast, the commercial nuclear power industry has typically left the interpretation of regulatory criteria to its suppliers.

Fiscal Year 1994 saw implementation of the Quality Assurance Requirements and Description Document by all program participants performing safety-related work. To verify the achievement of quality, OCRWM's Office of Quality Assurance continued to audit and assess safety-related activities. Quality assurance and technical specialists conducted rigorous audits to ferret out both existing and potential problem areas. Audit results were analyzed and corrective measures taken, enabling us to remedy problems and further improve the quality assurance process itself.

Quality assurance was also strengthened as a result of oversight by external parties. We continued to conduct quality assurance audits under the scrutiny of the Nuclear Regulatory Commission, the State of Nevada and affected units of local government, and the Nuclear Energy Institute. As OCRWM's program evolves, we are working to ensure that quality assurance is appropriately applied. In Fiscal Year 1994 the Nuclear Regula-

tory Commission registered concerns about our application of quality assurance to the design-control process, and we took immediate measures to modify our approach to address these concerns. We are making further improvements in Fiscal Year 1995.

In addition to conducting independent audits and assessments of safety-related activities, OCRWM's Office of Quality Assurance functions in an advisory capacity to the program's managers. In Fiscal Year 1994 the office played an important role in the issuance of the Request for Proposal for the multi-purpose canister system by ensuring that the Request for Proposal package met all quality assurance requirements in a timely manner. The office also verified, through audits and assessments, that applicable Federal regulations, codes and standards, and Departmental Orders are properly

High-level radioactive waste management program

identified in OCRWM program requirements documents and appropriately implemented.

Also in Fiscal Year 1994 quality assurance audits and assessments covered the full gamut of operations at the Yucca Mountain Site Characterization Office: work supporting the Exploratory Studies Facility, field and test coordination, the Field Operations Center, and the surface-based testing program. Important prerequisites to the start-up and operation of the tunnel boring machine were fully critiqued by OCRWM quality assurance personnel to ensure the long-term reliability and efficiency of that essential piece of equipment.

OCRWM continued to augment its quality assurance program with a quality concerns program that allows individuals to report any concerns they have about the quality of work. Concerns are investigated and are resolved under strict rules of confidentiality.

Integrating the Waste Management System

Storage, transport, and disposal functions must be evaluated as one unified system because decisions made about one element of the system may significantly affect others. Unless system-wide effects are adequately assessed, a unilateral decision to alter one element could jeopardize the licensing process and require costly design changes and serious schedule delays. But integrating and optimizing the Federal waste management system is a major technical and managerial challenge. Contributing to the difficulty of the task are the long period of system performance, the varying schedules for developing individual system elements, and the large number of assumptions that must be carried in the program's planning base. To control design work and system development, OCRWM uses a systems-engineering integration process based on well-established criteria.

Systems studies: multi-purpose canisters

By its nature, the use of multi-purpose canisters to store, transport, and dispose of spent fuel has

system-wide impacts. Accordingly, in developing the concept of a multi-purpose canister system, OCRWM used a systems engineering approach to define specific requirements and to identify and bound the interfaces between subsystems so that design efforts could be appropriately focused. In 1993 we had developed: 1) a concept of operations to establish a baseline for multi-purpose canister functions, 2) conceptual designs for the multi-purpose canister subsystems, and 3) the logistics for the multi-purpose canister system, to establish such variables as fleet size and handling considerations.

The conceptual design provided the basis for a series of studies that evaluated the multi-purpose canister system against existing and proposed alternatives for handling spent fuel. Published in September 1994 as *Multi-Purpose Canister System Evaluation – A Systems Engineering Approach*, these studies examined such subjects as health and safety impacts, design impacts on operational interfaces with the repository, life-cycle cost, the operational throughput of a multi-purpose canister system, regulatory considerations in system design, implications for at-reactor dry storage, programmatic risk issues, contingency analysis, and evaluation of alternative systems.

In 1994 we performed additional studies to assess the impacts of variations of the multi-purpose canister concept on various elements of the waste management system. These studies included:

- Sensitivity Analyses for the Multi-Purpose Canister System Conceptual Design Phase
- Evaluation of At-Reactor Modal Capacity
- Analysis of the System, Based on 4 PWR/9 BWR Capacity Multi-Purpose Canisters
- Life-Cycle Cost Analysis of an All-Large Multi-Purpose Canister System Using Dry Spent Nuclear Fuel Transfer.

These studies indicated that the multi-purpose canister system is viable and offers significant advantages over alternative systems; that it could be developed and implemented at a cost competitive with alternative systems; and

that it could be ready for deployment in 1998 if interim milestones are aggressively pursued.

On the basis of these studies, the Secretary of Energy decided, in February 1994, to proceed with design and certification of a multi-purpose canister system. We revised the program's technical baseline to reflect the Secretary's decision. We also proceeded with a Request for Proposal for multi-purpose canister designs, electing to employ performance-based specifications rather than prescribe a specific design or method of fabrication, in order to stimulate involvement from private industry. We will conduct additional systems studies as needed to support future decisions regarding deployment of the multi-purpose canister system.

Systems studies: waste disposal

OCRWM's current strategy for waste disposal is to load the multi-purpose canisters containing fuel assemblies into a protective disposal overpack for permanent emplacement in drifts. The multi-purpose canister, along with its contents, and the disposal overpack would together constitute the waste package that must meet regulatory standards: The materials from which the disposal overpack is fabricated must provide long-term containment of waste; the canister must be configured to maintain the fuel assemblies in a sub-critical mode; and decay heat must not adversely affect the repository's ability to isolate waste. These issues were considered in the conceptual design of the multi-purpose canister system and figured in the system studies performed in Fiscal Year 1994; they will be evaluated in later phases of design work on both the multi-purpose canister system and the waste package.

System studies: thermal loading

The question of how hot the repository will be is expected to be an important factor in licensing, and it will affect the design of the multi-purpose canister and the disposal overpack, and the cost of the repository system. That question is not yet answered. During Fiscal Year 1994 we continued to evaluate our thermal-loading strategy in light of four related objectives: 1) maintaining decay-heat

removal and near-field rock temperatures at acceptable levels, to ensure the integrity of the natural barriers, 2) maintaining long-term containment of the waste by ensuring the integrity of the engineered barrier system—defense in depth, 3) maximizing the canister's capacity in order to reduce the number of spent fuel shipments, and 4) complying with regulatory standards for thermal performance during transportation and storage.

To resolve thermal-loading issues while meeting these objectives will require multi-year, in-situ, thermal-loading tests, studies, and analyses. To wait for final resolution before proceeding with system design would mean delaying preparation of the environmental impact statement, procurement of the multi-purpose canister system, and repository design—deferring the target date for a license application by as much as a decade. To maintain the target date, in Fiscal Year 1994 we adopted a phased approach to resolving this issue. Initially, we will consider using a low repository thermal load when we submit our license application for authorization to construct the repository. This approach will serve to advance design work in the near term. By adopting flexible designs and operating parameters for the repository and waste package, we will also preserve opportunities to evaluate data from long-term field tests and to assess the impact of increasing the heat load in the repository before it is licensed for operation.

If the Secretary decides to proceed to full-scale deployment of the multi-purpose canister system, this design approach will support the 1997 Record of Decision that accompanies the final environmental impact statement for this decision. This design approach will also be used in the evaluation of site suitability to be completed by the end of Fiscal Year 1998 and, if we proceed to licensing, in the 2001 license application. In this latter case, higher thermal loads will be considered and evaluated against data gained from testing to determine how they could affect repository performance. If appropriate, a new thermal design and new operating parameters will be developed to support the license application update in 2008. Confirmatory testing will assess

the actual thermal effects of the emplaced waste packages and ensure that the repository is operating safely.

Using Planning To Define and Advance the Program

The key components of OCRWM's planning process are strategic planning; development of a comprehensive, multi-year program plan for the work conducted by the Headquarters management center and the two business centers (the Waste Acceptance, Storage, and Transportation Project and the Yucca Mountain Site Characterization Project); establishment of program-level and project-level technical, schedule, and cost baselines; and formulation of annual work plans.

The planning process provides the basis for determining, prioritizing, and allocating program resources; defining, costing, and executing work scope and schedules; and monitoring, analyzing, and improving program performance. In this last area, the strategic planning process drives our progress, providing senior managers with opportunities to continuously and collectively address the technical, managerial, and institutional challenges of program implementation. It is designed to support the formulation and—as conditions evolve—reformulation of program goals and the strategies for achieving them. Increasingly, OCRWM conducts its planning in consultation with stakeholders, and under the close scrutiny of oversight bodies.

In the fall of 1993, at the direction of the Secretary, OCRWM's Director initiated a comprehensive assessment of the program. In conjunction with the strategic planning process, he conducted a major review and realignment of the program's strategic direction, seeking the views of Congress and the Administration during deliberations on the Fiscal Year 1995 budget and consulting with oversight, regulatory, and technical review organizations, our stakeholder community, and Department of Energy senior managers. Program managers and staff met a number of times to consider how these diverse opinions

could be shaped into a viable strategy. From these meetings, and subsequent feedback, emerged the program approach and initiatives supporting it, which included:

- Reaffirming the program's mission, developing a vision statement, and defining goals to guide program direction.
- Realigning Headquarters and project organizations, including contractors, to focus on the program's primary business centers and to better leverage technical and managerial expertise and gain greater structural and procedural efficiencies.
- Describing, at a summary level for each business center, the technical work scope and schedule to be completed under existing and expected funding levels.
- Drafting a preliminary strategic plan that articulates the program-wide effects of our program approach.
- Drafting a comprehensive, multi-year program plan that embodies our new approach and implements our strategic plan. This three-volume document provides an overview of the program and defines business center and program management activities and milestones. In addition to serving as a management tool, it provides external parties with a clear and detailed understanding of our work and the measures of our progress.

Formulating the Budget

Costing out the new program approach

In keeping with the requirements of the Federal budget process, during Fiscal Year 1994 we were engaged in budget activities for three consecutive years: executing the Fiscal Year 1994 appropriations, developing the Fiscal Year 1995 congressional budget submittal, and formulating the Fiscal Year 1996 budget submittal to the Office of Management and Budget. The impact of the new program approach on this process was particularly acute during early 1994. To move the program forward, we had to define and assign

adequate levels of support for near- and intermediate-term activities. And we had to maintain substantial funding for the many nondiscretionary activities mandated by statute and regulation, such as financial assistance to affected parties, our quality assurance program, interactions with regulatory and oversight bodies, and other essential management functions.

Although it was widely understood that our new program approach required substantially more funding, our budget has been subject to Departmental and overall Federal discretionary spending caps. Although the Nuclear Waste Fund is derived from fees paid by utility ratepayers, not taxpayers, our budget is part of the Department of Energy budget. OCRWM therefore has had to compete with other offices within the Department and with other Federal programs for the funds that are available under the Budget Enforcement Act and the Balanced Budget and Emergency Deficit Control Act, legislation intended to limit the growth of the Federal deficit. Because OCRWM's funding has been categorized as discretionary, any increases have had to be offset by revenue increases or spending decreases in other programs. Historically, this fact had constrained the program from making the progress expected of it.

In costing out the new program approach, we did not want to constrain the scientific and technical work essential to meeting key milestones. However, constrained funding affected how work was sequenced and levels of support for certain activities, such as internal document review cycles. As a result, we developed the funding levels supporting the new program approach through an iterative process conducted in parallel with our formulation of technical work scope. In a mark of the greater openness in our program, we held two meetings in Febru-

ary 1994 to brief stakeholders on our Fiscal Year 1995 budget proposal.

We completed this task in time for our Fiscal Year 1995 budget submittal to the Office of Management and Budget. That budget was subsequently supported by the Congress, in that OCRWM's Fiscal Year 1995 appropriation was within \$10 million of the amount requested. A breakout of the Fiscal Year 1995 appropriation is shown in Table 3-1.

The need for continued adequate funding

The success of our program approach will depend in large measure upon the continued availability of adequate funding. To gain access to adequate and predictable levels of long-term funding from the Nuclear Waste Fund, in Fiscal Year 1994 the

Table 3-1
Program Appropriations
(Dollars in Millions)

	FY 1993	FY 1994	FY 1995
Yucca Mountain Site Characterization Project	\$244.7	\$259.5	\$375.3
Waste Acceptance, Storage, and Transportation Project	39.7	31.9	57.0
Quality Assurance, Program Management, Systems Integration, and Compliance	90.7	88.6	89.9
Total appropriated (new budget authority)	\$375.1	\$380.0	\$522.2

Administration proposed legislative language that would have established a mandatory appropriation from the Nuclear Waste Fund. This proposal was submitted in recognition of the fact that Congress, in passing the Nuclear Waste Policy Act of 1982, intended the Civilian Radioactive Waste Management Program to be self-financing. For that reason, we believe that the civilian portion of the program, which is supported by utility fee payments into the Nuclear Waste Fund, should be outside the competition for taxpayer dollars. Although Congress did not act on this legislative proposal during Fiscal Year 1994, we continue to believe that a funding mechanism is needed that reflects the original intent of the Congress and allows the program to progress in line with the new program approach supported by Congress in its action on the Fiscal Year 1995 appropriation.

Office of Civilian Radioactive Waste Management organization chart

Realigning Our Resources

OCRWM's Federal staff and the organizations that support OCRWM together hold the store of knowledge and expertise on which our work rests. Accordingly, one of our strategic goals is to make more effective use of our own human resources and of the support organizations on which we rely.

Restructuring the organization

In 1994, as a consequence of the Secretary's strategic initiatives and our own strategic planning process, OCRWM's Director restructured the organization to make it more task-oriented, efficient, and open. The resulting organization, depicted in the Figure below, was implemented on July 10, 1994. It organizes program resources under two business centers, the Yucca Mountain Site Characterization Project and the Waste Acceptance, Storage and Transportation Project;

and a Headquarters management center. The management center includes the Office of Quality Assurance, the Office of Human Resources and Administration, and the Office of Program Management and Integration. The Office of the Director defines overall policy and direction for the program.

This restructuring flattened the organization, decreasing the number of subordinate offices, and increasing the employee-to-supervisor ratio from three to one, to approximately seven to one. The reorganization served to:

- Provide clear lines of responsibility, authority, and accountability.
- Assign authority at organizational levels where the work is managed.
- Fully integrate all program activities across organizational and geographic divisions.

Proposed contractor structure

- Streamline the organization and eliminate middle-management positions.
- Clarify the roles and responsibilities of Headquarters and the business centers.
- Reduce duplication of effort.
- Improve our ability to achieve objectives by employing a team approach.

As of September 30, 1994, OCRWM employed 221 Federal staff, of whom 130 were stationed at Headquarters and 91 at the Yucca Mountain Site Characterization Office. In addition, support to OCRWM was provided by 22 Federal full-time equivalents (FTEs) at Headquarters and 11 Federal FTEs at Department of Energy Operations Offices. Support was also provided by approximately 200 employees of the U.S. Geological Survey, several hundred employees of the National Laboratories, and approximately 2,600 contractor staff. In further support of new program priorities, in Fiscal Year 1996, 35 new Federal positions will be assigned to the two

business centers, and some positions from the management center will be relocated to the Yucca Mountain Site Characterization Project.

