*FY 1993
Annual Report to Congress*

*Office of Civilian Radioactive
Waste Management*

*United States
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September 1994*

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Contents

<i>Introduction</i>	v
<i>From the Director</i>	vii
The Year in Review: October 1992 through September 1993	1
Surface-Based Testing: Gathering Data to Determine Suitability	17
Exploratory Studies Facility: Underground at Yucca Mountain	23
Thermal Loading: A Cross-Cutting Issue	31
Multipurpose Canisters: Rethinking Our Strategy	39
Public Involvement: Making Informed Decisions	47
International Programs: Sharing Information Globally	53
Education: Preparing for our Future	59
Transportation Programs: Planning for Safety	67
Protecting the Current and Future Environment	73
Review and Regulation: Comprehensive Oversight	79
Financial Statements	87
<i>Appendix A</i>	121
<i>Appendix B</i>	123
<i>Appendix C</i>	125
<i>Appendix D</i>	129

Introduction

As established by the Nuclear Waste Policy Act of 1982, as amended, the United States Department of Energy's Office of Civilian Radioactive Waste Management is responsible for managing and disposing of the Nation's spent nuclear fuel from civilian nuclear power reactors and high-level radioactive waste from defense activities. The program will provide leadership in developing and implementing strategies that assure the health and safety of the public and workers, protect the environment, and merit public confidence, in an economically viable manner.

To accomplish the program's mission, we are developing a waste management system culminating in a geologic repository for permanent disposal deep beneath the surface of the earth. Our goals include:

- determining whether Yucca Mountain, Nevada, designated by the Nuclear Waste Policy Amendments Act of 1987 as the only site currently to be evaluated, is suitable for a geologic repository;
- resolving the issue of acceptance of spent fuel from nuclear utilities in 1998;
- developing more effective working relationships with external parties who have an interest in the waste disposal mission; and
- establishing a new funding mechanism that will permit efficient and effective execution of our mission and achievement of our goals.

This is the tenth annual report submitted to the Congress by the Office of Civilian Radioactive Waste Management. This report contains details of the program's accomplishments and activities over the past fiscal year and the audited financial statements for the Nuclear Waste Fund.

This annual report is required by Section 304(c) of the Nuclear Waste Policy Act of 1982 (Public Law 97-425) as amended by the Nuclear Waste Policy Amendments Act of 1987 (Title V, Public Law 100-203). We submit this report to inform the Congress of our activities and expenditures during fiscal year 1993 (October 1, 1992 through September 30, 1993).

A summary of this year's significant activities follows in the *Year in Review* chapter. In the chapters following this summary, we have expanded on several topics that are relevant to our program's 1993 activities.

From the Director

We are pleased to present to the United States Congress this 1993 Annual Report on the nation's civilian radioactive waste management program.

This document reflects work performed by hundreds of people who are undertaking a technically complex, scientifically challenging and socially difficult task—disposing of our nation's radioactive waste in a way that ensures the health and safety of the public and the environment.

During fiscal year 1993, we made notable headway in this program. We stepped up work on determining whether Yucca Mountain is a suitable site for a geologic repository for nuclear waste. We advanced our efforts to develop a multipurpose canister system that can be used for storing, shipping and disposing of waste. We also increased public involvement in our decision-making. Much of this work was underway before I was confirmed as Director in October 1993. While this report officially covers the period between October 1992 and September 1993, we have included in this letter some highlights since then.

Energy Secretary Hazel O'Leary, in her confirmation hearing, stated she would focus on this program. Since taking office, she has directed us to:

- Proceed with Exploratory Studies Facility construction and underground site characterization activities at Yucca Mountain.
- Develop a new funding approach to ensure that adequate and consistent resources are available to meet program needs.
- Proceed with further development of a multipurpose canister system.
- Create a Chief Scientist position for the Yucca Mountain Project.
- Consider options relating to accepting spent nuclear fuel from commercial reactors in 1998 and initiate a dialogue with utilities with respect to continued at-reactor storage.
- Implement more extensive and effective public participation in program activities.
- Initiate negotiations with affected parties on the issue of payments equal to taxes, which compensates affected local governments for tax revenues lost to Federal Government activities.

The Secretary's direction guides a program that is addressing two major issues. The first is assuring efficient progress toward determining the suitability of the Yucca Mountain site for a permanent repository. The second is addressing the realities of near-term management of spent fuel by

resolving the waste acceptance issue and defining the Department's role for near-term storage.

To support the program's priorities, the Administration has proposed to the Congress a new funding approach that will provide an increasing annual funding profile over the next several years. This funding approach would bring about consistency between the program that we plan to carry out and the funding that would be available in the next and succeeding years. Most of the increased funding would be directed to excavating the Exploratory Studies Facility, conducting surface-based testing, and collecting and analyzing research data gathered at Yucca Mountain. A smaller part of the increase would support near-term storage and resolution of the waste acceptance issue.

We have increased the number of opportunities for stakeholders to provide input into program decisions. We have discussed the fiscal year 1995 budget proposal, as well as many other issues, with the community of stakeholders interested in our program. Additionally, forums were held to discuss multipurpose canisters and a report to Congress regarding the adequacy of plans to deal with future waste production from commercial nuclear power plants. In August 1993, we sponsored a meeting in Nevada with stakeholders to solicit ways to improve involvement in the program. These interactions have enhanced our understanding of the concerns of all involved, and we believe this expanded involvement already is affecting and improving our decisions.

In addition, Secretary O'Leary has undertaken a review of the Office of Civilian Radioactive Waste Management that will include a financial and management review of the Yucca Mountain project as well as an analysis of comments made about the program. Two people have been appointed to oversee the Yucca Mountain review – one appointed by the Secretary and one by the Governor of Nevada. Another component of the Secretary's review was undertaken by Professor James A. Thurber of The American University's Center for Congressional and Presidential Studies. Professor Thurber compiled and synthesized comments on the program over the past five years. His report was issued for public review and provided to the Secretary in final form on March 1, 1994. These reviews, in conjunction with the collaborative development of a goal-oriented strategic plan, will allow us to address many of the issues of the past and focus on the future.

We welcome the vigilance and insight of official oversight organizations as well as others who have less formal relationships with the program. We ask you to join us in shaping our future, and in supporting plans that will lead toward solutions.

Daniel A. Dreyfus
Director, Office of Civilian Radioactive
Waste Management
October 1, 1994

THE YEAR IN REVIEW:

October 1992 through September 1993

1

This country's radioactive waste management program is in its second decade. January 1993 marked the 10th anniversary of the signing of the Nuclear Waste Policy Act, which established the Office of Civilian Radioactive Waste Management within the Department of Energy to dispose of spent nuclear fuel and high-level radioactive waste.

Our program is young but has a remarkably long horizon. The waste management system will operate for many decades, and long lead times exist for planning and constructing the system. Beyond that, we have been directed to use a 10,000-year time frame for protecting people and the environment through safe waste disposal.

The past year has seen the radioactive waste management program achieve major milestones in many technical and institutional activities important to attaining the goal of safe and permanent disposal of spent nuclear fuel and high-level radioactive waste.

We examined the overall waste management program to determine the potential need for additional disposal, storage and transportation capabilities. We continued to investigate the candidate site at Yucca Mountain, Nevada, to determine its suitability for a geologic repository. We broke ground for the Exploratory Studies Facility, signalling the beginning of our underground testing program. We began examining the feasibility of a multipurpose canister system for waste storage, transportation and disposal. We continued to support a unique voluntary siting effort for a temporary storage facility through the Office of the Nuclear Waste Negotiator. We continued to develop components of a transportation system. And we continued to strengthen two-way communication with our stakeholders through public involvement, education and public information.

This chapter provides an overview of the program's significant achievements during fiscal year 1993.

CONFIRMATION OF PROGRAM DIRECTOR

On October 7, 1993, Dr. Daniel Dreyfus was confirmed by the United States Senate as the new Director of the Office of Civilian Radioactive Waste Management. Dr. Dreyfus, a civil engineer, previously served as vice president for strategic planning and analysis at the Gas Research Institute and earlier as staff director for the Senate Committee on Energy and Natural Resources. At the time of his nomination, Dr. Dreyfus was serving as a special assistant to Secretary of Energy Hazel O'Leary.

On September 22, 1993, the Senate Energy and Natural Resources Committee met to consider Dr. Dreyfus' nomination. During the hearing, members of Congress expressed concerns about schedule delays and ballooning costs of the program. Dr. Dreyfus responded that at least two considerations had to be addressed quickly. The first is that the utilities, the ratepayers and the general public need greater certainty regarding the Federal Government's intent to begin accepting waste in 1998. The second is that requests for an independent review of the management and scientific approach of the Yucca Mountain site characterization program must be addressed.

The text of Dr. Dreyfus' statement may be found in *Appendix A*.

SECTION 803 REPORT

In June 1993, we released a draft report on *Adequacy of Management Plans for the Future Generation of Spent Nuclear Fuel and High-Level Radioactive Waste*. The United States Congress, in the Energy Policy Act of 1992, instructed the Department of Energy to evaluate whether its current programs and

plans for management of nuclear waste, as mandated under the Nuclear Waste Policy Act, are adequate to deal with volumes or categories that might be generated by nuclear power plants newly licensed after October 1992. The Congress also asked the Secretary to report on additional transportation, interim storage, and geologic repositories needed for these potential new wastes.

The Department evaluated existing plans, as specified in the Nuclear Waste Policy Act and

Spent nuclear fuel pool at Surry Nuclear Power Plant in Virginia.

implementing regulations, and wrote the report based on scenarios that included amounts of waste higher than expected. A reference case was developed and compared with high estimates to ensure that programs and plans could handle extreme estimates over a wide range of conditions.

In addition to spent nuclear fuel and high-level radioactive waste that may be generated by new nuclear power plants, the report addressed other waste, including waste from defense sources. It was necessary to consider all these waste types in order to assess the potential effect of the disposal of additional spent nuclear fuel.

The analysis resulted in the conclusion that current programs and plans are adequate to handle waste generated by commercial

nuclear power plants licensed in the future, based on three findings:

- These radioactive materials will not be generated until well into the future.
- Flexibility has been built into the current program and plans.
- Development of the waste-management system is at an early stage, and there is ample opportunity to accommodate changing needs.

The June 1993 draft followed an evaluation process that invited substantive public involvement, first through an annotated outline and then through public review of a draft report.

Drafts were discussed in public meetings held in July 1993 in Las Vegas, Nevada, and in Washington, D.C. Comments made during the meetings and in letters to the Energy Department will be addressed in the final report, which is planned to be sent to the Congress and the President in 1994. The final document will include responses to all written comments.

GEOLOGIC DISPOSAL

Permanent disposal of spent nuclear fuel and high-level radioactive waste in a geologic repository is the primary objective of our program. Yucca Mountain, Nevada, was selected by Congress in 1987 as the only site currently to be evaluated as a potential repository. We are conducting extensive surface-based and subsurface site characterization studies to determine how well the geologic and hydrologic setting could isolate radioactive waste from the environment.

Site-characterization activities are divided into three types of scientific investigations: surface-based tests, which include analyzing rock, soil samples, and water movement; underground tests, which include examining rock at deep levels; and laboratory tests, which encompass analyses of rock, liquid and

gas samples collected from surface-based and underground test activities.

Issues being studied include whether the geology of Yucca Mountain is capable of isolating high-level radioactive waste, whether earthquakes or volcanic activity pose a significant future threat to a repository, whether natural resources that may be exploitable in the future exist at the site, and whether changes in regional rainfall or in the water table elevation might affect how well a repository would isolate waste.

Surface-Based Testing

In 1993, extensive surface-based site characterization activities focused on:

- drilling boreholes to collect subsurface data;
- excavating trenches and test pits to collect near-surface data;
- geologic mapping;
- laboratory analyses of samples collected in the activities listed above; and

The CME-850 drill rig is used to collect rock core and cuttings samples for geohydrology studies at the Yucca Mountain site.

- monitoring studies for continuous collection of data, such as seismic, meteorological, and ground water information.

This year, we completed the first borehole of the unsaturated-zone drilling program at 514 meters (1,686 feet), about 20 meters (65 feet) into the water table. We completed all the boreholes for the natural-infiltration studies drilling program. Data from tests performed in boreholes will assist in the determination of distribution and movement of water at the site, a critical factor affecting the ability of the site to minimize radionuclide migration to the accessible environment.

Mapping and trenching programs in Midway Valley to identify surface faulting at the proposed site of surface facilities were also concluded. We also completed numerous other trenches and soil pits supporting volcanic studies, fault and fracture mapping, and seismic hazard studies.

Exploratory Studies Facility

The groundbreaking for the Exploratory Studies Facility in November 1992 signalled the beginning of our underground testing program. Surface-based testing will not provide all the critical data needed to determine site suitability. We will conduct at-depth studies in the Exploratory Studies Facility, an underground laboratory consisting of up to 22 kilometers (14 miles) of tunnels on two levels cut beneath Yucca Mountain. This underground facility will allow scientists to conduct detailed studies at the planned depth of the repository and to

greatly increase our understanding of the mountain's complex geologic, hydrological and seismic conditions.

One of the most significant of our accomplishments during this fiscal year for the Exploratory Studies Facility was the completion in September 1993 of the north portal starter tunnel, approximately 60 meters (200 feet) long, that will be used as a launch chamber for a tunnel boring machine that will excavate the facility's main tunnel. Workers began excavations for the starter tunnel in April

1993, using conventional drill and blast tunneling techniques. The tunnel boring machine is scheduled to be delivered to the site for assembly in April 1994. We anticipate beginning excavation in September 1994, with the boring machine resurfacing at the south portal within two years.

The Exploratory Studies Facility testing program began soon after construction started for the north portal tunnel. We completed geologic mapping to the end of

the tunnel, and we conducted a consolidated sampling program during excavation. Once the starter tunnel was completed, excavation began on the first test alcove.