Restructuring contractual relationships and focusing management support

The original purpose of acquiring expert technical and scientific service organizations to support the Federal work force has had the unintended consequence of creating a fragmented, costly, and unwieldy contractor structure. By restructuring the relationships among our contractors and other program participants, such as the National Laboratories, we are gaining greater control of these valuable resources. Optimizing our use of contractors also frees our Federal staff to exercise those management and control functions reserved for Federal employees, and it gives us the full benefit of our contractors' abilities.

The major feature of this restructuring has been the consolidation of work performed by multiple contractors under our management and

operating contractor. This has eliminated some contractors and linked other participants via teaming agreements and other mechanisms. As of October 1, 1994, the total number of program participants had been reduced by 40 percent, from 44 at the time OCRWM's management and operating contract was awarded, to 25. Additional consolidation under the management and operating contractor's technical direction will be completed in 1995 and 1996. Delegating accountability for day-to-day performance to the management and operating contractor and reducing the number of program participants has, in turn, reduced the number of interfaces we must manage, freeing OCRWM staff to focus on critical program and project management issues, strategic planning, and policy implementation.

Another key area of restructuring has been management support. Management and technical support services are currently provided by several different contractors. We plan to award a single contract to consolidate these services. The contract should be in place in Calendar Year 1996.

Enhancing human resources

In Fiscal Year 1994 OCRWM's management center was charged with increasing emphasis on OCRWM's total quality management program and developing a customer service program. The philosophy of total quality management and customer service, and of continuous improvement, established in the Secretary's Strategic Plan, was incorporated into the strategic plan we developed in 1994. We also adopted the Department's core values, including customer-orientation, commitment to excellence, teamwork, respect for the environment, empowerment, ethical behavior, and the conviction that the people who work in support of the Department are its most valuable resource.

In Fiscal Year 1994 OCRWM undertook several initiatives to enhance its human resources. These initiatives serve our own immediate objectives. By reducing levels of management and by assigning employees greater accountability and a greater stake in decisions, we believe we can empower them to use their talents and abilities more fully to directly advance OCRWM's mission. The initiatives also carry out the Department's

commitment to create a more productive and rewarding work environment, to align the skills and expertise of employees with Departmental priorities, to create opportunities for career development, and to increase diversification of the work force in order to gain the benefit of new thinking and perspectives. Total quality management and customer service training programs in Fiscal Year 1995 will further these objectives.

Our efforts to involve OCRWM staff more actively in program decision-making directly improved the decisions that led to the recent reorganization. Related efforts to make the decision process more explicit, visible, and open to all interested parties, so that they can more easily contribute to it, should yield similar benefits. And we are encouraging more work force collaboration program-wide.

In Fiscal Year 1994 we began work to establish a career development program tailored to individual employee needs. When the program is implemented in Fiscal Year 1995, it will provide more opportunities for training, temporary assignments, mentorships, and other personnel-development initiatives.

Managing Information Resources

OCRWM's program is information-intensive, involving large volumes of information, some of which is subject to frequent change. Managing this information demands a pragmatic understanding of user needs and a sophisticated command of the latest technology in what is a fast-moving field.

Over the past decade OCRWM has emerged as a leader in information resource management, looked to by other offices within the Department and other Federal agencies for its skills. In Fiscal Year 1994 OCRWM demonstrated its information systems at the Department-wide 1994 Information Technology Conference in Chicago, and it has presented similar demonstrations to the Treasury Department and the Nuclear Regulatory Commission. OCRWM has been an active participant in the Department's Information Management Planning and Architecture Coordination Team and in related Departmental planning efforts.

The purpose of our information systems is to support vital communication among program participants, and between OCRWM and its regulators, its oversight bodies, its stakeholders, and the public. Fiscal Year 1994 saw greater reliance on our local and wide area networks, as more and more users at OCRWM Headquarters, the Yucca Mountain Site Characterization Office, and contractor organizations shared files and other data electronically. Reliance on videoconferencing for communication within the program and with our stakeholders also grew. We now use this technology in our quarterly meetings with the State of Nevada and affected units of local government.

Planning for improved information management systems

The National Performance Review conducted as part of the Administration's initiative on reinventing government found that a key to streamlining government and improving its efficiency is the strategic application of information technologies. To ensure that OCRWM's substantial investments in information technology contribute directly to key mission strategies, in Fiscal Year 1994 we established the policies and objectives, defined the responsibilities and authorities, and laid the groundwork for an improved structure for managing information. These initiatives support an intensive, program-wide planning effort implemented in Fiscal Year 1995.

In Fiscal Year 1994 we designed an information resources management performance assessment and improvement program. Scheduled for implementation in Fiscal Year 1995, it will help us measure our practices against "best-in-class" information resource management standards.

To ensure that information systems are securely anchored in management functions, we established an information management architecture that serves as the foundation upon which all information, data, and information systems are defined, organized, developed, accessed, maintained, and managed. This approach facilitates program-wide information management planning; it provides a mechanism for ensuring, measuring, and articulating how information technologies

can support our mission; and it supports the development of useful information systems.

Tailoring systems to user needs

Using this tool, we have created several information management systems to enhance staff productivity. For example, to respond more quickly to people who write to us, we have designed an electronic tracking system to manage controlled correspondence. It will result in a paperless controlled-correspondence process in Fiscal Year 1995. Other systems include a policy-position and source-materials database that supports preparation of documents that reference current policy, a regulatory tracking system that helps us honor our commitments to the Nuclear Regulatory Commission, and an integrated tracking system that helps us manage action items program-wide.

We are also working to capture, index, image, and store records generated by program activities, in particular, those records needed to support a license application to the Nuclear Regulatory Commission. (The Licensing Support System is discussed in Chapter 1.) In mid-1994 we launched a Licensing Data Management System to transform the current microfilm-based records system into an image-based system. This change will strengthen records processing, storage, and retrieval capabilities; reduce the number of personnel required to perform these functions; and thus cut costs.

Taken together, these information management initiatives point toward a future in which program participants are linked in a seamless network that enables them to readily access information, shape it to their needs, and share it widely—with an ease and efficiency that will benefit all parties with a stake in the waste management system.

Rebaselining the Program

The long-term, complex, and costly nature of OCRWM's program requires management controls that are rigorous enough to ensure control, yet flexible enough to accommodate

Major Program Milestones

inevitable change. The functions of planning and budgeting, described above, converge in the baselining activities that enable managers to both exercise control and adapt to change.

The baselining process

OCRWM uses a set of “baselines” to describe, in detail, the planning elements of the waste management system and the relationships among them. The program technical baseline consists of a hierarchy of several documents at the program, project, and contractor levels that explicitly identify the requirements for meeting all program technical objectives. Similarly, the schedule baseline sequences interdependent activities, milestones, and events at each of these levels to meet all the technical requirements embodied in the program technical baseline. The program cost baseline identifies the funding needed to perform the technical work scope in accordance with schedule baseline milestone dates. The cost and schedule baselines are combined in a single document at the program level. Collectively, these baselines establish a multi-year standard for measuring program performance.

Once the technical, schedule, and cost requirements are defined at the program level, a time-phased, multi-year baseline is developed. This program-level baseline serves as the basis for

dividing the technical work scope, schedule milestone target dates, and resource requirements into fiscal year increments. The cost and schedule baseline for the current fiscal year is the most detailed and is established at the levels where work is performed and performance is measured. Subsequent fiscal years are defined at appropriate planning levels, with out-year planning at a more summary level than near-term planning. Prior to the beginning of the current fiscal year, detailed annual work plans are developed at the contractor, project, and program levels, and performance measures are identified. These detailed work plans establish the monthly planned expenditures and milestone dates for the organizations performing the work. When approved, these annual work plans become the basis for establishing the performance measurement baseline that is used for monitoring and evaluating the performance of contractors, the projects, and the program during the year.

Baselining the new program approach to site characterization

During Fiscal Year 1994 OCRWM’s new program approach to site characterization and the proposed multi-purpose canister initiative led to the realignment of available resources and modification of program requirements. We revised the Fiscal Year 1994 performance measurement

baseline to reflect these changes. We also completed the detailed annual work planning required to establish the Fiscal Year 1995 performance measurement baseline that supports the objectives of the program approach.

In October 1994 OCRWM's Program Change Control Board formally adopted the new program approach to site characterization, authorized its implementation, and directed that appropriate documents be revised to establish program-level technical, schedule, and cost baselines for the new approach. The point of departure for the rebaselining effort is OCRWM's program plan, issued in December 1994. The program-level technical, schedule, and cost baseline multi-year targets established in the program plan became the basis for developing multi-year baselines by fiscal year increment.

The Yucca Mountain Site Characterization Project planning basis was revised accordingly, to reflect redirection of resources toward achieving key program-level baseline milestones: 1) evaluation of technical site suitability by the end of Fiscal Year 1998, 2) preparation of the draft environmental impact statement by the end of Fiscal Year 1998, and of the final statement in 2000, and 3) submittal of the license application in 2001. The new planning basis reflects the interim program-level schedule and cost baseline for the Yucca Mountain Site Characterization Project based on the new funding profile established in the program plan.

Baselining the multi-purpose canister system

The decision to propose a multi-purpose canister system for the waste management system resulted in major changes that cascaded through a hierarchy of program and project documents. The program and project technical baselines were revised; the project schedule baseline was modified to reflect the work required to make multi-purpose canisters available in 1998; and the project cost baseline was updated to reflect changes in work scope, as well as revised schedules for all activities.

With no interim storage facility on the horizon, and as the Department had proposed to develop multi-purpose canisters suitable for

temporary storage of spent fuel, the Monitored Retrievable Storage Project was redesignated the Waste Acceptance, Storage, and Transportation Project. Project documentation was also modified to reflect termination of work on the BR-100 rail transportation cask, which was superseded by the multi-purpose canister system.

Reestablishing a multi-year program baseline

As a result of past underfunding of the program and schedule delays, a multi-year program baseline could not be fully defined and was difficult to keep current. In Fiscal Year 1994 OCRWM undertook a major initiative to begin revising its "out-year" technical, cost, and schedule requirements, by establishing a Program Cost and Schedule Baseline transition schedule to ensure that rebaselining proceeds as planned. A new Program Cost and Schedule Baseline reflecting the new program approach is scheduled for submittal to the Program Baseline Change Control Board in late 1995.

Realistic, multi-year technical, schedule, and cost baselines, supported by schedule networks integrated across the program, promise to serve as valuable management tools that will help us—and Congress, oversight bodies, and our stakeholders—better measure our progress.

Strengthening other management controls

To further strengthen our control of the program, in Fiscal Year 1994 we clarified the roles and responsibilities of the program and project baseline change control boards, which ensure that only changes that receive formal board approval are incorporated into the technical, cost, and schedule baselines. To enable OCRWM managers to more effectively monitor performance against annual work plans, we adopted a standardized performance measurement system for all components of the program. The system will also serve as a tool for ensuring that multi-year cost and schedule baselines, once reestablished, are consistently maintained. Also, we initiated bi-monthly, program-wide Director's Program Review meetings in which program progress against schedule and cost targets is reviewed in detail. These meetings are open to the public.

Chapter Four

Working with External Parties

For the Civilian Radioactive Waste Management Program to succeed, we must earn public confidence in the scientific integrity of our work, the fairness of the process by which we carry out our work, and the importance of that work. Recognizing the controversial and unprecedented nature of the program, Congress provided for extensive review, regulation, and oversight. Moreover, many of the program's stakeholders participate actively in our work. The result is a program that is among the most closely scrutinized in the Federal Government.

Our interactions with external parties are discussed throughout this report, and, in a few instances, the information below is necessarily similar to that in other chapters. This consolidated overview is intended to convey the breadth and depth of the scrutiny we receive and to indicate a few highlights of Fiscal Year 1994 activities.

Review, Regulation, and Oversight

The list of external parties that play a role in the program is lengthy and reflects diverse and often conflicting interests. It includes Congress; Federal regulatory and other oversight agencies; utilities, public utility commissions, and utility industry groups; the State of Nevada and units of local government affected by characterization of the Yucca Mountain site; Indian Tribal organizations; labor unions; environmental and other public interest groups and local citizens' groups; potential transportation corridor states; and still other parties.

- Foremost among the parties exercising oversight is the Congress, which monitors our progress, appropriates funding, and defines the statutory basis of the program.
- The General Accounting Office, an arm of Congress, has been auditing our program for many years. In September 1994 it issued a report calling for a comprehensive review of the program. We believe that such a review would delay our progress and that a wealth of insight has already been generated by our own extensive consultations with stakeholders and review by other external bodies. The independent management and financial review directed by the Secretary, described below, is also likely to contribute valuable insights into how we can further improve program performance.
- Within the Department, OCRWM is subject to a variety of policy, management, and budget controls. Additionally, in Fiscal Year 1993 the Secretary called for an independent financial and management review of the Yucca Mountain Site Characterization Project to develop long-term recommendations. The review covers financial and business management techniques, schedule and the credibility of milestones, contracting practices, internal planning processes, and organizational effectiveness. The review process was initiated during Fiscal Year 1994; recommendations are due in Fiscal Year 1995.
- The Department's Inspector General conducts frequent audits of the program. A June 1994 report, *Audit of Costs and Management of the Yucca Mountain Project*, recommended greater Federal control of the project and a stronger role for the Project Office. Our restructuring of

the Yucca Mountain Site Characterization Office and restructuring of contractor relationships has achieved the intent of the recommendations.

- The Nuclear Waste Policy Act provides for the Nuclear Regulatory Commission to license the repository and certify designs related to storage and transportation of spent nuclear fuel and high-level radioactive waste. In Fiscal Year 1994 prelicensing interactions between us continued to generate a steady stream of issues that we are working jointly to resolve.
- As directed by Congress in the Energy Policy Act of 1992, the Environmental Protection Agency is revising its high-level waste disposal standard for radiological releases from a repository. Other Agency regulations protecting air and water quality are delegated to the State of Nevada, which enforces them. Our Fiscal Year 1994 activities were in compliance.
- The Nuclear Waste Technical Review Board was created by Congress to review our technical and scientific work. The Board has made many constructive recommendations that we have adopted, and it has been foremost in urging us to accelerate our underground studies.
- We turn to the National Academy of Sciences for peer review. In Fiscal Year 1994 following a period of public comment, we chose to have the Academy manage the peer review process that will support the evaluation of whether the Yucca Mountain site is technically suitable for a repository.
- Pursuant to the Nuclear Waste Policy Act, the State of Nevada and 10 affected units of local

government oversee our work and to receive the funding that will enable them to exercise such oversight. The State has historically opposed OCRWM's site characterization activities at Yucca Mountain, and it conducts an oversight program of considerable technical sophistication. Local governments hold more varied views. They, too, engage in oversight activities.

Review, Regulation, and Oversight

- Utilities that signed OCRWM's Standard Contract, which was promulgated as a regulation in 1983 and executed between the owners and generators of spent nuclear fuel and the Department, hold a legal right to have the Federal Government take title to, and remove, their spent fuel. They follow the program closely and work to shape it.

- The Department of Transportation will regulate OCRWM's highway shipments

of spent fuel and high-level radioactive waste, and we are designing our transportation program to comply with its regulations.