Waste Package Development

In October 1992, we began advanced conceptual design of the waste package, which consists of the waste, the outer disposal container, and any internal container, such as a multipurpose canister. Isolating nuclear

Aerial photograph of the Exploratory Studies Facility in October 1993.

wastes from the environment requires methods of long-term containment. We believe an underground repository is a safe disposal method because it will provide multiple layers of protection through both natural and manmade barriers: a strategy referred to as defense in depth. The waste package is the manmade, or engineered, barrier to the release of radionuclides—radioactive atoms.

Spent nuclear fuel and high-level radioactive waste will be sealed in a corrosion-resistant metal or ceramic container designed to hold the waste for at least several hundred years, until most of the radioactivity has decayed to levels that pose little risk to health and the environment. Scientists and engineers assume that, over thousands of years, some of the manmade barriers in a repository will break down. Once that happens, natural barriers, including the rock housing the repository itself, will stop or significantly slow the movement of radioactive particles.

The waste package design program includes developing and analyzing designs, testing potential container materials, testing waste forms, and characterizing the waste package emplacement environment. Seven specific concepts for the waste package have been identified for evaluation, based on scientific and engineering data gathered over the past ten years. Each concept combines different characteristics: for example, thin-walled or thick-walled; self-shielded or non-self-shielded; and small or large packages. Most designs are based on multi-barrier concepts and will emphasize the use of a multipurpose canister. (Chapter 5, *Multipurpose Canisters*, explains this concept further.) Preliminary evaluations of thermal, radiological, criticality, and structural characteristics of the designs have been completed on the seven concepts.

In August 1993, the Department of Energy and the Nuclear Regulatory Commission

Artist's drawing of waste packages emplaced in boreholes in a repository.

conducted a technical exchange on waste package and engineered barrier system design. The purpose of the exchange was to discuss our definition of the regulatory requirement, "substantially complete containment," and how the concept is being used in design activities. Additionally, we reported on the status and progress of our waste package design efforts.

In September 1993, we sponsored a three-day workshop for interested parties to comment on the current status of waste package development as it relates to site characterization. This workshop was a follow-up to the Engineered Barrier System workshop held in June 1991, at which approaches to an engineered barrier system were presented and discussed. The objective of the waste package workshop was to provide a forum to discuss ideas relative to all aspects of container development, such as containment barrier degradations, materials selection, and performance assessment.

Performance Assessment

The scope of our performance assessment activities has been expanded this year. Performance assessment is the practice of predicting the behavior of a system—in this case a repository at Yucca Mountain—under a

Data from site characterization activities such as logging trenches contributes to performance assessment models.

range of different conditions that could occur in the future. Performance assessment relies on sophisticated numerical models to describe the physical behavior of the system, and also depends on detailed underlying data and scientific judgment to provide a reasonable projection of that behavior.

Scientists have constructed computer models for potentially significant future events—such as a volcanic eruption, a change in climate, or human intrusion—that could result in radioactive releases to the environment at the Yucca Mountain site. At the same time, the likely consequences of these events together with their probabilities of occurring have been modeled. Through these analyses of expected and unexpected events, scientists try to predict all the possible and foreseeable events and then assess the repository's ability to withstand these events as currently designed.

Our performance assessment program serves two broad purposes. If the Yucca Mountain candidate site is judged suitable for a repository, we will use the data acquired from scientific investigations and repository design to assess the safety of the repository for a license application by demonstrating compliance with the criteria given in Nuclear Regu-

latory Commission regulations (10 CFR Part 60, *Disposal of High-Level Radioactive Wastes in Geologic Repositories*).

More immediately, performance assessment guides the site characterization program toward collecting the data that will be needed to evaluate the suitability of the site and by supporting repository design and construction efforts.

As with many of our programs, performance assessment is a process that evolves as new data become available and models are refined. In fiscal

year 1993, we conducted analyses for the second Total System Performance Assessment, which measures the ability of the repository system as a whole—including both manmade and natural barriers—to contain and isolate radionuclides.

This assessment enhances and expands upon the simulations in the first assessment. Major improvements include: incorporating the effects of alternate thermal loads; better conceptualizations of unsaturated and saturated hydrologic flow; more sophisticated source term models; and more site information. We have also conducted sensitivity and uncertainty analyses to refine the model and to determine which parameters merit particular attention in upcoming iterations.

Reports to the Nuclear Regulatory Commission

In March 1993, we issued our first topical report to the Nuclear Regulatory Commission on "Evidence of Extreme Erosion During the Quaternary Period." The report concluded that extreme erosion had not occurred in that period, based in part on a comparison between hillslope erosion and stream incision around the Yucca Mountain candidate site with erosion rates in similar environments.

STORAGE AND TRANSPORTATION

Multipurpose Canister Study

In February 1993, we completed a feasibility study of a multipurpose canister system for potential use in storing, transporting, and disposing of spent nuclear fuel. We have now evaluated how that technology can be incorporated into the waste management system. The multipurpose canister would be loaded with spent-fuel assemblies and sealed and stored in a dry storage cask, if necessary, at a reactor site. The canister would be placed in a transportation cask and transferred to a temporary storage

facility or to the geologic repository for permanent disposal.

This concept reduces the need for routine handling of individual fuel assemblies at a temporary storage facility and repository, which would simplify operations and reduce radiation exposure to workers. Also, the multipurpose canister would be suitable for storing spent nuclear fuel at power plants.

Based on the positive results from the feasibility study, we began developing a conceptual design. As part of this process, we held public workshops in July and November 1993 to increase the involvement and understanding of the multipurpose canister concept by stakeholders such as utilities, vendors, State and local governments, and other interested parties. These workshops were designed to ensure that all issues and alternatives related to the implementation of such a

We also submitted a draft annotated outline to the Nuclear Regulatory Commission for a topical report on seismic hazard assessment methodology. We use topical and technical reports on specific, important-to-safety subjects as tools to receive guidance and comment from Commission staff on regulatory definitions, interpretations, and methodologies. (Other interactions with the Nuclear Regulatory Commission are discussed in Chapter 11, *Review and Regulation*.)

In March 1993, we forwarded a draft of the *Status of Volcanic Hazard Studies for the Yucca Mountain Site Characterization Project* to the Nuclear Regulatory Commission. This report, prepared by Los Alamos National Laboratory, summarized a range of work covering more than a decade of volcanism studies. A technical exchange on volcanism was held with Commission staff in June, and the final report will address many comments received at that meeting.

International Programs

In 1993, we signed new international agreements with Sweden and Spain and extended an ongoing agreement with Canada, demonstrating our continuing interest in exchanging information with international organizations and other countries with nuclear power capabilities that are considering waste disposal options.

The Department of Energy and the Swedish Nuclear Fuel and Waste Management Company (SKB) will carry out joint experimental and analytical development activities related to the disposal of spent nuclear fuel and high-level radioactive waste at the Hard Rock Laboratory facility on the island of Äspö, Sweden. This agreement is an extension of the ongoing cooperative relationship that the Energy Department has maintained with Sweden since 1977. Work performed under the agreement will give us direct access to SKB's experience and expertise and will help us select appropriate technology, procedures, and instrumentation for our repository characterization activities.

concept are identified prior to a decision regarding use of the technology in the waste management system.