- Transportation interest groups, including parties who have entered into cooperative agreements with us, have been active in shaping OCRWM's nationwide transportation system.
- The Federal Occupational Safety and Health Administration, through its State of Nevada counterpart, oversees work force safety at the Yucca Mountain site.
- Still other parties, including environmental groups and scientific and professional organizations, examine our work, as do national and local media.

Working with Stakeholders

Active stakeholder involvement is crucial to earning confidence in our work, and, to be effective, the forms that this involvement takes must serve the needs of both stakeholders and OCRWM. Since OCRWM was created in 1983, we have steadily expanded our interactions with stakeholders, and in our recent reorganization we purposely decentralized this function so that they can interact directly with program staff responsible for the issues of concern. Our interactions are designed to keep stakeholders informed and to involve them early on in shaping decisions that affect them. In Fiscal Year 1994 we began to draft a Public Involvement Plan that offers guidance, policy, and procedures for involving stakeholders in the decision-making process. We will issue it for comment in 1995 and will revise it appropriately, so that it responds to stakeholders' concerns and needs.

Fiscal Year 1994 was marked by intensive efforts to involve stakeholders in program development and decision-making, and some of our interactions on particular issues are referenced elsewhere in this report. A few of these efforts, and efforts that served a larger public, included the following:

- **Open meeting policy** - In October 1993 we established a policy that opens all program meetings to the public, with the exception of executive committee and staff meetings. Our purpose is to provide stakeholders with the earliest possible access to planning and decision-making that affect them.
- **OCRWM Calendar** - We continued to distribute a monthly calendar that identifies meetings that are open to the public and meetings providing opportunities for public participation. The calendar also identifies meetings that are videoconferenced, so that stakeholders can participate in them without extensive travel.
- **National stakeholder meetings** - We conducted public meetings to solicit stakeholder comments on a wide variety of issues and program activities. Examples are:
 - A second workshop, held in November 1993 in Washington, D.C., on the multi-purpose canister conceptual design.
 - Two meetings in February 1994 to brief stakeholders on OCRWM's Fiscal Year 1995 congressional budget request.
 - A May 1994 meeting in Las Vegas, Nevada, to update stakeholders on site characterization activities and to discuss the proposed process for evaluating the technical suitability of the Yucca Mountain site.
 - An information workshop and Yucca Mountain site tour for more than 80 Native American Tribal representatives.
 - Two August 1994 meetings to discuss the proposed process for evaluating the technical suitability of the Yucca Mountain site and to receive comments on the process.
 - Three public forums to identify and discuss issues related to radioactive waste transportation. OCRWM's Transportation Coordination Group meeting in June 1994 drew more than 150 participants representing utilities; State, county, and Tribal governments; vendors; and regulatory agencies. In January and June, the Department of Energy sponsored two meetings of the Transportation External Coordination Working Group, a joint effort of four Department offices representing 10 programs engaged in radioactive waste transportation activities, and organizations representing 31 State, Tribal, local, and industry organizations.

As described in Chapter 1, the Yucca Mountain Site Characterization Office engaged in extensive interactions with the State of Nevada, affected units of local government, and other stakeholders to keep them informed of project progress.

Cooperative agreements

Cooperative agreements provide a funding mechanism to ensure that we have the benefit of interested national, regional, and State organizations' participation in the program. We have entered into these agreements with the following organizations:

- National Association of Regulatory Utility Commissioners
- National Congress of American Indians
- National Conference of State Legislatures
- League of Women Voters
- Western Interstate Energy Board
- Council of State Governments (both the Midwest Office and the Eastern Regional Conference)
- Commercial Vehicle Safety Alliance
- Southern States Energy Board
- Council of Radiation Control Program Directors, Inc.

We met with members of these groups on many occasions throughout Fiscal Year 1994 to discuss such topics as our new program approach, funding levels, National Environmental Policy Act requirements, and transportation issues, and to respond to their concerns.

Outreach and public information

So that the public can more readily and easily obtain timely information about OCRWM's program, we worked in Fiscal Year 1994 to strengthen the following public information efforts:

- OCRWM National Information Center — The Center's information specialists continued to provide information about the program to the general public through a toll-free number staffed from 9:00 a.m. to 7:00 p.m. (Eastern time) Monday through Friday. The Center serves as a clearinghouse for program fact sheets, brochures, program publications, educational materials, exhibits, and videotapes. During Fiscal Year 1994 the Center handled more than 8,500 inquiries from callers in 50 States and 33 countries. It distributed more than 381,000 copies of OCRWM publications and more than 1,600 copies of informational videos about OCRWM's program.
- Participation in technical and scientific conferences — In collaboration with a number of national and international scientific and technical organizations, we participate in professional seminars and conferences on radioactive waste management. The most

prominent is a major international conference on high-level waste held annually in Las Vegas, Nevada. The May 1994 conference attracted more than 1,000 scientists, engineers, and other professionals to approximately 90 technical and plenary sessions.

- INFOLINK — This interactive database provides access to an array of program information for individuals and institutions who hold accounts with the network. Users can review and order information products and communicate with other users. News releases, speeches, technical papers, congressional testimony, the *OCRWM Bulletin*, fact sheets, and other program publications are available. In Fiscal Year 1994, 23,000 documents were distributed through this service to the more than 500 individuals and institutions who held accounts.
- The *OCRWM Bulletin* — This quarterly newsletter reports on program developments. It was distributed to more than 8,900 parties in Fiscal Year 1994.

Yucca Mountain outreach activities

The Yucca Mountain Site Characterization Office conducts a comprehensive public outreach program intended for residents of Nevada but open to all other members of the public, as well. In Fiscal Year 1994 it reached thousands of people through:

- Three Science Centers in Beatty, Las Vegas, and Pahrump, Nevada, which drew 18,600 visitors.
- Two hundred and twenty public tours to the Yucca Mountain site, involving 6,200 visitors.
- More than 380 presentations on the site characterization project, made to civic, educational, business and professional groups, and students—a total of more than 23,600 people.
- Various educational activities, including workshops for students and teachers, grades kindergarten through 12.
- Transportable exhibits displayed at 44 public events in Nevada and 12 technical conferences around the nation.
- More than 1,400 responses to requests for information from external parties.

Chapter Five

Financial Management

Our primary financial responsibility is managing our program's two principal sources of funding: the Nuclear Waste Fund (NWF) and the Defense Nuclear Waste Disposal appropriation. Although funds from these sources are recorded in separate internal accounts because they reflect separate congressional appropriations, they are consolidated in the financial statements. In this chapter, when it is important to the meaning of the text, Nuclear Waste Fund or Defense Nuclear Waste Disposal appropriation monies are specifically identified. Otherwise, program funding is aggregated. Table 5-1 on the following page shows the status of program revenues as of September 30, 1994.

Sources of Program Funding

Ratepayer dollars for civilian waste

The Nuclear Waste Fund accounts for monies received and expenditures made toward eventual disposal of civilian spent nuclear fuel. A separate account in the U.S. Treasury, it segregates nuclear waste disposal revenues and expenditures from other Government accounts. It was established by the Nuclear Waste Policy Act, which requires that all costs of the waste management system be recovered through fees charged to generators and owners of spent nuclear fuel and high-level radioactive waste. Nearly all the commercial spent fuel to be disposed of is owned by utilities that operate nuclear power plants, and it is their ratepayers who ultimately pay for disposal.

Two kinds of fees are levied on the owners and generators of spent nuclear fuel. The fees are defined in the Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste, which was promulgated as a regulation in 1983 and executed between the owners and generators of

OCRWM income stream versus appropriations*

spent nuclear fuel and the Department. The first fee is a one-time fee for all nuclear electricity generated and sold prior to April 7, 1983. The Standard Contract allowed spent nuclear fuel owners to pay the one-time fee immediately or to defer payment and incur interest. The second fee is an ongoing fee of 1.0 mill (one tenth of one cent) per kilowatt-hour on nuclear electricity generated and sold after that date. Utilities make quarterly payments of the ongoing fee into the Nuclear Waste Fund.

Through the end of Fiscal Year 1994 the Fund had accrued revenues of \$10.767 billion, including interest, of which \$4.100 billion had been expended. In Fiscal Year 1994 the Fund accrued total revenues of \$1.012 billion, compared to \$958 million in Fiscal Year 1993. Fiscal Year 1994 civilian revenues include \$572 million in quarterly kilowatt-hour fees, \$66 million in interest on and adjustments to one-time fees, and \$373 million in investment earnings. On September 30, 1994, the book value of Nuclear Waste Fund investments was approximately \$4.606 billion, as compared to \$4.178 billion at the end of Fiscal Year 1993.

The money in the Nuclear Waste Fund can be expended only after Congress has appropriated it. For Fiscal Years 1993 and 1994 Congress appropriated \$275 million and \$260 million, respectively, from the Nuclear Waste Fund for the Civilian Radioactive Waste Management Program.

Managing the Nuclear Waste Fund includes receiving and verifying payments, accounting for revenues and expenses, developing estimates of total-system life cycle costs, analyzing the adequacy of the fee charged to the owners and generators of the wastes OCRWM will dispose of, arranging for independent audits of the Nuclear Waste Fund, and investing funds to meet long-term program needs. Monies in excess of those required to cover current program costs are invested in U.S. Treasury securities.

Table 5-1
Status of Program Revenues as of September 30, 1994
(Dollars in Millions)

Cumulative Revenues	Civilian Fee Payments into NWF*	NWF Investment Earnings	Defense Payments*		Total
			Into NWF	Appropriated	
Accrued	\$8,668	\$2,099	\$897		\$11,664
Realized	\$6,669	\$2,004	\$12**	\$214**	\$8,901
Unrealized	\$1,999	\$95	\$671		\$2,763

* Includes interest on unrealized amounts

** Beginning with Fiscal Year 1993 Congress established a Defense Nuclear Waste Disposal appropriation in lieu of direct payment into the NWF.

Taxpayer dollars for defense wastes

In 1985 the President issued a decision that the high-level radioactive wastes resulting from the Department's atomic energy defense activities may be disposed of in the same repository as spent nuclear fuel from civilian reactors, with each party paying its own full costs. To implement that decision, a methodology for allocating the costs for defense-related waste was developed through public rulemaking and published in an August 1987 *Federal Register* notice. As of September 30, 1994, computed by this cost allocation methodology, the accrued but unpaid portion of program costs for which the Department's Office of Environmental Management is responsible, including accrued interest, totaled approximately \$671 million. The defense waste disposal share of program costs was \$77 million during Fiscal Year 1994, plus \$25 million in accrued interest on prior balances.

We are developing a Memorandum of Agreement with the Office of Environmental Management to govern arrangements for the disposal of defense waste. The agreement will outline the responsibilities of the parties, specify procedures for identifying wastes for disposal, assign fees by waste types, and establish payment schedules.

The Office of Environmental Management made payments of \$5 million and \$7.5 million into the Nuclear Waste Fund in Fiscal Years 1991 and 1992, respectively. Beginning with Fiscal Year 1993 Congress established a Defense Nuclear Waste Disposal appropriation in lieu of direct payment by the Department into the Nuclear Waste Fund. For Fiscal Years 1993 and 1994

Congress appropriated \$100 million and \$120 million, respectively, toward the Federal Government's share of the cost of the waste disposal system.

Expenditures

As explained in Chapter 3 of this report, expenditures from the Nuclear Waste Fund and the Defense Nuclear Waste Disposal appropriation are subject to the Federal budget process, with new obligations limited to the funds appropriated by Congress for that year, plus unobligated prior-year balances. Consequently, although the Nuclear Waste Fund consists of ratepayer, not taxpayer, dollars, the same controls exercised on Federal tax dollars are applied to expenditures from the Fund.

As shown in Table 5-1, total accrued revenues as of September 30, 1994, were \$11.664 billion. Program costs to date total \$4.326 billion, leaving a balance as of September 30, 1994, of \$7.338 billion in deferred fee and investment revenue. The program's total appropriations from the Nuclear Waste Fund and the Defense Nuclear Waste Disposal appropriation were \$380 million in Fiscal Year 1994 and \$375 million in Fiscal Year 1993.

The statements of the financial position of the Nuclear Waste Fund and Defense Nuclear Waste Disposal revenues and expenditures for Fiscal Year 1994 and the report of OCRWM's independent auditors are presented at Appendix A.

Civilian Radioactive Waste Research and Development Account

The Office of Civilian Radioactive Waste Management also administers the Civilian Radioactive Waste Research and Development account. Like the Defense Nuclear Waste Disposal appropriation, this account consists of appropriations from general taxpayer revenues. It is used to carry out generic research, development, and demonstration activities authorized by Title II of the Nuclear Waste Policy Act. The unaudited year-end statement of operations for this account is provided in Table 5-2.

Estimating Total-System Life Cycle Costs and Assessing Fee Adequacy

The Nuclear Waste Policy Act requires the Secretary to review annually the adequacy of the fee

charged to utilities and, if the fee is inadequate or excessive, to recommend to the Congress an adjustment to the fee to cover the total costs of the waste management system. Both total program costs and the timing of expenditures can affect the adequacy of the fee. For example, if the cost of a major component of the system rises, the fee might have to rise to cover it. However, this increase in cost could be offset by

Table 5-2 Civilian Radioactive Waste Research and Development Account Statement of Operations • Years ended September 30, 1994 and 1993 (Dollars in thousands • Unaudited)		
	1994	1993
Spent Fuel Storage and Development		
Operating Expenses	\$568	\$753
Plant and Capital Equipment	<u>0</u>	<u>0</u>
Subtotal	\$568	\$753
Program Management		
Operating Expenses	\$105	\$100
Plant and Capital Equipment	<u>0</u>	<u>0</u>
Subtotal	\$105	\$100
Totals		
Operating Expenses	\$673	\$853
Capital Equipment	<u>0</u>	<u>0</u>
Total Civilian Radioactive Waste Research and Development	\$673	\$853

deferring certain activities, thus reducing current expenditures and allowing investment income to rise. To support the fee adequacy review, we periodically estimate the total-system life cycle cost of the waste management system and then use cash-flow models to calculate the balance that would remain in the Nuclear Waste Fund at the end of the program.

The most recent total-system life cycle cost estimate was issued in December 1990. It was prepared to evaluate the impacts of the Nuclear Waste Policy Amendments Act of 1987 on program costs, and it provided estimates from the date of enactment of the Nuclear Waste Policy Act of 1982 through repository closure and decommissioning. Estimates ranged from \$25.6 billion to \$34.6 billion (in constant 1988 dollars), de-

pending on assumptions about the number of repositories and the projected quantities of spent nuclear fuel. The defense-waste share of the total-system cost was estimated to range from \$3.8 billion for a single-repository system to \$5.6 billion for a two-repository system in constant 1988 dollars—or roughly 15 percent of total program costs. Subsequent fee-adequacy assessments have been based on the 1990 estimate of total system cost. To date, no assessment has found a compelling reason to change the fee.

In Fiscal Year 1994 we began work on a new total-system life cycle cost estimate that will reflect the new program approach. A new fee-adequacy analysis based on the new total-system life cycle cost estimate is scheduled to be issued in Fiscal Year 1995.