By the end of the fiscal year, we began reviewing the draft *Multipurpose Canister Implementation Program Conceptual Design Phase Report*, which includes conceptual designs for various components of the multipurpose canister system, cost and schedule estimates, and supporting systems studies.

A transportation cask for spent nuclear fuel was displayed at several locations involved in MRS feasibility studies.

Monitored Retrievable Storage Feasibility Grants

During the past two years, we have supported a voluntary approach to finding a site for a monitored retrievable storage facility, an aboveground facility at which radioactive waste would be stored temporarily before being transported to the repository. In August 1993, two Indian Tribes applied for the final phase of a three-part financial assistance process to help in assessing the feasibility of hosting such a facility in their communities.

The Office of the Nuclear Waste Negotiator has the responsibility for seeking a voluntary host—a willing State or Indian Tribe with a technically qualified site—with whom to negotiate an agreement on reasonable terms. The agreement would be submitted to Congress for approval.

In support of this voluntary siting process, the Department of Energy has made available

phased financial assistance grants to help States, Indian Tribes, and local governments gather and disseminate information about nuclear waste issues in general and about technical, health and safety, and economic issues relating directly to the construction and operation of a monitored retrievable storage facility.

Initial (Phase I) grants of up to \$100,000 were awarded to conduct a preliminary feasibility study for siting a temporary storage facility within the applicant's jurisdiction. We received 21 applications from local governments and Indian Tribes and awarded 12 initial study grants. (See Appendix B for a list of all grant applicants.)

By the end of fiscal year 1993, nine subsequent (Phase IIa) grant applications had been received. These subsequent grants were intended to support more detailed examinations and further public information activities. Grants of \$200,000 each were awarded to the Mescalero Apache Tribe of New Mexico, the Skull Valley Band of Goshutes in Utah, the Fort McDermitt Paiute-Shoshone Tribe on the Nevada-Oregon border, and the Tonkawa Tribe of Oklahoma.

As of September 30, 1993, the Mescalero Apache Tribe of New Mexico and the Skull Valley Band of Goshute Indians in Utah had taken the third step in the voluntary siting process. Each submitted written notice in August 1993 to the Office of the Nuclear Waste Negotiator of its intent to formally negotiate hosting a monitored retrievable storage facility and had proposed specific sites for consideration.

In response to a request from the Office of the Nuclear Waste Negotiator, we performed on-site assessments of the sites proposed by the two Phase IIb applicants and made preliminary determinations of the technical suitability of each site.

The Energy and Water Development Appropriations eliminated Phase IIb grants for fiscal year 1994. Both Phase IIb grant applicants have indicated that, even without the additional funds, they are prepared to move forward with formal negotiations toward a possible agreement to host the monitored retrievable storage facility.

Conceptual Design Report

In November 1992, we released the *Conceptual Design Report* for a monitored retrievable storage facility. The main objectives of the report were:

- to evaluate the technical feasibility of several monitored retrievable storage design options,
- to establish technical performance levels, and
- to develop reliable cost estimates and realistic schedules.

The report offers a complete design for each of six separate spent-fuel-storage concepts. Each design was evaluated on the basis of safety, feasibility, cost, and construction time. The report concludes that a monitored retrievable storage facility can be designed and operated in compliance with all applicable Federal regulations in a manner that protects health, safety and the environment.

As part of the multipurpose canister feasibility study effort, the monitored retrievable storage conceptual design was updated in September 1993 to reflect a facility based on the multipurpose canister concept, handling both bare spent nuclear fuel and sealed canisters.

Conceptual designs are only the first of three

phases in the facility design process. If a site is selected for a monitored retrievable storage facility, we will initiate the second phase, which will include a detailed safety analysis report.

Transportation Safety

In November 1992, we issued the *Strategy for OCRWM to Provide Training Assistance to State, Tribal, and Local Governments*. Emergency situations involving the transportation of radioactive waste are a major concern to State, Tribal, and local governments. Section 180(c) of the Nuclear Waste Policy Act requires the Department of Energy to provide technical assistance and funds to States to train public safety officials of appropriate units of local governments and Indian tribes in safe transportation procedures and emergency response if spent nuclear fuel or high-level radioactive waste will be transported through their jurisdictions.

Comments on the draft strategy were received from a number of affected governments and interested groups and were incorporated into the final report. The program plans to begin providing assistance to jurisdictions along routes leading to a monitored retrievable storage facility three to five years prior to the start of waste shipments. Similar assistance will be provided to jurisdictions along routes to a repository.

OCRWM's deputy director addresses participants at the May 1993 public update meeting in Las Vegas.

EXTERNAL RELATIONS

Public Involvement

In August 1993, we began an effort to formalize our public involvement process. Although public involvement is a cornerstone of the Department of Energy's mission statement, it is often cited as an area of shortcoming in the waste management program. Public involvement has been targeted by the Secretary of Energy and the Director of this program as a key area for improvement. Both have stated their commitment to improving access to information and to the processes that result in improved decisionmaking.

Shortly after Secretary of Energy Hazel O'Leary took office and even before a permanent program director was in place, a renewed effort began to involve interested and affected parties in the program. In April 1993, the Secretary directed the program to consult with stakeholders on developing a collaborative process for long-term public involvement in the program's direction and decisionmaking.

As a result of this direction, we conducted a day-long workshop in August 1993 in Las Vegas, Nevada, with stakeholders and interested members of the public to solicit comments on how they wish to interact with the program. More than 175 representatives from the State of Nevada, affected local governments, Indian Tribes, utility organizations, local citizens' groups, environmental groups, and the public participated.

The workshop affirmed that there is no simple consensus among interested parties, and that the Department of Energy must be able to

work with different groups with different viewpoints as it opens its program to public participation. (See Chapter 6, *Public Involvement*, for further discussion of the workshop.)

Cooperative Agreements

In 1993, we continued to seek expert opinion on and unique insights into our program from specific audiences through cooperative agreements.

One of our program's key constituencies is the utilities who generate spent fuel in their nuclear power plants. In 1993, we awarded a cooperative agreement to the National Association of Regulatory Utility Commissioners

(NARUC), a nonprofit corporation whose members are engaged in the regulation of utilities and carriers in the United States and who have primary responsibility to represent consumers of electricity. The cooperative agreement funds the organization's Nuclear Waste Program Office which monitors and reviews legislation and regulations to assess their effect on its con-

stituents and members. The Program Office also provides advice to state utility commissioners, decisionmakers, and other interested parties on the development of policies related to high-level nuclear waste.

In 1993, we renewed our cooperative agreement with the National Congress of American Indians, the oldest and largest Native American advocacy organization in the United States, representing 150 Tribal governments. Indian Tribes have a legal and political relationship with the Federal government, defined by the Constitution, treaties, statutes, and court decisions. We

Representatives from the National Association of Regulatory Utility Commissioners (NARUC) tour the Yucca Mountain site in September 1992.

interact regularly with the Indian Tribes and Tribal groups that have traditional cultural and spiritual ties to Yucca Mountain.