APPENDIX A

Financial Statements

Prepared by KPMG Peat Marwick LLP

**UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE
WASTE MANAGEMENT
NUCLEAR WASTE FUND**

Financial Statements

September 30, 1994 and 1993

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Table of Contents

	<u>Page</u>
Overview	1-6
Independent Auditors' Report on Financial Statements	7
Statements of Financial Position	8
Statements of Operations	9
Statements of Cash Flows	10 - 11
Statements of Budget and Actual Expenses	12
Notes to Financial Statements	13 - 25
Independent Auditors' Report on Compliance with Laws and Regulations	26-27
Independent Auditors' Report on the Internal Control Structure	28-29

Overview

The mission of the Office of Civilian Radioactive Waste Management (OCRWM) is to manage and dispose of the Nation's spent nuclear fuel and high-level radioactive waste. The Office provides leadership in developing and implementing strategies that assure public and worker health and safety, protect the environment, merit public confidence, and are economically viable. OCRWM was established by the Nuclear Waste Policy Act (NWPA) of 1982, as amended, to dispose of spent nuclear fuel and high-level radioactive waste from commercial and defense activities in a permanent geologic repository. The Nuclear Waste Policy Amendments Act (NWPAA) of 1987 designated the Yucca Mountain, Nevada, site for detailed scientific investigation to evaluate the site's suitability for a geologic repository. The NWPAA also authorized the siting, construction, and operation of a monitored retrievable storage (MRS) facility, subject to certain conditions.

The Civilian Radioactive Waste Management Program will provide, under contracts executed between the Department and the owners and generators of spent nuclear fuel from civilian power reactors, nuclear waste storage and disposal services in return for the payment of fees into the Nuclear Waste Fund (NWF). In addition, it will provide disposal services, in return for the payment of fees by the Federal Government, for high-level radioactive waste from atomic energy defense activities.

During Fiscal Year 1994 the OCRWM organization was restructured. The new organization defined two "business centers"--the Yucca Mountain Site Characterization Project and the Waste Acceptance, Storage and Transportation Project (WAST)--and a management center for the program that provides integration and management support to the Director and the projects.

As of September 30, 1994, the Office of Civilian Radioactive Waste Management employed approximately 221 Federal staff. In addition, support to OCRWM was provided by 22 Federal full-time equivalents (FTEs) at Headquarters, 11 Federal FTEs at DOE Operations Offices and 2,616 contractor employees. OCRWM is comprised of five offices, as follows:

- Office of Quality Assurance, responsible for developing and overseeing compliance with a quality assurance (QA) program that meets the requirements of the Nuclear Regulatory Commission.
- Office of Human Resources and Administration, responsible for managing the NWF, managing business relations with the Program's management and operating contractor and support services contractors, developing and maintaining information systems, managing OCRWM's education and public information activities, and providing administrative support services.
- Office of Program Management and Integration, responsible for strategic and contingency planning, controlling the Program's schedule and cost, managing relations with waste management programs of other nations, coordinating the implementation of systems engineering activities, managing regulatory coordination efforts, and coordinating interactions with affected units of government, external oversight bodies and other stakeholders.

- Yucca Mountain Site Characterization Office, responsible for managing the scientific evaluations and studies necessary to determine the suitability of the Yucca Mountain candidate site for construction of a geologic repository, design of the waste package and the repository, managing the related National Environmental Policy Act (NEPA) process, and preparing the repository license application.
- Office of Waste Acceptance, Storage and Transportation, responsible for managing the waste acceptance process and development and deployment of the multi-purpose canister (MPC) subsystem and the transportation subsystem, supporting any viable interim storage siting initiatives, and managing the related NEPA process.

The Program is funded from three sources: the NWF, the Defense Nuclear Waste Disposal appropriation, and the Civilian Waste R&D appropriation. The financial statements cover work funded by the first two sources only.

The NWF was established by the NWPA. It consists of fees paid to Department of Energy (DOE) by the owners and generators of spent nuclear fuel. The Defense Nuclear Waste Disposal appropriation was established by the Congress as an alternative to direct payment by the Department into the NWF for the cost of disposing of high-level radioactive waste resulting from atomic energy defense activities, in accordance with the full cost recovery provisions of the NWPA, as amended. Funds in excess of those needed to pay Program costs are invested in U.S. Treasury securities. As of September 30, 1994, cumulative revenue from fees totaled approximately \$8.333 billion, and cumulative interest earnings and other revenue totaled approximately \$3.330 billion. Cumulative expenses, including direct appropriations from the NWF, the Nuclear Regulatory Commission, Office of the Nuclear Waste Negotiator and the Nuclear Waste Technical Review Board, totaled approximately \$4.326 billion. Funds from the Defense Nuclear Waste Disposal appropriation are not deposited into the NWF.

Limitations of the Financial Statements

The accompanying financial statements were prepared to report the financial position, results of operations, cash flows, and budget and actual expenses of the NWF and the Defense Nuclear Waste Disposal appropriation used for nuclear waste disposal activities, pursuant to requirements of the NWPA, as amended, and the Chief Financial Officers Act of 1990.

While the statements have been prepared from the books and records of the NWF and the Defense Nuclear Waste Disposal appropriation in accordance with the formats prescribed by the Office of Management and Budget, the statements are different from the financial reports used to monitor and control budgetary resources, which are prepared from the same books and records.

The statements should be read with the realization that they relate to the NWF and Defense Nuclear Waste Disposal appropriation used for nuclear waste disposal activities; that unfunded liabilities reported in the financial statements cannot be liquidated without the enactment of an appropriation; and that the payment of all liabilities, other than those resulting from contractual obligations, can be abrogated by the DOE.

Program Performance Measures

OCRWM's ability to meet major milestones in its Program Schedule Baseline has been significantly hampered by the unavailability of sufficient funding since 1991, when an independent cost-estimating team validated cost estimates for OCRWM's two projects -- the Yucca Mountain Site Characterization Project and the WAST (formerly the Monitored Retrievable Storage) Project. The Program Schedule Baseline was in the process of being revised and, therefore, in 1994, OCRWM measured its performance against major milestones in its Program Work Plan:

- In August 1994, one month ahead of schedule, a Safety Analysis Report for the GA-4 transportation casks was submitted to the Nuclear Regulatory Commission;
- In September 1994, testing of the tunnel-boring machine was initiated at the Yucca Mountain candidate repository site. This milestone, scheduled for August 1994, was delayed by review of health and safety issues;
- Completion of Phase I of the tunnel boring activity, scheduled for September 1994, was completed in November 1994; and
- Completion of the design of the Exploratory Studies Facility (ESF) North Ramp, scheduled for May 1994, was completed in January 1995, due to changes in the repository layout design, resolution of review comments, and QA deficiencies.

Other significant project-level accomplishments in FY 1994 included:

Yucca Mountain Site Characterization Project

- Creation of a Chief Scientist position, as recommended by a panel of the National Academy of Sciences - January 1994;
- Issuance of the initial summary report for repository and waste package advanced conceptual design - August 1994;
- Release of draft summary report on the site suitability process for public comment - August 1994.

Waste Acceptance, Storage, & Transportation (WAST) Project (formerly MRS Project)

- Issuance of a Notice of Inquiry requesting comments on the need for and development of an interim spent nuclear fuel storage facility - May 1994;
- Issuance of Request for Proposals for the acquisition of the MPC System - June 1994;
- Completion of a draft transportation plan - June 1994;
- Approval of the MPC System Conceptual Design Report - September 1994; and
- Issuance of the "Multi-Purpose Canister System Evaluation Report" (DOE/RW-0445) - September 1994.

OCRWM Program Approach

In Fiscal Year (FY) 1994, the Program was restructured to ensure that efficient, measurable progress toward determining the suitability of the Yucca Mountain candidate site for a permanent repository is made and, if the site is found suitable, that the Program is able to proceed with the environmental impact statement, site recommendation, and licensing and construction of a repository. A new Program Approach and a more realistic Program funding profile for the new Program Approach were developed, and the Congress expressed its support by providing a 37 percent increase in Program funding for FY 1995.

The OCRWM Program Approach supports the original intent of the Nuclear Waste Policy Act (NWPA) and the Nuclear Regulatory Commission (NRC) rule, 10 CFR Part 60, for a site characterization program that will provide sufficient information for decisions by the DOE on site suitability and site recommendation, and by the NRC on construction authorization. Decisions by the NRC with regard to licensing repository operations and authorizing repository closure would be supported by the knowledge gained after submittal of the License Application (LA) for construction authorization .

Performance Measures under the Program Approach include:

- Begin multi-purpose canister environment impact statement process - FY 1995.
- Begin repository environmental impact statement process - FY 1995.
- Following Departmental approval of the multi-purpose canister final environmental impact statement, publish the record of decision in the Federal Register - FY 1996.
- If the environmental impact statement record of decision supports fabrication and deployment of multi-purpose canisters, receive formal approval from the Department to proceed with the multi-purpose canister subsystem implementation and authorize the fabrication of multi-purpose canisters - FY 1997.
- Receive formal approval from the Department to deploy multi-purpose canisters to utilities for initial at reactor storage - FY 1998.
- Perform a technical site suitability evaluation for the Yucca Mountain site that is based on the record of technical and regulatory compliance assessments developed using the Program's suitability process - FY 1998.
- Distribute the draft repository environmental impact statement to begin the public comment period - FY 1998.
- Obtain authorization for follow-up procurement of multi-purpose canisters to continue deployment to utilities - FY 1999.
- Following Department approval of the repository final environmental impact statement, publish the record of decision in the Federal Register - FY 2000.
- Submit the site recommendation report to the President, if the site is determined to be suitable for repository development - FY 2000.
- Submit the repository license application to the Nuclear Regulatory Commission - FY 2001.

Financial Performance Measures

During Fiscal Year 1994, the NWF earned 6.8% from investments of intermediate-term Treasury securities. As of September 30, 1994, the book value of Treasury notes and bills was about \$4.6 billion, at a market value of \$4.4 billion. The Fund's total return, on a book value basis, was 8.9% for the last year, while its total return on the basis of market value was -3.8%. Nevertheless, the market value of the Fund continued to outperform the index of intermediate-term Treasury securities, which returned - 4.2% . Net income from investment activities in Fiscal Year 1994 was \$373 million, including \$299 million in interest earned on investments and \$74 million in gains from the sale of securities. The NWF adheres to sound financial management practices and strategies. Bills are paid in a timely manner, accounts receivable are properly managed, and sound internal controls are in place. In addition, reviews of the Fund are performed by both internal and external auditors.

DOE is required to receive fee payments, invest excess cash and make disbursements from the NWF in accordance with the requirements of the NWPA of 1982, as amended. As of September 30, 1994, two financial performance measures were used to evaluate Fund performance: (1) the amount of interest earnings lost as a result of untimely receipt of remittances from the owners and generators of spent nuclear fuel; and (2) excessive uninvested daily cash balances.

Timeliness of Receipts

A review of the timeliness of receipts by the NWF was performed with the following results:

Eight late payments were received during Fiscal Year 1994. Five of these late payments, totaling \$2,182,017, resulted in lost interest to the Fund. The total lost interest from these late payments was \$981. After reviewing the circumstances surrounding the late payments, the Contracting Officer determined that it was not appropriate to seek reimbursement for the lost interest.

The other three late payments, which totaled \$7,603,846, resulted in no lost interest to the Fund.

Uninvested Daily Cash Balances

Investments of excess funds of the NWF, i.e., quarterly fees, receipts from investment maturities and semi-annual interest collections from investments, were evaluated to determine if excess uninvested cash balances existed. The allowable cash balances are \$1,000 for Treasury notes and \$5,000 for Treasury bills. A review of the daily investment activities concluded that there were no occurrences of excessive uninvested daily cash balances.

Summary Findings

Sound technical and financial management is essential to achieving OCRWM's mission. During Fiscal Year 1994, significant progress was made on the Yucca Mountain Project, and OCRWM began the development of multi-purpose canisters (MPCs) for the storage, transportation, and disposal of spent nuclear fuel. A decision was made to request no further funding for Monitored Retrievable Storage siting-related activities until a site is identified. During Fiscal Year 1994, a new approach was developed for the OCRWM Program, which focuses resources on early evaluation of the technical suitability of the Yucca Mountain candidate repository site and rapid development of the MPC system. This new approach, formally approved by the Director, OCRWM, on October 1, 1994, provides a realistic strategy for achieving the intent of the NWPA, as amended, while preserving major Program milestones, including the submittal to NRC in 2001 of a license application for repository construction, if the site is determined to be suitable. The Congress supported the Program Approach by providing a 37 percent increase in funding for Fiscal Year 1995.

The ultimate success of the new Program Approach depends upon continued Departmental, Administration and Congressional support to ensure that adequate funds and Federal manpower are available to sustain Program momentum.

2001 M. Street, N.W.
Washington, DC 20036

Independent Auditors' Report on Financial Statements

United States Department of Energy
Office of Civilian Radioactive Waste Management:

We have audited the accompanying statements of financial position of the Nuclear Waste Fund (NWF) as of September 30, 1994 and 1993, and the related statements of operations, and cash flows, for the years then ended and cumulatively from inception (January 7, 1983) to September 30, 1994, and the statements of budget and actual expenses for the years ended September 30, 1994 and 1993. These financial statements are the responsibility of the NWF's management. Our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with generally accepted auditing standards; *Government Auditing Standards* (1988 Revision), issued by the U.S. General Accounting Office; and Office of Management and Budget Bulletin 93-06, *Audit Requirements for Federal Financial Statements*. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of the Nuclear Waste Fund at September 30, 1994 and 1993, and the results of its operations, its cash flows and its budget and actual expenses for the periods indicated above, in conformity with generally accepted accounting principles.

Our audits were made for the purpose of forming an opinion on the basic financial statements taken as a whole. This information presented in management's Overview is not a required part of the basic financial statements but is supplementary information required by Office of Management and Budget Bulletin 94-01, *Form and Content of Agency Financial Statements*. We considered whether this information is materially inconsistent with the basic financial statements. Such information has not been subjected to the auditing procedures applied in the audits of the basic financial statements and, accordingly, we do not express an opinion on it. The performance information included in the Overview is addressed in our auditors' report on the internal control structure in accordance with OMB Bulletin 93-06.

This report is intended for the information of the management of the NWF and the United States Department of Energy. This restriction is not intended to limit the distribution of this report, which is a matter of public record.