Through its cooperative agreement, the National Congress of American Indians advises the Energy Department on Tribal interests across a range of program issues, including transportation and temporary storage. Various committees monitor legislation and regulations; update Tribes on the high-level waste program activities; consult with stakeholders on Tribal rights and interests; and identify Tribes potentially affected by transportation or storage activities.

In 1993, we continued to work cooperatively with many external organizations to study and resolve issues related to transporting radioactive waste. We have consulted with various regional, professional and technical groups, including the National Conference of State Legislatures, the Western Interstate Energy Board, the Southern States Energy Board, and the Midwestern Office of the Council of State Governments. Through cooperative agreements with these groups, we have benefited from their knowledge and viewpoints in areas such as emergency response, state inspections, highway routing, pre-notification, physical protection, liability coverage, and infrastructure improvements.

For example, in July 1993, we renewed a five-year cooperative agreement with the Conference of Radiation Control Program Directors, the chartered board representing state radiation safety officials. Under the award, the Conference's Committee on Radioactive Material Transportation will

- evaluate and report on the resources and needs of state agencies involved with the transportation of spent nuclear fuel and high-level waste;
- develop informational materials for the general public;

- prepare educational materials about primary emergency response functions for professionals who would first respond in a crisis, such as fire fighters, state and local police, and emergency medical technicians;
- and represent the concerns, needs, and program developments of the state radiation control programs to our program staff and to other related government agencies and professional associations.

Affected Governments

Recognizing that the storage and disposal of high-level nuclear waste will most directly affect the communities in which waste facilities may be located, we continued to provide financial assistance to affected governments.

The Nuclear Waste Policy Act authorizes the Secretary of Energy to designate certain units of government as "affected" because of their jurisdiction over, or proximity to, the site of a geologic repository or a temporary storage facility. Currently, Nye County, in which the Yucca Mountain site is located, and nine contiguous counties in Nevada and California

are designated as affected units of government. These counties are eligible for extensive participation and oversight rights and certain forms of financial assistance.

Direct payments are provided to the State of Nevada and affected counties to enable them to monitor site characterization activities, to inform their residents of program developments, and to develop requests for impact assistance. In fiscal year 1993, the State of Nevada received \$5 million and each of the affected local governments received an apportioned amount from an additional \$6 million. The University of Nevada system, including the Desert Research Institute, received \$3.7 million for various infrastructure and geologic studies; and \$750,000 was made available to continue funding for the mobile sampling platform developed and operated by the Harry Reid Center for Environmental Studies at the University of Nevada, Las Vegas.

In addition, the Department of Energy is proceeding to make payments equal to the amount of taxes that would be assessed if a private organization were conducting site characterization activities, commonly referred to as Payments-Equal-To-Taxes, as directed by the Nuclear Waste Policy Act. In September 1993, the Energy Department made a \$2 million interim payment to Nye County; an initial payment of \$1 million was made in 1992. Early in fiscal year 1994, Clark, Esmeralda, and Lincoln Counties in Nevada and Inyo County in California received a total of \$102,000 for the period 1986 through June 1992. The State of Nevada also received over \$204,000 for sales and use taxes through 1992.

MANAGEMENT ISSUES

Technical Baselines

In 1993, we completed developing a set of documents that provides a single, integrated technical baseline for the entire waste management system. These system requirements

documents address the system-level technical requirements imposed on our program by laws, regulations, orders, and standards and facilitate our compliance with them.

Although documents addressing regulatory controls for most of the system elements did exist previously, there was not a uniform set of requirements documents for each major element of the waste management system. The completed system requirements documents replace existing documents and establish one top-level document for the entire system and subordinate documents for each of the four major system elements—waste acceptance, disposal, storage, and transportation.

Each document was developed using standard systems engineering procedures for developing complex systems. Starting with a functional analysis, the systems engineering process divides the waste management program mission into functions made up of sets of specific technical requirements. The functional requirements were developed in 1991 and 1992.

System requirements documents flow into design requirements documents, which define the project-level requirements for the design of individual system segments. This year, the Yucca Mountain Project approved five new design requirements documents derived from the disposal system requirements: repository, site design and test, engineered barrier design, Exploratory Studies Facility, and surface-based testing facilities.

Any complex system must be managed to ensure that the effects throughout the entire system of any individual change to the baseline are recognized and controlled. In 1993, we completed the first of a three-phase effort toward implementing a centralized configuration information system. This system will identify, evaluate, approve, implement, verify, and record changes to the system if those changes relate to cost, schedule or technical requirements.

A program-wide management system now is in place to perform this function, including a baseline management plan and implementing procedures guiding the process through which changes are approved and controlled. This system will use a shared data base to manage the system's configuration information. A Configuration Management Implementation Group was chartered and conducted the first of its monthly meetings in August 1993.

Business Management Review

In April 1993, in order to help identify our organization's business-management strengths and weaknesses, we began a program of self-assessment that examined how effective our program-wide and project-level business practices are. All waste management program and project offices participated

in preparing the Business Management Review Self-Assessment.

Areas addressed in the review included the effectiveness of both Department and contractor organizational structures; technical expertise; the adequacy of budget guidance and work authorization systems; environmental safety and health compliance; the adequacy of business management and accounting systems; program office oversight and contractor cost-effectiveness; the adequacy of program/project management systems; facilities management; training; management of purchased services; and the acquisition processes for data processing equipment and capital equipment.

This assessment is in its final stages, and a report will be published and made publicly

available. The report will address any planned remedial actions.

Program Management

In 1993, we strengthened our program management practices and capabilities. We initiated a formal budget planning process. We developed work plans with detailed budgets, work scope, and schedule milestones which provided an integrated basis for providing work assignments to contractors.

Additionally, we adopted for program-level use the project control system used by the Yucca Mountain Project to plan and measure performance against the approved plan. We initiated regular program review meetings which are open to the public where program cost and schedule performance is reviewed.

Information Resources Management

During fiscal year 1993, we focused on improving the coordination and integration of the managerial and technological aspects of our information resources management program by establishing and implementing the OCRWM Information Management Architecture. The primary objective of the architecture is to establish clear and firm links between our investments in information technology and providing access to the information required to support the accomplishment of our program's missions, goals, and objectives. Our efforts to establish and implement the architecture continue to serve

as models for improving the management and operation of information resources across all Energy Department organizations.

We also began work on reengineering the way we process information and records. Beginning in fiscal year 1995, we expect to realize a \$1.5 million annual savings based on the restructuring of records processing work flows made possible through the introduction of electronic imaging, optical character readers, and full-text data base software. We expect further cost savings from our efforts to process information on the basis of its value to the radioactive waste management program, which will be determined through the use of expert systems. Information with a limited value will be indexed and stored differently, and less expensively, than that with a high value; for example, that which is relevant to the licensing of a geologic repository.

Finally, we continued to make significant progress toward establishing and implementing InfoSTREAMS (Information Storage, Retrieval and Access Management System), our effort to provide shared access to office automation software, data bases and information systems, and telecommunications networks used throughout the program. InfoSTREAMS is helping us to create, process, store, access/retrieve, review, and disseminate the information and records needed to support program operations and meet regulatory requirements for document authentication, traceability, and records turnover and disposition.

Many experts think that Yucca Mountain has features that may make it suitable for development as a potential geologic repository. By suitable, scientists mean that the rock will keep spent fuel and high-level radioactive waste sufficiently isolated deep below the mountain's surface for many thousands of years so that radioactive material will not cause harm to people or to the environment. Among Yucca Mountain's unique features are that it is far from large population centers and its climate is very dry. The mountain has an extremely deep water table and a unique combination of rock characteristics. This combination leads many to think that the site is capable of isolating wastes.

However, other characteristics of the area's geology have led some experts to question the suitability of the Yucca Mountain site. Issues that need further investigation include how an earthquake might affect a repository and the ground water table and what effects future volcanic activity might have on a repository.

To assess suitability, we are conducting an extensive site-characterization program – the scientific investigation of the physical and technical characteristics of the site essential to support a repository. Our priority is early exploration of major qualifying and disqualifying site conditions. To this end, we have expanded our surface-based testing program. And although we are in the early stage of our underground exploration, we are confident data from this new arena will contribute significantly to assessing qualifying and disqualifying features.

2

SURFACE-BASED TESTING:

Gathering Data to Determine Suitability

Years of study, called site characterization, are planned at Yucca Mountain, Nevada, to collect and analyze detailed environmental and geologic data from aboveground and underground. Many scientific and technical issues about the geologic characteristics of Yucca Mountain must be resolved, such as:

- how much water there is in the rock and how it moves through the rock;
- how an earthquake might affect a repository and the ground water table;
- the effects future volcanic activity might have on a repository; and
- whether the development of a repository would have acceptable environmental impacts.

Site-characterization activities are divided into three types of scientific investigations: surface-based tests, which include analyzing rock, soil samples, and water movement; underground tests, which include examining rock at deep levels; and laboratory tests,

which encompass analyses of rock, liquid and gas samples collected from surface-based and underground test activities.

Prioritizing Our Activities

One of the program's strategic objectives has been to determine, as soon as possible, whether the site is suitable based on certain factors. The Department of Energy's general siting guidelines specify both disqualifying and qualifying conditions for characteristics important to the near- and long-term safety of a repository, including physical features relevant to waste isolation – geohydrology, geochemistry, climatic changes, and tectonics – as well as other features, such as socioeconomic and transportation impacts and ease and cost of repository construction and operation.

In 1991, a contractor study was conducted to determine if any disqualifying factors had been found which precluded further site characterization, and to focus near-term

Mapping in
Solitario
Canyon.

investigations on those activities that might disqualify Yucca Mountain as a repository site. The *Report of Early Site Suitability Evaluation of the Potential Repository Site at Yucca Mountain, Nevada*, released in February 1992, concluded that evidence currently available showed there was no technical reason at that time to stop studying the Yucca Mountain site.

We reassess our site-characterization activities periodically to reprioritize them based on new demands and expanding data. Our priority in 1994 is early exploration of major disqualifying and qualifying site conditions. The early identification of a significant disqualifying factor, if there is one, would be critical knowledge because it would signal the need for a new siting decision by the Congress.

Surface-Based Testing

Surface-based studies at Yucca Mountain have been in progress since May 1986. These studies include:

- drilling holes to understand the geology, volcanic activity, and geohydrology;
- digging trenches to study faults and volcanism;
- sending sound waves down from the surface to measure response from rock layers; and
- other geophysical methods to study the potential for earthquakes and volcanoes, the Earth's magnetic field, and the area's background radioactivity.

Initially, these studies consisted of non-surface-disturbing testing in existing exploratory boreholes and wells; analyses of, and experiments with, rock and water samples; geophysical surveys; meteorological, hydrologic, and seismic monitoring; geologic mapping, and sampling of materials at the surface.

Following these initial surface studies, major new surface-disturbing work began in July 1991 when the State of Nevada granted the necessary environmental permits for air quality and underground injection control. In 1992, the State granted a necessary waste appropriation permit. Surface-based activities were expanded further in November 1992 to support construction of the north portal for the Exploratory Studies Facility.

Drilling Programs

Exploratory drilling is used to characterize underground conditions from the surface. Boreholes are drilled into and surrounding Yucca Mountain to obtain information on geological structure, faults, rock characteris-

The LM-300 drill rig on site at UZ-14.

tics, depth to the water table, water chemistry, infiltration of surface water, water movement in soil and rock, and the amount of water present in the unsaturated zone.

A significant characteristic of the Yucca Mountain site is its thick, unsaturated rock zone, which would allow the repository to be located about 240 to 370 meters (800 to 1,200 feet) above the water table. The unsaturated rock is expected to be the principal natural barrier to the migration of radionuclides – radioactive atoms – from the stored spent nuclear fuel and high-level radioactive waste to the accessible environment.

One of the challenges in gathering accurate data is drilling through the unsaturated zone with minimal physical or geochemical changes to the rocks and soil. The core samples derived from these boreholes are being examined to determine the nature and structure of the geological foundation underlying Yucca Mountain in a comprehensive and thorough fashion. Instruments will be placed in boreholes to gauge how quickly and how far naturally occurring water might move through the rock.

In March 1993, we completed the first borehole of the unsaturated zone drilling program, using the LM-300 drill rig, which uses state-of-the-art techniques to dry drill a 12-inch diameter borehole to acquire uncontaminated scientific samples from the unsaturated zone. The final depth of this first drillhole, identified as UZ-16, was approxi-

This is how a slice of Yucca Mountain might look. Site characterization activities are providing scientists with information about faults and the nature and extent of the unsaturated zone.

reached a depth of 397 meters (1,302 feet) by the end of the fiscal year.

One of the program's strategic objectives in 1994 is the early exploration of major qualifying and disqualifying physical site conditions.

mately 514 meters (1,686 feet), about 20 meters (65 feet) into the water table. Testing of the unsaturated zone is now underway in this borehole. We began drilling a second drillhole, UZ-14, in April 1993. It had

All boreholes for the natural infiltration drilling program were completed this year. The purpose of this drilling is to determine the extent to which rain or melted snow penetrates the soil and bedrock on and near the mountain. These boreholes are between 15 and 76 meters (50 and 250 feet) deep and use a neutron probe to measure the moisture content of the subsurface rock monthly. Ninety-nine neutron-access boreholes have been drilled since 1983, 24 of these within the last two years.

Hydrologic investigations studying water infiltration into the unsaturated zone beneath the surface zone below the surface of Yucca Mountain have yielded samples that suggest the average residence time of the water migrating through the rock units between the surface and the depth of the potential repository is several hundred thousand years. Water infiltration into the soil cover atop Yucca Mountain is held near the surface where it evaporates back to the atmosphere and very little infiltrates the bedrock. So far, these tests suggest that extremely little moisture is likely to infiltrate the rocks at the repository level from natural processes.

Excavation activities at the Ghost Dance fault.

In 1993, paleoclimate studies, which represent a complementary approach in estimating the seasonal and yearly precipitation that fell on Yucca Mountain during the last 50,000 years, focused on the collection of fossil plants and animals and the assessment of the climatic conditions under which they would have thrived.