KPMG Peat Marwick LLP

December 16, 1994

Member Firm of
Klynfield Peat Marwick Goerdeler

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Statements of Financial Position

September 30, 1994 and 1993

(Dollars in thousands)

Assets	1994	1993	Liabilities and Net Position	1994	1993
Entity assets:			Liabilities covered by budgetary resources:		
Intragovernmental assets:			Intragovernmental liabilities, short-term:		
Fund balance with Treasury	\$ 1,962	(60)	Accounts payable	\$ 5,897	4,867
Investments (note 2)	4,605,844	4,177,810	Other funded liabilities	277	297
Current portion of accounts receivable:			Other intragovernmental, amounts due to utilities (note 4)	1,217	6,259
Receivable from Department of Energy (note 1)	136,174	124,472	Governmental liabilities, short-term:		
kWh fees (note 3)	5,550	2,091	Accounts payable	10,975	10,231
Accrued investment interest (note 2)	94,881	94,588	Other governmental:		
Advances and prepayments	-	37	Amounts due to utilities (note 4)	21,481	187,277
Other intragovernmental	79	230	Accrued payroll and benefits	3,980	4,228
Governmental assets:			Other	23,479	28,003
Current portion of accounts receivable from utilities (note 3):			Intragovernmental liabilities, long-term:		
One-time spent fuel fees	-	3,036	Amounts due to utilities (note 4)	-	558
kWh fees	138,515	130,587	Deferred investment revenue	1,975,936	1,606,260
Interest receivable on one time spent fuel fees	-	814	Governmental liabilities, long-term:		
Advances and prepayments	668	100	Amounts due to utilities (note 4)	-	18,029
Other governmental	525	2	Deferred fees revenue	5,361,764	5,049,838
Capital equipment, net (note 5)	47,894	33,574	Contract holdback	651	446
Receivable from Department of Energy, long-term (note 1)	535,150	562,000	Total liabilities covered by budgetary resources	7,405,657	6,916,293
Governmental assets:			Liabilities not covered by budgetary resources:		
Long-term portion of accounts receivable (note 3):			Governmental liabilities:		
One-time spent fuel fees	879,514	878,847	Accrued leave	1,516	1,339
Interest on one-time spent fuel fees	975,219	909,504	Other liabilities	14,802	-
Total assets	\$ 7,421,975	6,917,632	Total liabilities not covered by budgetary resources	16,318	1,339
			Total liabilities	7,421,975	6,917,632
			Contingencies (notes 3 and 10)		
			Net position	-	-
			Total liabilities and net position	\$ 7,421,975	6,917,632

The accompanying notes are an integral part of these statements.

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Statements of Operations

Years ended September 30, 1994 and 1993
and cumulatively from January 7, 1983, date of inception
to September 30, 1994

(Dollars in thousands)

	<u>1994</u>	<u>1993</u>	<u>Cumulative</u>
Revenue:			
Revenue from fees (note 3):			
One-time spent fuel fees:			
Public	\$ 736	-	2,178,637
Intragovernmental	-	-	156,866
kWh fees:			
Public	555,455	576,856	5,175,873
Intragovernmental	16,934	14,140	152,737
Defense high-level waste fees, intragovernmental (note 1)	77,100	68,810	669,080
Interest on one-time spent fuel fees, public (note 3)	65,715	54,201	1,003,465
Interest, intragovernmental:			
Income on investments	298,596	287,841	1,901,764
Defense high-level waste fees (note 1)	25,480	21,870	228,000
Other revenue - net gain on sale of investments	<u>74,282</u>	<u>25,031</u>	<u>197,274</u>
	1,114,298	1,048,749	11,663,696
Less - deferred fee and investment revenue	<u>(681,602)</u>	<u>(650,300)</u>	<u>(7,337,700)</u>
Total revenue	<u>432,696</u>	<u>398,449</u>	<u>4,325,996</u>
Expenses (note 11):			
Program expenses:			
First repository	281,585	232,228	2,869,573
Second repository	1	-	108,888
Monitored retrievable storage	35,503	42,328	267,613
Program support	88,047	93,459	821,283
Interest (notes 1 and 4)	3,150	7,274	133,346
Other expenses - transfer appropriations (note 7)	<u>24,410</u>	<u>23,160</u>	<u>125,293</u>
Total expenses	<u>432,696</u>	<u>398,449</u>	<u>4,325,996</u>
Excess of revenue over expenses	\$ <u>-</u>	<u>-</u>	<u>-</u>

The accompanying notes are an integral part of these statements.

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Statements of Cash Flows

Years ended September 30, 1994 and 1993
and cumulatively from January 7, 1983,
date of inception to September 30, 1994

(Dollars in thousands)

	<u>1994</u>	<u>1993</u>	<u>Cumulative</u>
Cash flows from operating activities:			
Excess of revenue over expenses	\$ -	-	-
Adjustments affecting cash flows:			
Increase in accounts receivable	(58,771)	(41,654)	(2,670,122)
Increase in other assets	(1,196)	(6,414)	(96,153)
Increase in accounts payable	1,774	3,639	16,872
Increase (decrease) in amount due to utilities	(189,425)	(153,289)	22,698
Increase in deferred revenue	681,602	650,300	7,337,700
Increase (decrease) in other liabilities	(4,410)	6,260	29,903
Depreciation expense	5,821	5,801	54,453
Amortization of premiums and accretion of discounts on investments	43,575	35,486	409,763
Net gain on sale of investments	(74,282)	(25,031)	(197,274)
Non-fund adjustments	<u>14,623</u>	<u>(153)</u>	<u>44,808</u>
Net cash provided by operating activities	<u>419,311</u>	<u>474,945</u>	<u>4,952,648</u>
Cash flows from investing activities:			
Proceeds from sales and maturities of investments	1,087,545	430,323	6,942,957
Purchases of investments	(1,484,872)	(899,795)	(11,761,290)
Purchases of capital equipment	<u>(19,962)</u>	<u>(7,142)</u>	<u>(132,353)</u>
Net cash used in investing activities	<u>(417,289)</u>	<u>(476,614)</u>	<u>(4,950,686)</u>

(Continued)

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Statements of Cash Flows, Continued

(Dollars in thousands)

	<u>1994</u>	<u>1993</u>	<u>Cumulative</u>
Cash flows from financing activities:			
Borrowings from U.S. Treasury	\$ -	-	264,964
Repayments on loans from U.S. Treasury	-	-	(264,964)
Borrowings from DOE for capital equipment	-	-	9,739
Repayments on loans from DOE for capital equipment	<u>-</u>	<u>-</u>	<u>(9,739)</u>
Net cash provided by financing activities	<u>-</u>	<u>-</u>	<u>-</u>
Net cash provided by (used in) operating, investing, and financing activities	2,022	(1,669)	1,962
Fund balances with U.S. Treasury, beginning	<u>(60)</u>	<u>1,609</u>	<u>-</u>
Fund balances with U.S. Treasury, ending	\$ <u><u>1,962</u></u>	<u><u>(60)</u></u>	<u><u>1,962</u></u>

The accompanying notes are an integral part of these statements.

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Statements of Budget and Actual Expenses

Years ended September 30, 1994 and 1993

(Dollars in thousands)

	Budget				Actual	
	1994		1993		1994	1993
	Resources	Obligations	Resources	Obligations	Expenses	Expenses
First repository	\$ 278,281	278,022	245,019	242,288	281,585	232,228
Second repository	(8)	(8)	-	(4)	1	-
Monitored retrievable storage	34,279	32,788	49,818	39,835	35,503	42,328
Program support	91,966	85,855	112,664	100,131	88,047	93,459
Interest credit to utilities (notes 1 and 4)	-	-	-	-	3,150	7,274
Other expenses (transfer appropriations - note 7)	-	-	-	-	24,410	23,160
	<u>\$ 404,518</u>	<u>396,657</u>	<u>407,501</u>	<u>382,250</u>	<u>432,696</u>	<u>398,449</u>

Budget Reconciliation

Total actual expenses	\$	<u>432,696</u>	<u>398,449</u>
Add:			
Capital acquisitions		19,962	7,142
Proceeds from sale of capital equipment		425	48
Uncosted obligations (note 1)		551	733
Interest credits to utilities included in accrued expenditures		<u>112</u>	<u>909</u>
		<u>21,050</u>	<u>8,832</u>
Less:			
Prior-year appropriations costed in the current year (note 1)		733	-
Depreciation		5,821	5,801
Other non-fund adjustments		1,799	(47)
Interest		3,150	7,274
Payments-equal-to-taxes accrual (note 10)		13,000	-
Transfer appropriations (note 7)		<u>24,410</u>	<u>23,160</u>
		<u>48,913</u>	<u>36,188</u>
Accrued expenditures, per the SF-133 reports on budget execution	\$	<u>404,833</u>	<u>371,093</u>

The accompanying notes are an integral part of these statements.

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands)

(1) *Organization and Summary of Significant Accounting Policies*

(a) *Legislative Background*

The Nuclear Waste Policy Act (NWPA) was signed into law on January 7, 1983. The NWPA establishes a framework for the financing, siting, licensing, operating and decommissioning of one or more mined geologic repositories for the Nation's spent nuclear fuel and high-level radioactive waste which is to be carried out by the Department of Energy's (DOE) Office of Civilian Radioactive Waste Management. In addition, the NWPA contains several other features including:

- Assigning responsibility for the full payment of disposal cost to the owners and generators of high-level waste and spent nuclear fuel and, accordingly, creating a special Nuclear Waste Fund (NWF) within the Treasury of the United States.
- Committing the Federal Government to study the need for and feasibility of one or more monitored retrievable storage (MRS) facilities.
- Providing for contracts between the DOE and the owners and generators of spent nuclear fuel and high-level radioactive waste pursuant to which DOE is to take title to the spent nuclear fuel or high-level radioactive waste as expeditiously as possible, following commencement of repository operations, and in return for payment of fees established by the NWPA, begin disposal of the spent nuclear fuel or high-level radioactive waste not later than January 31, 1998.
- Requiring evaluation of the use of disposal capacity at one or more repositories for the disposal of high-level radioactive waste resulting from atomic energy defense activities (defense waste). In April 1985, the President notified DOE of his determination that a separate defense waste repository was not necessary and directed DOE to proceed with arrangements for disposal of such waste. Fees, equivalent to those paid by commercial owners, must be paid for this use by the federal government.

Under the NWPA, expenditures from the NWF may be used only for nongeneric research, development and demonstration activities. Costs incurred for these activities are expensed as incurred.

In June 1987, DOE issued the Office of Civilian Radioactive Waste Management (OCRWM) Mission Plan Amendment. The amendment, which was submitted to Congress, extended the date for spent nuclear fuel acceptance at a repository from 1998 to the year 2003.

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands unless otherwise noted)

On December 22, 1987, the President signed into law the Budget Reconciliation Act for fiscal year 1988 (Amendments Act), which contained amendments to the NWSA. The legislation directed DOE to characterize only the Yucca Mountain site in Nevada as a candidate site for the first repository.

The legislation also provided for the termination of site-specific activities at all candidate sites other than the Yucca Mountain site, within 90 days of enactment, and for phasing out, not later than 6 months after enactment, all research programs in existence designed to evaluate the suitability of crystalline rock as a potential repository host medium. In the event that the Yucca Mountain site proves unsuitable for use as a repository, the legislation requires DOE to terminate site-specific activities and report to Congress.

Additionally, the legislation annulled and revoked DOE's MRS proposal, submitted to Congress on March 31, 1987, to construct an MRS facility in Oak Ridge, Tennessee. However, the legislation authorized DOE to site, construct and operate one MRS facility subject to the following conditions: after the MRS Commission submits its report to Congress, DOE may conduct a survey and evaluation of potentially suitable sites for an MRS; the selection of a site for an MRS may not be made until after the Secretary of Energy recommends to the President a site for development of the first repository; construction of the MRS may not begin until the Nuclear Regulatory Commission (NRC) issues a license for the construction of a repository; the quantity of spent fuel at the MRS at any one time may not exceed 10,000 metric tons until a repository begins accepting spent fuel or solidified high-level radioactive waste; and the quantity of spent nuclear fuel or high-level radioactive waste at the MRS at any one time may not exceed 15,000 metric tons.

Further, the legislation authorized DOE to pay interest on overpayments of kilowatt hour (kWh) fees consistent with the December 5, 1985 ruling of the United States Court of Appeals as discussed in note 4. Interest on these overpayments of kWh fees was fully paid or credited as of September 30, 1990.

On March 16, 1988, a Petition for Review was filed before the United States Court of Appeals for the District of Columbia regarding the calculation of net generation in determining kWh fees to be paid by the utilities. The petition sought judicial review of DOE's treatment of transmission and distribution losses in calculating net generation. On March 17, 1989, the Court decided that the fee should be based on electricity generated and sold. On September 7, 1990, DOE issued a Notice of Proposed Rulemaking to change the basis of the fee, consistent with the Court ruling. In November 1990, Congress granted approval for DOE to pay or credit interest to the utilities on the kWh overpayments. The Department estimated that the credits would be prorated over a four-year payment period from fiscal year 1992 through fiscal year 1995.

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands unless otherwise noted)

On October 1, 1994, following intensive deliberation and much consultation, and with the support of the Congress which gave the program a 37 percent increase in funding for fiscal year 1995 over fiscal year 1994, OCRWM began implementing a new program approach. This approach aligns program realities, program resources and stakeholder expectations on a timetable that preserves critical milestones, including submittal to the NRC of a license application for repository construction in 2001, if the Yucca Mountain site is determined to be suitable. OCRWM is currently updating its cost, schedule and technical baselines to reflect the new program approach.

In its report of November 1, 1989, the MRS Review Commission found that "cumulatively the advantages of an MRS would justify the building of an MRS if: (1) there were no linkages between the MRS and the repository; (2) the MRS could be constructed at an early date; and (3) the opening of the repository were delayed considerably beyond its presently scheduled date of operation." The MRS Review Commission recommended that Congress authorize the construction of a Federal emergency storage facility to provide storage before permanent geologic disposal.

Although the Amendments Act prohibits the selection of an MRS site through a DOE-directed site-survey process until the repository site is recommended to the President, it allows for expedited siting to proceed via a Nuclear Waste Negotiator, who may negotiate a proposed agreement with a State or Indian Tribe that would agree to host a repository or MRS facility. The Negotiator shall submit to Congress any proposed agreement. No proposed agreement shall have legal effect unless enacted into federal law.

In fiscal year 1994, the Energy and Water Development Act provided no funds for grants to potential MRS hosts. The Negotiator has continued his efforts in fiscal year 1994 but has not identified a volunteer host. Funding for fiscal year 1995 does not provide for MRS siting activities and, if Congress were to approve a proposal to site a monitored retrievable storage facility, an additional appropriation would be required to implement it. The Office of the Nuclear Waste Negotiator is scheduled to expire in January 1995.

(b) Significant Accounting Policies

Basis of Presentation - These financial statements include all activity related to the NWF and the Defense Nuclear Waste Disposal appropriation used for nuclear waste disposal activities.

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands unless otherwise noted)

Basis of Accounting - In 1991, GAO participated with the Office of Management and Budget (OMB) and the Treasury Department in the establishment of the Federal Accounting Standards Advisory Board (FASAB). The FASAB was organized to make recommendations regarding the accounting standards to be implemented by departments and agencies. The resulting standards will be concurrently issued by GAO and OMB. In the interim, and in accordance with FASAB's recommendation that agencies continue to prepare financial statements using their current accounting policies, the NWF continues to prepare its financial statements based upon generally accepted accounting principles. Transactions are recorded on an accrual accounting basis and a budgetary basis.

Revenue Recognition - A one-time fee (see note 3) was recorded by the NWF as of April 7, 1983, for spent nuclear fuel generated prior to that date. Fees based upon kWh of electricity generated by civilian nuclear reactors on or after April 7, 1983 are accrued as earned. All fees are recognized as revenue to the extent of expenses incurred. Revenue in excess of current expenses is deferred; deferred revenue is not segregated between federal and nonfederal activities. The life cycle of the program is expected to extend over a period of nearly 100 years.

The NWPA requires an annual evaluation of the adequacy of fees to ensure full cost recovery and provides for adjustment of such fees, as needed, with the approval of Congress. As of November 1990, the total-system life cycle cost (TSLCC) for the system with a repository at Yucca Mountain, Nevada; a facility for MRS; and a transportation system, was estimated at \$26,000,000 (expressed in constant 1988 dollars). In the event that a second repository is required and is authorized by Congress, the TSLCC was estimated at \$34,000,000 to \$35,000,000, depending on the quantity of spent fuel and high-level waste to be disposed of. No update of the TSLCC has been published since November 1990, however OCRWM intends to update the TSLCC in fiscal year 1995.

To estimate the share of the total-system costs that should be allocated to the disposal of defense high-level waste in the civilian repositories, the methodology announced by the DOE in the *Federal Register* in August 1987 was used. Estimates of the defense-waste share of costs, as of December 1990, are approximately \$4,000,000 (15 percent of the total) for the single-repository system and approximately \$6,000,000 (17 percent of the total) for the two-repository system.

To date, OCRWM has not entered into an agreement with the Office of Environmental Management for payment of fees and interest to the NWF on DOE's defense high-level waste share of costs. OCRWM has estimated that approximately \$897,080 of costs incurred to date by the NWF, including interest of \$228,000, assessed from passage of the NWPA (January 1983), are attributable to defense high-level waste based on the methodology previously published. Of this total amount, DOE has paid or funded \$225,756 as of September 30, 1994. (See also note 12). Total revenue from defense high-level waste fees and interest was \$102,580 and 90,680 in 1994 and 1993, respectively.

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands unless otherwise noted)

For fiscal years 1994 and 1993, Congress appropriated \$120,000 and \$100,000, respectively, from the Defense Nuclear Waste Disposal appropriation to be used for nuclear waste disposal activities. As of September 30, 1993, OCRWM had used \$95,528 of the fiscal year 1993 appropriation, with \$3,739 being obligated for payment in fiscal year 1994, and \$733 remaining to be costed. As of September 30, 1994, OCRWM had used the remaining fiscal year 1993 appropriation of \$4,472, and had used \$113,256 of the current year appropriation. Also at September 30, 1994, OCRWM had obligated \$6,694 of the fiscal year 1994 appropriation for payment in 1995, with \$551 being uncostered, and \$50 remaining to be obligated in fiscal year 1995.

For fiscal year 1995, Congress has appropriated \$129,430 from the Defense Nuclear Waste Disposal appropriation to be used for nuclear waste disposal activities.

Investments - Investments are in U.S. Treasury securities and are stated at cost, adjusted for amortization of premiums and accretion of discounts, which are recognized as adjustments to interest income using the effective interest method. Investment income, net of investment expenses and interest credits to utilities, is deferred.

Capital Equipment - Equipment is capitalized at cost if the initial acquisition cost is \$5 or more. Capital equipment is depreciated on a straight-line basis over the estimated useful lives of the assets which range from 5 to 30 years. Maintenance costs are borne by the NWF for equipment either on loan from non-NWF programs or shared with other programs.

Liabilities - Liabilities represent the amount of monies or other resources that are likely to be paid by the NWF as the result of a transaction or event that has already occurred. However, no liability can be paid by the NWF absent an appropriation. Liabilities for which an appropriation has not been enacted are therefore classified as liabilities not covered by budgetary resources and there is no certainty that the appropriation will be enacted. Also, liabilities of the NWF arising from other than contracts can be abrogated by the government, acting in its sovereign capacity.

Accrued Annual Leave - To the extent that current or prior year appropriations are not available to fund annual leave earned but not taken, funding will be obtained from future financing sources.

Tax Status - The NWF, as a part of the Department of Energy which is a federal agency, is not subject to federal, state or local income taxes.

Reclassifications - Certain 1993 amounts have been reclassified to conform to the 1994 presentation.

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands unless otherwise noted)

(2) Investments

Investments consisting of U.S. Treasury securities held as of September 30 of each year consisted of the following:

	1994		1993	
	<u>Book value</u>	<u>Market value</u>	<u>Book value</u>	<u>Market value</u>
Due within 1 year	\$ 18,289	18,289	19,881	19,881
Due after 1 year but within 5 years	1,979,900	1,993,262	2,044,844	2,249,437
Due after 5 years but within 10 years	2,044,924	1,914,654	2,113,085	2,280,206
Due after 10 years	<u>562,731</u>	<u>510,941</u>	<u>—</u>	<u>—</u>
	\$ <u>4,605,844</u>	<u>4,437,146</u>	<u>4,177,810</u>	<u>4,549,524</u>

Accrued interest receivable on investments as of September 30, 1994 and 1993, totaled \$94,881 and \$94,588, respectively.

(3) Receivables Due from Utilities

All owners and generators of civilian high-level waste and spent nuclear fuel have entered into contracts with the DOE for nuclear waste disposal services and for payment of fees to the NWF.

The NWPA specifies two fees to be paid to the NWF for disposal services: (a) a one-time charge per kilogram of heavy metal in solidified high-level waste or spent nuclear fuel existing prior to April 7, 1983; and (b) a one mill per kWh fee on all net electricity generated by civilian nuclear power reactors after April 7, 1983. The Secretary shall annually review the fees established. In the event the Secretary determines either insufficient or excess revenue is being collected, the Secretary shall propose an adjustment to the fee to ensure full cost recovery. The contracts between DOE and the owners and generators of the waste provide three options for payment of the one-time spent fuel fee, one of which must have been selected by June 30, 1985, or within two years of contract execution. The options were:

- (1) Payment of the amount due, plus interest earned from April 7, 1983, in 40 quarterly installments, with the final payment due on or before the first scheduled delivery of spent fuel to DOE;
- (2) Payment of the amount due, plus interest from April 7, 1983, in a single payment, any time prior to the first delivery of spent fuel to DOE;

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands unless otherwise noted)

- (3) Payment of the amount due, any time prior to June 30, 1985, or two years after contract execution, in the form of a single payment, with no interest due.

Under options (1) and (2), interest accrues from April 7, 1983, to date of first payment, at the 13-week Treasury bill rate compounded quarterly. Under option (1), beginning with the first payment, interest is calculated at the 10-year Treasury note rate in effect at the time.

During 1994 and 1993, payments or adjustments of one-time spent fuel fees by owners and generators of civilian high-level waste and spent nuclear fuel consisted of:

	<u>1994</u>		<u>1993</u>
	<u>Payments</u>	<u>Adjustments</u>	<u>Payments</u>
Option (1)	\$ (3,036)	—	(8,472)
Option (2)	—	667	—
Option (3)	<u>(69)</u>	<u>69</u>	<u>—</u>
	\$ <u>(3,105)</u>	<u>736</u>	<u>(8,472)</u>

Receivables from utilities at September 30 of each year consisted of:

	<u>1994</u>	<u>1993</u>
One-time spent fuel fees:		
Option (1)	\$ 143,531	146,567
Option (2)	<u>735,983</u>	<u>735,316</u>
	<u>879,514</u>	<u>881,883</u>
Kilowatt-hour fees	<u>144,065</u>	<u>132,678</u>
Interest on one-time spent fuel fees:		
Option (1)	159,747	149,878
Option (2)	<u>815,472</u>	<u>760,440</u>
	<u>975,219</u>	<u>910,318</u>
Total accounts receivable from utilities	1,998,798	1,924,879
Less current portion	<u>(144,065)</u>	<u>(136,528)</u>
Total receivables from utilities, excluding current portion	\$ <u>1,854,733</u>	<u>1,788,351</u>

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands unless otherwise noted)

Public and intragovernmental receivables from utilities at September 30 of each year were as follows:

	<u>1994</u>	<u>1993</u>
Current portion of accounts receivable:		
Public	\$ 138,515	134,437
Intragovernmental	<u>5,550</u>	<u>2,091</u>
	144,065	136,528
Long-term portion of accounts receivable --		
Public	<u>1,854,733</u>	<u>1,788,351</u>
Total accounts receivable from utilities	\$ <u>1,998,798</u>	<u>1,924,879</u>

(4) *Amounts Due to Utilities*

On December 5, 1985, the United States Court of Appeals for the District of Columbia ruled against the DOE regarding the calculation of kWh fees. Consistent with the ruling, utilities were requested to recalculate their fees since April 7, 1983, and submit their request for reimbursement to NWF for approval and subsequent refund or credit against kWh fees. Fees reimbursed or credited since 1986 as a result of this ruling totaled \$42,936.

On December 31, 1991, DOE issued the final rule amending the calculation of kWh fees effective January 30, 1992. The utilities were requested to submit revised calculations, and the Department advised each of the utilities that it would implement the refund process for previous overpayments, plus interest, through credits against future quarterly payments or through refunds for those utilities no longer generating. The refund process is to be completed in two phases. In the first phase, principal overpayments and accrued interest through March 31, 1992, were made available for credit during the period from July 1, 1992 through September 30, 1994. In the second phase, any remaining principal and additional accrued interest for the period April 1, 1992 through September 30, 1994, was calculated and made available for credit during fiscal year 1995. The credits were prorated over a four-year payment period as follows:

<u>Fiscal year</u>	
1992	7.5%
1993	40.0%
1994	45.0%
1995	7.5%

Interest is payable on the cumulative unpaid overpayment balance, plus accrued interest thereon. Interest is calculated based on the average 91 day Treasury bill auction bond equivalent rate for each calendar quarter.

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands unless otherwise noted)

OCRWM is in the process of finalizing verification of the revised calculations submitted by the utilities. Estimated fees to be credited total \$291,459 of which \$2,095 and \$(685) have been charged (credited) against kWh fees for 1994 and 1993, respectively. As of September 30, 1994 and 1993, the liability for unpaid fees was \$4,468 and \$147,934, respectively.

Interest expense for 1994 and 1993 on account of these overpayments was \$3,150 and \$7,274. Accrued interest payable as of September 30, 1994 and 1993, was \$18,230 and \$64,189, respectively.

Amounts due to utilities as of September 30, 1994 and 1993 consisted of:

September 30, 1994			
	Public	Intragovern- mental	Total
Current portion:			
kWh fees payable	\$ 4,013	455	4,468
Accrued interest payable	<u>17,468</u>	<u>762</u>	<u>18,230</u>
Total	\$ <u>21,481</u>	<u>1,217</u>	<u>22,698</u>
September 30, 1993			
	Public	Intragovern- mental	Total
Current portion:			
kWh fees payable	\$ 140,253	4,313	144,566
Accrued interest payable	<u>47,024</u>	<u>1,946</u>	<u>48,970</u>
	<u>187,277</u>	<u>6,259</u>	<u>193,536</u>
Long-term portion:			
kWh fees payable	3,286	82	3,368
Accrued interest payable	<u>14,743</u>	<u>476</u>	<u>15,219</u>
	<u>18,029</u>	<u>558</u>	<u>18,587</u>
Total	\$ <u>205,306</u>	<u>6,817</u>	<u>212,123</u>

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands unless otherwise noted)

(5) *Capital Equipment, Net*

Capital equipment and related accumulated depreciation consisted of the following at September 30, 1994 and 1993:

	<u>1994</u>	<u>1993</u>
Capital equipment	\$ 82,170	68,109
Work-in-progress	<u>1,750</u>	<u>1,276</u>
	83,920	69,385
Less accumulated depreciation	(36,026)	(35,811)
Net book value	\$ <u>47,894</u>	<u>33,574</u>

(6) *Financing*

The NWPA provides that the NWF consist of:

- Unexpended balances available on the date of enactment for functions or activities incident to the disposal of civilian high-level radioactive waste or civilian spent nuclear fuel.
- Appropriations made by Congress
- Receipt of fees
- Investment income from authorized investments

Expenditures may be made from the NWF subject to appropriations which require triennial authorization. Investments may be made in U.S. obligations from funds in excess of current needs. If at any time monies available in the NWF are insufficient to discharge responsibilities under the NWPA, additional borrowings may be made from the U.S. Treasury. The NWPA limits the NWF from incurring expenditures, entering into contracts and obligating amounts to be expended, except as provided in advance by appropriation Acts.

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands unless otherwise noted)

(7) Transfer Appropriations

During 1994 and 1993, Congress authorized certain funds to be transferred directly from the NWF to various entities to pay for necessary expenses of the NWF. Amounts transferred consisted of:

	<u>1994</u>	<u>1993</u>	<u>Cumulative</u>
Nuclear Regulatory Commission	\$ 22,000	21,100	105,582
Nuclear Waste Technical Review Board	2,160	2,060	13,502
Office of the Nuclear Waste Negotiator	<u>250</u>	<u>—</u>	<u>6,209</u>
	<u>\$ 24,410</u>	<u>23,160</u>	<u>125,293</u>

The Nuclear Waste Technical Review Board (Board) and the Office of the Nuclear Waste Negotiator (Negotiator) were established under the Amendments Act. The Board, an independent establishment within the executive branch of the U.S. government, was established to evaluate the technical and scientific validity of activities undertaken by the Secretary, including site characterization activities and activities relating to the packaging or transportation of high-level radioactive waste or spent nuclear fuel. The Negotiator, who was appointed by the President and approved by the Senate, is to seek a State or Indian Tribe willing to host a repository or MRS facility, at a technically qualified site, on reasonable terms.

(8) Pension Plan

DOE employees working in OCRWM are covered by the Civil Service Retirement System (CSRS) or the Federal Employees Retirement System (FERS). As required by law, employees make contributions to the plans based on a percentage of their salaries with an amount contributed by OCRWM in accordance with the required retirement system regulations. Data regarding the CSRS and the FERS actuarial present value of accumulated benefits, assets available for benefits, and unfunded pension liability are not available to individual departments and agencies and therefore not disclosed by the NWF. As such, reporting is the responsibility of the U.S. Office of Personnel Management.

The total pension expense for 1994 and 1993 was \$1,389 and \$1,284, respectively.

(9) Transactions With Other Government Agencies

The NWPB established the Office of Civilian Radioactive Waste Management within DOE to carry out the provisions of the NWPB and created a separate fund in the Treasury of the United States. All of the investment and borrowing powers of the NWF are limited to transactions with the U.S. Treasury. In discharging its obligations under the NWPB, DOE contracts for services with numerous contractors including other federal government agencies. Further, significant administrative services are provided by DOE.

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands unless otherwise noted)

As of September 30, 1994 and 1993, the NWF owed other government agencies \$4,548 and \$3,458, respectively, for services and costs provided to the NWF. For the years ended September 30, 1994 and 1993, the NWF had incurred costs of \$26,861 and \$24,576, respectively, for services and costs provided by other government agencies.

As discussed in note 1, the NWF is owed \$671,324 as of September 30, 1994 from DOE for the disposal of defense high-level waste in civilian repositories.

(10) *Contingencies*

The DOE is currently involved in various litigation arising from its activities. Although certain proceedings are at a preliminary stage, management does not expect that resolution of this litigation will have a material effect on the financial position of the NWF.

The NWPA requires the DOE to provide, each fiscal year, payments-equal-to-taxes to eligible States, Indian tribes, and affected units of local governments. These payments are equal to the amount that they would receive were they authorized to tax Federal site characterization activities at a candidate repository site or site specific activities at an MRS site. The DOE has published a Notice of Interpretation and Procedures in the *Federal Register* outlining the implementation of Section 116(c) (3) and 118(b) (4) of the NWPA.