Much of this year's surface-based activities supported the design of the Exploratory Studies Facility. Eight boreholes were drilled along the north ramp alignment to provide geologic layering and rock properties data for the layout and construction of the underground facility.

Drilling neutron access boreholes.

Trenching

Over several years, we have excavated trenches and test pits to expose subsurface layers of soil and rock to allow evaluation of geologic faults that may be capable of generating earthquakes. Similar excavations have

Geohydrology studies focus on how water moves through Yucca Mountain and how water could affect a repository.

allowed us to evaluate volcanic history and to provide continuous geologic sections to examine evidence of past climates.

This year, we completed the fault-trenching program in Midway Valley, a site which may be used for repository surface facilities. We excavated and mapped six trenches and cleared four natural bedrock surfaces, or pavements, across the Bow Ridge, Paintbrush Canyon, Stagecoach Road, Solitario Canyon, and Bare Mountain faults. The geologic deposits exposed in these trenches are being examined for evidence of how frequently and in what directions displacements have occurred along these faults, specifically in the last two million years.

Extensive mapping of the Ghost Dance fault, the major fault structure cutting through the proposed repository block, was accomplished this past year to define more accurately the width of the fault zone.

Trenching studies at Crater Flats and at Lathrop Wells continued. We are investigating the nature and age of volcanic cones to the west of Yucca Mountain. Small-scale soil test pits were dug to collect samples of volcanic rock, which will be used to further characterize the age and origin of these features.

Project scientists have been studying faults and monitoring earthquakes in the region to gather information about the likelihood and potential impact of earthquakes on a repository.

play in retarding the migration of radionuclides – radioactive atoms – from a repository. Studies of the rocks beneath Yucca Mountain show that zeolites are distributed in both the matrix and the fractures in three

rock units beneath the potential repository horizon and above and within the saturated zone.

This year, we also continued studies of Fran Ridge, an area selected for conducting a preliminary large-block test to develop equipment and procedures for at-depth testing to determine how the heat emitted by nuclear waste would affect the underground environment. The area was cleared of surface debris in preparation for blasting and rock cutting to define the block.

Other Studies

Studies already are being done and more are planned on environmental, socioeconomic and transportation issues. (Chapters 9 and 10, *Environment* and *Transportation*, contain further information on these programs.)

Socioeconomic studies include estimates of the repository program's effect on employment, including jobs with the program and jobs supporting the work of people in the program. We also are studying potential effects on community service, tourism, and population distribution.

Transportation studies evaluate shipping methods and routes in Nevada. The studies also will include technical and financial assistance needed for public safety organizations for emergency response training.

Seismologists calibrate the instruments that monitor what goes on under the Yucca Mountain region.

Ongoing studies are focused on the analysis of naturally occurring minerals in the volcanic rocks and fractures to assess the history of water movement through the mountain in the last eight million years, and the potential role that these minerals, called zeolites, may

3

EXPLORATORY STUDIES FACILITY:

Going Underground At Yucca Mountain

Because one of the keys to determining the suitability of the Yucca Mountain site lies in the investigation of the site's geology through underground exploration, we accelerated our efforts this year to design and construct an underground testing facility.

We achieved two major milestones. In November 1992, we broke ground for the Exploratory Studies Facility, a laboratory to conduct site-characterization activities underground. And in September 1993, we completed excavation of the facility's north portal starter tunnel—the launch chamber from which a tunnel boring machine will excavate over 25.6 kilometers (15.5 miles) of tunnels cut through Yucca Mountain.

Site Characterization

Yucca Mountain, designated by the Congress in 1987 as the only site to undergo site characterization at this time, has many inherent qualities which may allow it to keep nuclear waste isolated for thousands of years.

One of our strategic objectives is to determine whether the site is suitable for development as a repository. To that end, most of our program's resources are directed at an extensive program of site characterization.

There are three types of scientific site-characterization investigations: surface-based tests, which include analyzing rock, soil samples, and water movement; underground tests, which include examining rock at deep levels; and laboratory tests, which encompass analyses of rock, liquid and gas samples collected from surface-based and underground test activities.

Underground Testing

Underground exploration and testing complement surface-based testing. Because many of the geologic features in the area, such as faults and fractures, are nearly vertical, surface-based activities such as drilling and mapping provide only limited information on these characteristics. The best ap-

proach for examining the character and extent of some geologic features is excavating access ramps (inclined tunnels) and horizontal tunnels (drifts).

The underground exploration and testing program has a number of key objectives:

- to gather otherwise unobtainable data on the major geologic features through the mountain;
- to gain access to the underground so that various thermal, hydrologic, and mechanical tests can be initiated on-site; and
- to allow a continuous, early look at the natural system to assess site suitability and provide critical data for repository design.

Excavating an underground facility is important in a larger sense, too, because if there are any disqualifying features that would lead to abandoning the Yucca Mountain site, they most likely will be revealed through excavating the exploratory tunnels.

The Exploratory Studies Facility

Extensive tunneling throughout the geologic block at Yucca Mountain will give visual

access to the complex geological makeup of the site. Underground exploration and testing will be conducted in the Exploratory Studies Facility, consisting of two U-shaped tunnel loops on two separate levels under the surface. As currently planned, this facility will have a main horizontal tunnel, or drift, where

The sooner we get underground, the sooner our scientists can discover if there's any reason to disqualify Yucca Mountain as unsuitable for a potential repository.

the majority of the testing activities will take place. The main test area is connected to the surface by a ramp at each end, one to the north portal and one to the south portal. The Exploratory Studies Facility will consist of 25.6 kilometers (15.5 miles) of tunnels and more than 28 hectares (70 acres) of surface facilities.

The main test area, or gallery, will be located in the welded tuff of the Topopah Spring formation, about 300 meters (1,000 feet) below the surface. Two lateral tunnels, the west and east drifts, will extend from the main tunnel.

Connected to and below the main tunnel will be another, smaller tunnel, designated the Calico Hills Exploratory Tunnel. Many alcoves will branch off from the tunnels to provide access to fault zones and to provide sites for further tests.

Our current design specifies extensive testing areas so that many activities can be conducted simultaneously. Planned test facilities include: over 40 test alcoves off the north and south ramps, a core test area of 2.5 kilometers (1.6 miles) of

Aerial view of the north portal of the Exploratory Studies Facility, February 1993.

tunnel containing numerous alcoves and support facilities, as well as additional alcoves in other areas of the facility.

Scientists from many different fields of expertise will conduct tests to gather data to evaluate site suitability, to provide data for the designs of the repository and waste package, to predict long-term performance of the entire repository system, and to support a

site characterization. Exploration will include mapping the geology to record the condition of the host rock and overlying rock strata, collecting rock samples, and monitoring drift stability. Understanding the character and extent of the faults that cross the site is especially important. Hydrogeology and geochemistry tests will examine the flow of ground water along faults and fractures and through the rock matrix. Thermal testing will

Proposed
Exploratory
Studies
Facility
Design

license application should the site prove suitable. To provide data for potential repository design and construction, scientists will assess the strength and response of the rock mass once ramps and drifts are constructed in the facility to understand how the rock is likely to perform in an actual repository.