During fiscal year 1994, the DOE entered into an agreement with Nye County, for \$37,900 of payments-equal-to-taxes, covering the period from May 1986 through June 1999. The DOE has made payments totalling \$7,400 through September 30, 1994 and has accrued an additional \$13,000 attributable to the tax periods ending as of September 30, 1994. In fiscal year 1992, the DOE made a payment of \$771 to Benton County, Washington for payments-equal-to-taxes. In November 1993, Benton County filed an appeal increasing its request to \$45,752. An evidentiary hearing before DOE's Office of Hearings and Appeals has been scheduled for January 1995. The outcome of this matter is not expected to have a material effect on the financial position of the NWF.

(11) *Expenses by Object Classification*

The NWF's expenses by object classification for fiscal years 1994 and 1993 consisted of:

	<u>1994</u>	<u>1993</u>
Personal services and benefits	\$ 18,474	16,940
Contractual services	347,652	327,748
Other	39,010	23,327
Interest	3,150	7,274
Transfer appropriations (note 7)	<u>24,410</u>	<u>23,160</u>
Total expenses	\$ <u>432,696</u>	<u>398,449</u>

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
NUCLEAR WASTE FUND

Notes to Financial Statements

(Dollars in thousands)

(12) Additional Department Waste

In November 1993, DOE's Office of Environment, Safety and Health issued a report which identifies additional waste owned by the Department, from both commercial and defense projects, that may be disposed of in civilian repositories. The Department is in the process of determining its additional liability to the Nuclear Waste Fund. Although the Department has not determined the appropriate cost methodology to apply to this waste, if the one-time fee methodology contained in the Standard Contract for Disposal of Spent Nuclear Fuel/or High Level Radioactive Waste were used, the Department's additional liability to the NWF would range from \$200,000 to \$500,000, plus interest, which would be assessed from April 7, 1983. These amounts have not been recorded in the accompanying financial statements as of September 30, 1994, because the amount of fees, attributable to this waste, is not reasonably able to be determined until additional studies and information are received.

2001 M. Street, N.W.
Washington, DC 20036

Independent Auditors' Report on Compliance with Laws and Regulations

United States Department of Energy
Office of Civilian Radioactive Waste Management:

We have audited the financial statements of the Nuclear Waste Fund (NWF) as of and for the year ended September 30, 1994, and have issued our report thereon dated December 16, 1994.

We conducted our audit in accordance with generally accepted auditing standards; *Government Auditing Standards* (1988 Revision), issued by the Comptroller General of the United States; and Office of Management and Budget (OMB) Bulletin 93-06, *Audit Requirements for Federal Financial Statements*. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement.

Compliance with laws and regulations applicable to the NWF is the responsibility of the NWF's management. As part of obtaining reasonable assurance about whether the financial statements are free of material misstatement, we tested compliance with laws and regulations that may directly affect the financial statements and certain other laws and regulations designated by OMB and the Department of Energy (DOE):

- Nuclear Waste Policy Act
- Nuclear Waste Policy Amendments Act
- Chief Financial Officers' Act of 1990
- Federal Managers' Financial Integrity Act of 1982
- Budget and Accounting Procedures Act of 1950
- Prompt Payment Act
- Civil Service Reform Act of 1978
- Fair Labor Standards Act of 1938
- Federal Employees' Compensation Act
- Federal Employees' Health Benefits Act of 1959

However, the objective of our audit of the financial statements was not to provide an opinion on overall compliance with such laws and regulations. Accordingly, we do not express such an opinion.

As part of our audit, we also obtained an understanding of management's process for evaluating and reporting on internal control and accounting systems as required by the Federal Managers' Financial Integrity Act (FMFIA) and compared the NWF's fiscal year 1994 FMFIA reports with the evaluation we conducted of the entity's internal control structure.

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The results of our tests of compliance indicate that, with respect to the items tested, the NWF complied, in all material respects, with the provisions referred to in the third paragraph of this report. With respect to items not tested, nothing came to our attention that caused us to believe that the Nuclear Waste Fund had not complied, in all material respects, with those provisions.

This report is intended for the information of the management of the Nuclear Waste Fund and the United States Department of Energy. This restriction is not intended to limit the distribution of this report, which is a matter of public record.

KPMG Peat Marwick LLP

December 16, 1994

2001 M. Street, N.W.
Washington, DC 20036

Independent Auditors' Report on the Internal Control Structure

United States Department of Energy
Office of Civilian Radioactive Waste Management:

We have audited the financial statements of the Nuclear Waste Fund (NWF) as of and for the year ended September 30, 1994, and have issued our report thereon dated December 16, 1994.

We conducted our audit in accordance with generally accepted auditing standards; *Government Auditing Standards* (1988 Revision), issued by the Comptroller General of the United States; and Office of Management and Budget (OMB) Bulletin 93-06, *Audit Requirements for Federal Financial Statements*. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement.

In planning and performing our audit of the financial statements of the NWF as of and for the year ended September 30, 1994, we considered its internal control structure in order to determine our auditing procedures for the purpose of expressing our opinion on the financial statements and to determine whether the internal control structure meets the objectives identified in the following paragraph. Our consideration included obtaining an understanding of the internal control policies and procedures and assessing the level of control risk relevant to (1) all significant cycles, classes of transactions, or account balances; and (2) the performance information control objective described in the following paragraph.

The management of the NWF is responsible for establishing and maintaining an internal control structure. In fulfilling this responsibility, estimates and judgments by management are required to assess the expected benefits and related costs of internal control structure policies and procedures. The objectives of an internal control structure are to provide management with reasonable, but not absolute, assurance that transactions, including those related to obligations and costs, are executed in compliance with applicable laws and regulations that could have a direct and material effect on the financial statements and any other laws and regulations that OMB, NWF management, or the Department of Energy have identified as being significant and for which compliance can be objectively measured and evaluated; funds, property and other assets are safeguarded against loss from unauthorized use or disposition; transactions are properly recorded and accounted for to permit the preparation of reliable financial statements in accordance with generally accepted accounting principles and to maintain accountability over the assets; and data that support reported performance measures are properly recorded and accounted for to permit preparation of reliable and complete performance information. Because of inherent limitations in any internal control structure, errors, irregularities, or instances of noncompliance may nevertheless occur and not be detected. Also, projection of any evaluation of the structure to future periods is subject to the risk that procedures may become inadequate because of changes in conditions or that the effectiveness of the design and operation of policies and procedures may deteriorate.

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For the purpose of this report, we have classified the significant internal control structure policies and procedures in the following categories:

- General accounting and financial reporting
- Cash and cash receipts
- Investments and investment revenue
- Revenue and accounts receivable
- Personnel and payroll
- Purchasing, disbursements and accounts payable
- Capital equipment

For all of the internal control structure categories listed above, we obtained an understanding of the design of relevant policies and procedures, determined whether they had been placed in operation, assessed control risk, and performed tests of the control structure.

Our evaluation of the controls for performance information was limited to those controls designed to ensure the existence and completeness of the information. With respect to the performance measure control objective, we obtained an understanding of the relevant internal control structure policies and procedures designed to permit the preparation of reliable and complete performance information, and we assessed control risk.

Our consideration of the internal control structure policies and procedures would not necessarily disclose all matters in the internal control structure that might constitute material weaknesses under standards established by the American Institute of Certified Public Accountants and OMB Bulletin 93-06. A material weakness is a reportable condition in which the design or operation of one or more of the specific internal control structure elements does not reduce to a relatively low level the risk that errors or irregularities in amounts that would be material in relation to the financial statements being audited, or material to a performance measure or aggregate of related performance data, may occur and not be detected within a timely period by employees in the normal course of performing their assigned functions. We noted no matters involving the internal control structure and its operations that we consider to be material weaknesses as defined above.

However, we noted certain matters involving the internal control structure and its operation that we have reported to the management of the Nuclear Waste Fund, in a separate letter dated December 16, 1994.

This report is intended for the information of the management of the Nuclear Waste Fund and the United States Department of Energy. This restriction is not intended to limit the distribution of this report, which is a matter of public record.

KPMG Peat Marwick LLP

December 16, 1994

APPENDIX B

Key Federal Laws and Regulations

The Office of Civilian Radioactive Waste Management must comply with the requirements set forth in the Nuclear Waste Policy Act of 1982 and its amendments, as well as those mandated in other laws. The program must also comply with the regulations of other Federal agencies, including the Nuclear Regulatory Commission (NRC), the Department of Transportation (DOT), and the Environmental Protection Agency (EPA).

The Nuclear Waste Policy Act

The Nuclear Waste Policy Act of 1982 as originally enacted set basic policies concerning:

- **Development of Geologic Repositories.** The Act establishes a framework for the siting, characterization, construction, and operation of 2 permanent geologic repositories for disposal of spent nuclear fuel and high-level radioactive waste.
- **Storage.** The Act provided for a limited amount of emergency interim storage and for developing a proposal to site and construct a monitored retrievable storage (MRS) facility on a firm schedule.
- **Intergovernmental Relations.** The Act set requirements for interactions between the Federal Government and States, local governments, and Indian Tribes.
- **Other Federal Responsibilities.** The Act assigned the responsibility for nuclear waste management to specific Federal agencies.
- **Nuclear Waste Fund.** The Act required the establishment of a fund to cover nuclear waste disposal costs paid for by user fees on electricity generated by nuclear power and sold.
- **Office of Civilian Radioactive Waste Management.** The Act established the office within the Department of Energy (DOE).

The Nuclear Waste Policy Amendments Act of 1987 significantly revised the 1982 policies. The 1987 Act:

- Directed DOE to characterize only the Yucca Mountain site in Nevada, to determine whether it is suitable as a repository site and to postpone consideration of the need for a second repository until the year 2007;
- Authorized the siting, construction, and operation of an MRS facility subject to certain conditions that link the construction and operation of the facility very tightly to the construction and licensing of a repository;
- Provided financial incentives for States or Indian Tribes on whose land a repository or MRS facility is sited;
- Increased external oversight by establishing the Nuclear Waste Technical Review Board, authorizing on-site oversight representatives of host States, Indian Tribes, and localities, and providing for increased local government participation;
- Established the Office of the Nuclear Waste Negotiator to attempt to reach an agreement with a State or Indian Tribe willing to host a repository or MRS facility.

The Energy Policy Act

On October 24, 1992, the President signed the Energy Policy Act of 1992 into law. The Act includes key elements of the National Energy Strategy proposed by the Administration in 1990. A number of provisions affect the Office of Civilian Radioactive Waste Management.

Section 801 of the Act directed the EPA to contract with the National Academy of Sciences to provide "findings and recommendations on reasonable standards for protection of the public

health and safety" that would govern the long-term performance of a high-level nuclear waste repository at the Yucca Mountain site. Within one year of receiving the Academy's recommendations, the EPA is required to promulgate public health and safety standards that "shall prescribe the maximum annual effective dose equivalent to individual members of the public from releases to the accessible environment from radioactive materials stored or disposed of in the repository." The NRC is then required to modify its technical requirements and criteria consistent with the Agency's standards.

Section 802 extended the term of the Office of the Nuclear Waste Negotiator until January 29, 1995.

Section 803 instructed the Department of Energy to evaluate whether its current programs and plans for management of nuclear waste are adequate to deal with additional volumes or categories that might be generated by nuclear power plants newly licensed after October 1992.

Major Environmental Laws

National Environmental Policy Act (1969). The National Environmental Policy Act (NEPA) mandates that all Federal agencies and departments take into consideration the impacts their actions may have on the environment.

NEPA requires that agency actions undergo environmental review early in the planning process and that the review process for major Federal actions significantly affecting the quality of the human environment be open to public participation. This review entails the preparation of an environmental assessment or an environmental impact statement, either on a specific project or regulation, or a broad program.

Clean Air Act (1970). The Clean Air Act Amendments authorizes the EPA to set standards for radioactive and hazardous pollutant emissions into the atmosphere. In 1989 EPA issued emissions standards for weapons facilities, low-level waste disposal facilities, and uranium mill tailings sites. States can set more stringent standards than those required by EPA.

Clean Water Act (1972). The Federal Water Pollution Control Act, also known as the Clean Water Act, prohibits the discharge of any pollutant, including radioactive and hazardous wastes, into any U.S. navigable waters (broadly defined) without a permit. Discharge limits in permits are determined in accordance with water quality standards. The Clean Water Act expressly requires that all Federal facilities comply with its standards and permitting requirements. The Clean Water Act was most recently amended as the Water Quality Act of 1987.

Resource Conservation and Recovery Act (1976). The Resource Conservation and Recovery Act (RCRA) was enacted to address the widespread problem of contamination from the disposal of municipal and industrial hazardous and solid waste. The Act established an important national policy: governments and private companies should minimize the amount of hazardous waste they produce and must treat, store, or dispose of existing waste in ways that minimize its threat to health, safety, and the environment.

Comprehensive Environmental Response, Compensation and Liability Act (1980). The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) set another important national policy: regulation of the release of hazardous substances to the environment whether the result of previous (historic) releases or active releases (spills). CERCLA also provided for Federal response and compensation for unpermitted and uncontrolled releases (including threats of release) of hazardous substances. Funds for the Federal emergency response to releases and cleanup of closed sites were provided for by the Hazardous Substance Response Trust Fund ("Superfund"), which was established under CERCLA. However, the Federal government was permitted to seek reimbursement for cleanup from liable parties. For active and historic releases, CERCLA provided a means to compel the liable parties to undertake cleanups at their own expense. The Superfund Amendments and Reauthorization Act (SARA), which was enacted in 1986, re-established the Superfund and established the Federal facilities cleanup program. A new reporting program was also established under Title III of SARA, Emergency

Planning and Community Right-to-Know Act (EPCRA). EPCRA requires that releases of hazardous substances to the environment above certain threshold amounts be reported.

The Hazardous and Solid Waste Amendments of 1984 (HSWA) instituted waste minimization. Under waste minimization, the generators of hazardous wastes are required to certify that they have a program in place to reduce the volume or quantity and toxicity of their hazardous waste. In addition, generators are required to certify that the proposed method of treatment, storage, or disposal of their hazardous waste is that practicable method currently available to the generator.

Key Regulations

These rules are published in the Code of Federal Regulations, which is divided into volumes organized by Title and Part. For example, "10 CFR 60" refers to "Part 60 of Title 10."

10 CFR 2 (NRC) *Rules of Practice for Licensing*. Specifies the licensing process and requires an electronic record-keeping system to preserve data needed for licensing.

10 CFR 20 (NRC) *Standards for Protection Against Radiation*. Establishes standards for radiation safety at an NRC-licensed facility.

10 CFR 50, Appendix B (NRC) *Quality Assurance Criteria for Nuclear Power Plant and Fuel Reprocessing Plants*. Establishes quality assurance requirements.

10 CFR 60 (NRC) *Disposal of High-Level Radioactive Wastes in Geologic Repositories*. Sets forth technical requirements governing development of a permanent geologic repository for spent nuclear fuel and high-level radioactive waste. Includes the NRC's oversight and licensing duties.

10 CFR 71 (NRC) *Packaging and Transportation of Radioactive Material*. Implements Department of Transportation requirements for

packaging and transporting spent nuclear fuel and high-level radioactive waste.

10 CFR 72 (NRC) *Licensing Requirements for the Independent Storage of Spent Fuel and High-Level Radioactive Waste*. Sets forth technical requirements for licensing private storage facilities to receive, ship, and store spent fuel, and outlines procedures by which DOE is licensed to receive, ship, and store spent fuel at a temporary facility.

10 CFR 960 (DOE) *General Guidelines for the Recommendation of Sites for Nuclear Waste Repository*. Promulgated to establish guidelines to compare sites; now used as the basis for the Site Characterization Plan for the Yucca Mountain Project.

10 CFR 961 (DOE) *Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Waste*. Outlines the contract with utilities to receive, ship, and dispose of spent nuclear fuel and high-level waste.

40 CFR 191 (EPA) *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High Level and Transuranic Radioactive Wastes*. Originally issued in 1985 pursuant to the Nuclear Waste Policy Act, the regulations were remanded in 1987 in response to an objection filed by the National Resource Defense Council. However, in 1992, the Waste Isolation Pilot Plant Land Withdrawal Act (WIPP LWA) reinstated the disposal standard, except for those sections that were subject to the remand order. In addition, the WIPP LWA exempted "the characterization, licensing, construction, operation, or closure of any site required to be characterized under Section 113(a) of Public Law 97-425" (NWPA of 1982) from regulation under 40 CFR 191. Pursuant to section 801 of the Energy Policy Act of 1992, the EPA is developing a separate standard applicable to the Yucca Mountain Site.

49 CFR 171-179 (DOT) *Hazardous Materials Regulations*. Specifies general Department of Transportation requirements for the transportation of radioactive materials.

APPENDIX C

Key Fiscal Year 1994 Appearances by OCRWM before Regulators and Oversight Bodies

NUCLEAR REGULATORY COMMISSION

<u>Date</u>	<u>Topic</u>
10/4-6/93	Technical exchange: status of the Exploratory Studies Facility design and construction activities, selected design issues.
10/13/93	Technical exchange: progress report on studies pertaining to migration of radionuclides in the unsaturated zone.
10/14/93	Technical exchange: provided information on studies pertaining to radionuclide release from the engineered barrier system.
10/15/93	Site visit to Los Alamos National Laboratory.
11/9/93	Technical exchange: Multi-Purpose Canister Implementation Program Conceptual Design Report.
11/16/93	Quality assurance quarterly meeting: status of the implementation of the new Quality Assurance Requirements and Description document and other quality assurance issues.
11/17/93	Technical exchange: technical basis for a future topical report on seismic hazards assessment methodology.
11/18/93	Management meeting on interactions between the Department of Energy and the Nuclear Regulatory Commission.
11/30-12/1/93	Technical exchange: burnup credit in the criticality analysis for spent fuel casks and containers.
12/8/93	Technical exchange: status of the Exploratory Studies Facility design and construction activities.
12/13/93	Advisory Committee on Nuclear Waste: briefing on overall project status, Exploratory Studies Facility progress and test plans.
12/14/93	Advisory Committee on Nuclear Waste: working group meeting on unsaturated zone hydrology.
12/15/93	Advisory Committee on Nuclear Waste: tour of the Yucca Mountain site.
12/20/93	Advisory Committee on Nuclear Waste: preparation for the upcoming Advisory Committee briefing of the Nuclear Regulatory Commissioners.

1/31/94	Advisory Committee on Nuclear Waste: follow-up to the 12/15/93 tour of the Yucca Mountain site for two members of the Committee.
2/1-2/94	Technical exchange: Yucca Mountain site visit and the evaluation of a potentially adverse condition—extreme erosion.
2/10/94	Technical exchange: burnup credit in the criticality analysis for spent fuel casks and containers.
2/23/94	Quality assurance quarterly meeting: status of the implementation of the revised Quality Assurance Requirements and Description document and other quality assurance issues.
2/23-24/94	Advisory Committee on Nuclear Waste: review of the plans for topical reports and the status of volcanism studies.
3/23-24/94	Advisory Committee on Nuclear Waste: overview of the Commission's high-level radioactive waste research on natural analogs and its application to Yucca Mountain regulatory requirements and performance assessment.
3/30-31/94	Technical Exchange: burnup credit for spent fuel casks and multi-purpose canisters.
4/19/94	Technical meeting on the status of the Exploratory Studies Facility design and construction activities.
4/19-20/94	Yucca Mountain site visit.
4/20-21/94	Advisory Committee on Nuclear Waste: status of the Commission's volcanology research, current issues on the multi-purpose canister, and report on resolving "Important-To-Safety" issue.
4/30/94	Quality assurance quarterly meeting: status of the implementation of the revised Quality Assurance Requirements and Description document and other quality assurance issues.
5/2-5/94	Yucca Mountain site visit: discussion of characterization of faults and fractures near the site and rock properties along the north ramp of the Exploratory Studies Facility.
5/16/94	Advisory Committee on Nuclear Waste: working group meeting on capabilities in computer modeling and performance assessment.
5/17/94	Management meeting on interactions and scheduling.
5/17-18/94	Advisory Committee on Nuclear Waste: timeliness and efficiency of work being done by the Center for Nuclear Waste Regulatory Analysis.
5/19/94	Management meeting on the program approach and issue resolution topics.
6/6/94	Briefing to Nuclear Regulatory Commission by Dr. Daniel A. Dreyfus, OCRWM's Director.
6/9/94	Advisory Committee on Nuclear Waste: continuation of the 5/17-18/94 meeting.

6/28/94	Technical exchange: topical report concerning the use of burnup credit in the criticality analysis.
6/29-30/94	Advisory Committee on Nuclear Waste: State of Nevada comments on tectonics, the Commission's Systematic Analysis regulatory process, proposed rule related to design events, and definition of "Important-To-Safety."
7/26/94	Management meeting on the program approach and issue resolution topics.
7/27/94	Technical meeting on the status of the Exploratory Studies Facility design and construction activities.
8/16-17/94	Advisory Committee on Nuclear Waste: the Commission's waste confidence decision, the program approach, role of the Advisory Committee, and the Extreme Erosion Topical Report.
8/31/94	Quality assurance meeting on OCRWM's management and operating contractor's Design Quality/Quality Assurance Program.
9/21/94	Management meeting on site suitability evaluation process, Civilian Radioactive Waste Management Program Plan, site characterization plan/study plan work scope consolidation, multi-purpose canisters and burnup credit, and issue resolution.
9/21-22/94	Advisory Committee on Nuclear Waste: the program approach, and substantially complete containment.
9/27-28/94	Technical Exchange: update on the progress on the Total System Performance Assessment.

NUCLEAR WASTE TECHNICAL REVIEW BOARD

<u>Date</u>	<u>Organization</u>	<u>Topic</u>
10/19-20/93	Full Board	Drilling program, and surface-based and Exploratory Studies Facility-based testing.
11/1-2/93	Joint Panel on Engineered Barrier System and Transportation Systems	Technical challenges of interim storage, and multi-purpose canister design and integration.
11/22/93	Panel on Environment & Public Health	Environmental activities at Yucca Mountain.
01/10-11/94	Full Board	Public trust and confidence, alternative program strategy, systems engineering update, and performance assessment.
03/8-9/94	Panel on Structural Geology & Geoengineering	Probabilistic assessment of seismic and volcanic hazards.
03/10-11/94	Panel on Engineered Barrier System	Waste package research plans, and tour of Lawrence Livermore National Laboratory.

Fiscal Year 1994 Annual Report to Congress

03/21-22/94	Panel on Environment & Public Health	Tour of environmental activities at Yucca Mountain, workshop on environmental studies, and National Environmental Policy Act discussion.
04/11-12/94	Full Board	Lessons learned from siting other facilities, saturated zone hydrology, and Exploratory Studies Facility update.
06/13-14/94	Panel on Structural Geology & Geoengineering	Impacts of Scenario A on Exploratory Studies Facility design and construction.
06/15/94	Panel on Engineered Barrier System	Hanford defense high-level waste activities, and plutonium disposition overview.
06/16/94	Panel on Engineered Barrier System	Tour of Hanford site.
07/12-13/94	Full Board	Radionuclide migration, and spent nuclear fuel transportation.
9/12-13/94	Panel on Hydrogeology & Geochemistry	Groundwater travel time, and hydrological studies update.

CONGRESS

Senate Hearings

<u>Date</u>	<u>Committee/Subcommittee</u>
11/8/93	Energy and Natural Resources Committee; Science, Space and Technology Subcommittee
3/1/94	Energy and Natural Resources Committee
6/8/94	Appropriations Committee, Interior & Related Agencies Subcommittee

House of Representatives Hearings

<u>Date</u>	<u>Committee/Subcommittee</u>
3/7/94, 3/14/94	Appropriations Committee, Energy and Water Development Subcommittee
3/17/94	Natural Resources Committee Joint Hearing: Energy and Mineral Resources; Oversight and Investigations
8/3/94	Energy and Commerce Committee; Energy and Power Subcommittee

APPENDIX D

OCRWM Publications, Fiscal Year 1994

OCRWM Bulletin (Special Edition: MPC Conceptual Design Report Submitted to OCRWM), November 1993 (DOE/RW-0428)

Yucca Mountain Site Characterization Project Technical Data Catalog (quarterly supplement), December 1993 (DOE/RW-00134-T8)

OCRWM Baseline Management Procedure for Document Identifiers, December 1993 (DOE/RW-0416-Rev.1)

Spent Fuel Storage Requirements 1992-2036, December 1993 (DOE/RW-0431)

Conceptual Design for a Waste-Management System that Uses Multi-purpose Canisters, January 1994 (DOE/RW-0432)

Systems Engineering Management Plan, January 1994 (DOE/RW-0436)

Site Characterization Progress Report: Yucca Mountain, Nevada, April 1, 1993 - September 30, 1993, Number 9, February 1994 (DOE/RW-0434)

Waste Acceptance System Requirements Document (WASRD), February 1994 (DOE/RW-0351P)

Transportation System Requirements Document, February 1994 (DOE/RW-0425)

Yucca Mountain Site Characterization Project: Technical Data Catalog (quarterly supplement), March 1994 (DOE/RW/00134-T9)

Total System Performance Assessment, 1993: An Evaluation of the Potential Yucca Mountain Repository, March 1994 (DOE/RW-00134-T12)

Integrated Data Base for 1993: U.S. Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, March 1994 (DOE/RW-0006-Rev. 9)

Monitored Retrievable Storage System Requirements Document, March 1994 (DOE/RW-0420-Rev. 1)

Mined Geologic Disposal System Requirements Document, March 1994 (DOE/RW-0404P-Rev. 1)

OCRWM Bulletin, Of Mountains and Science (Winter 1994), March 1994 (DOE/RW-0430)

Civilian Radioactive Waste Management System Requirements Document, Rev. 1, March 1994 (DOE/RW-0406P)

Review and Selection of Unsaturated Flow Models, April 1994 (DOE/RW-00134-T11)

Calculations Supporting Evaluation of Potential Environmental Standards for Yucca Mountain, April 1994 (DOE/RW-00134-T10)

Program Cost & Schedule Baseline (PCSB), April 1994 (DOE/RW-0253 Rev. 3)

OCRWM Bulletin, Of Mountains and Science (Spring 1994), May 1994 (DOE/RW-0439)

Regulatory Guidance Document, May 1994 (DOE/RW-0441)

Teleconference for Educators '94: "Science, Society, and America's Nuclear Waste," June 1994 (DOE/RW-0440)

OCRWM Systems Engineering Management Plan (SEMP), June 1994 (DOE/RW-0051/Rev. 3)

OCRWM Procedure for Reporting Software Baseline Change Information, July 1994 (DOE/RW-0446)

OCRWM Bulletin (Special Bulletin, Multi-purpose Canister Procurement), August 1994 (DOE/RW-0444)

Multi-Purpose Canister System Evaluation —A Systems Engineering Approach, September 1994 (DOE/RW-0445)

Locations of Spent Nuclear Fuel and High-Level Radioactive Waste Ultimately Destined for Geologic Disposal, September 1994 (DOE/RW-0447)

FY 1993 Annual Report to Congress, September 1994 (DOE/RW-0449)

Spent Fuel Storage Requirements 1993-2040, September 1994 (DOE/RW-0431 Rev. 1)

Site Characterization Progress Report: Yucca Mountain, Nevada, October 1, 1993 - March 31, 1994, Number 10, October 1994 (DOE/RW-0450)

APPENDIX E

Selected Publications from Other Organizations, Fiscal Year 1994

GENERAL ACCOUNTING OFFICE

Nuclear Waste: Foreign Countries' Approaches to High-Level Waste Storage and Disposal, August 4, 1994

Nuclear Waste: Comprehensive Review of the Disposal Program Is Needed, September 27, 1994

NUCLEAR WASTE TECHNICAL REVIEW BOARD

Underground Exploration and Testing at Yucca Mountain, October 1993

Letter Report to Congress and the Secretary of Energy, February 1994

U.S. Nuclear Waste Technical Review Board Report to the U.S. Congress and the Secretary of Energy, January to December 1993, May 1994

NUCLEAR REGULATORY COMMISSION

NRC Surveillance Observation Report 94-S2 of OCRWM Surveillance HQ-SR-94-03 of Vitrification Projects Division, March 3, 1994

NRC Observation Audit Report 94-08 of DOE OCRWM Audit HQ-94-03 of Office of Waste Management High-Level Waste Division, July 3, 1994

NRC Observation Audit Report 94-09 of OCRWM Audit YMP-94-07 of OCRWM Headquarters, August 11, 1994

NRC Observation Audit Report 94-09 of DOE OCRWM Audit YMP-94-07 of OCRWM Headquarters, August 22, 1994

NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL

Workshop on Establishing Institutional Credibility for SEAB Task Force on Radioactive Waste Management, 1994

SECRETARY OF ENERGY ADVISORY BOARD

Earning Public Trust and Confidence: Requisites for Managing Radioactive Wastes, November 1993

DEPARTMENT OF ENERGY'S OFFICE OF INSPECTOR GENERAL

Report on Audit of Costs and Management of the Yucca Mountain Project, June 23, 1994

Followup Audit of the Cask Development Program, March 15, 1994

U.S. DOE ENERGY INFORMATION ADMINISTRATION

Spent Nuclear Fuel Discharges from U.S. Reactors 1992, May 5, 1994

STATE OF NEVADA

Nevada - Nuclear Waste News, published monthly by the Nevada Agency for Nuclear Projects/Nuclear Waste Project Office

Annual Report: Investigation of Hydro-Tectonic Hazards at the Proposed Yucca Mountain High-Level Nuclear Waste Repository, Nuclear Waste Project Office, January 1994

Yucca Mountain Socioeconomic Project: The Autumn 1993 Nevada State Telephone Survey: Key Findings, February 1994 (NWPO-SE-058-94)

Monitoring Sectors and Geographies Vulnerable to Stigma: A Model Framework and Approach, March 1994 (NWPO-SE-059-94)

The 1994 Clark County, Nevada, Survey: Key Findings on Trust, Risk Perception and the High-Level Nuclear Waste Issue, July 1994 (NWPO-SE-060-94)

AFFECTED UNITS OF LOCAL GOVERNMENT

Scientific Roundtable on Yucca Mountain Pneumatic Continuity: Progressing from Conceptual Models of Gas Circulation in the Vadose Zone to Confident Characterization, January 1994

Eureka County

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Clark County

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