The variety of data gathered will help scientists determine the geologic, hydrologic, geoengineering, and geochemical properties of the layers of rock deposits that make up the potential repository area. Some of these tests will assess how the natural and engineered barriers will perform under conditions similar to those in a potential repository.

Currently, 42 testing activities in four general categories have been defined as part of overall

include experiments with heaters to determine how the heat emitted by nuclear waste would affect the underground environment.

Facility Design

During the past several years, our plans for the design of the underground facility, as well as for exploring and testing, have evolved substantially from the concept presented in the Site Characterization Plan in 1988. In 1991, we completed a major review of the Exploratory Studies Facility design, incorporating a number of recommendations from outside reviewers, such as the Nuclear Waste Technical Review Board and the Nuclear Regulatory Commission. We modified the original design to include inclined ramps rather than vertical access shafts so that data collected are representative of the entire site. We also altered our original plans for using drill-and-blast excavation methods in favor of

using mechanical mining techniques that will minimize potential disturbances to the host rock.

In January 1992, we received approval to develop final designs for the Exploratory Studies Facility from the Department's Energy System Acquisition Advisory Board. Final design is ongoing. We are developing detailed drawings and construction specifications required to build the facility.

We have adopted a phased approach that divides the facility into discrete design packages. By the end of fiscal year 1992, we had finished initial technical reviews and had begun verification for the first design package, which included surface-disturbing activities for the north portal access to the facility, the tunnel-boring machine launching chamber, access roads, and surface facilities. During fiscal year 1993, two additional design packages were

ESF north portal from Midway Valley, January 1993.

tunnel to be excavated by the tunnel boring machine. The Nuclear Waste Technical Review Board encouraged use of a small tunnel diameter for stability, cost-effectiveness, and safety. In October 1992, we submitted a ramp-sizing study for the facility. The results showed that a 7.6-meter (25-foot) diameter tunnel boring machine would reasonably satisfy all known programmatic requirements. In April 1993, the Secretary of Energy concurred with this determination.

Recent proposed changes to the layout would provide greater flexibility in design and construction of the Exploratory Studies Facility.

The Exploratory Studies Facility design continues to evolve, and we reexamine our conclusions as actual construction reveals new data. We also continue to seek review and comment from experts outside the program. In November 1992, the Yucca Mountain Project participated in a three-day workshop on alternative design concepts and construction strategies for the Exploratory Studies Facility sponsored by the Nuclear Waste Technical Review Board's Panel on Structural Geology and Geoenvironment. The

Rock surface preparation at the north face, January 1993.

begun and initial review completed. One package contains the design of all surface structures on the north portal pad, and the second includes the design of the north ramp from the surface to the Topopah Spring layer.

One of the major design decisions that we reached earlier this year was the size of the

ESF north portal from Midway Valley, June 1993.

packages to be placed in drifts further above the water table.

All our design and construction activities are conducted under stringent quality assurance procedures. We will prepare an impact analysis defining the changes to baseline costs and schedule that would result from making any changes to the Exploratory Studies Facility design. Change-control boards at the project, program, and Department levels each will evaluate the proposed changes to determine any resulting technical, cost, schedule, regulatory, environmental, institutional, health, or safety impacts. Each

board must approve any changes before they can be implemented.

workshop included discussions on a range of key issues by experts in underground tunneling and construction who provided valuable insight and comments on the Exploratory Studies Facility design.

At the July 1993 Nuclear Waste Technical Review Board meeting, we proposed several changes to the layout of the underground facility as a result of new information from advanced conceptual designs and surface-based testing, design refinements, and comments from oversight groups. The enhanced layout would provide greater flexibility in design and construction of the Exploratory Studies Facility. One suggested change was to reduce the relatively steep grades of the ramps, which would allow the use of conventional rail transport during the facility's construction. We also proposed realigning the main tunnel to parallel the Ghost Dance Fault, excavating shorter tunnels perpendicular to the main one to allow for exploration of the fault at several points. The enhanced layout also would allow waste

Construction Begins

On November 30, 1992, site preparation began for pad construction at the north portal entrance to the Exploratory Studies Facility. On a 4-hectare (10.5-acre) area, workers carefully removed and stored topsoil, and then graded and built up the area to

Surveyors at the entrance to the north portal tunnel before beginning photogrammetry, April 1993.

Installing explosive charges for blast on ESF face, April 1993.

be used for support facilities. Once the groundwork on the entrance pad ends, construction crews will begin putting up the buildings that excavators will use as support facilities. Among them are an office/warehouse complex, a visitors' center, machine and equipment shops, storage areas, changing rooms, showers, and all the other necessities generally found in large mining operations. Before the tunnel boring machine can be used, electrical substations will have to be built and power lines extended to the site.

On April 2, 1993, workers at Yucca Mountain began excavations for the north portal starter tunnel at a ridge known as Exile Hill. An 18.5-meter (60-foot) vertical rock face was carved out of the hillside. Next, workers cleared a "box-cut," a horseshoe-shaped entry-point. The exposed rock was secured by rock-bolts and wire mesh to protect workers from rockfall and other hazards.

Workers excavated slowly and in stages, using traditional drill-and-blast methods. To preserve the mountain's effectiveness as a repository, should it be suitable

for one, the natural geological barrier must be studied with limited impact. Blasting the entire entrance open with large charges of explosives could damage both the mountain and the starter tunnel. Instead, measured drilling and small charges were used, followed by extensive ripping and tearing with large equipment.

On September 9, 1993, we achieved a major goal – excavation of the final few meters of the 60-meter (200-foot) starter tunnel – 11 days ahead of schedule and without mishap. The starter tunnel will serve as an assembly area and launch chamber for a tunnel boring machine, similar to that used to excavate the

On September 9, 1993, excavation of the final few meters of the starter tunnel was completed, 11 days ahead of schedule.

tunnels under the English Channel, between Great Britain and France. The tunnel boring machine is an operator-driven drilling vehicle equipped with cutters capable of excavating a 7.6-meter (25-foot) diameter hole in solid

Entrance to the north portal starter tunnel, May 1993.

Entrance to the starter tunnel after the blast, August 1993.

rock. To work properly, it must be positioned against a vertical face inside Yucca Mountain. The starter tunnel is necessary so that the boring machine can grip the sides of the tunnel and push its cutters into the rock.

The 700-ton boring machine is slated for delivery in April 1994, arriving piece by piece through some 70 truck shipments. Once assembled, the machine will be moved by rail into the starter tunnel.

Once "launched," the tunnel boring machine will begin excavating the 7.8-kilometer (4.7-mile) Topopah Spring tunnel loop from north to south. We anticipate beginning excavation in September 1994, with the boring machine resurfacing at the south portal within two years. Then access would be available from both portals for excavating alcoves and turnouts and to begin testing activities. A conveyor-belt system will carry the excavated rock out of the underground via the north portal.

After completing the main tunnel loop, we will begin

excavating additional east-west tunnels and the core test area using other mechanical excavation equipment. When all excavation is complete on the Topopah Spring layer, excavation to the Calico Hills layer will begin.

Although the starter tunnel is intended as a small and carefully designed first step into the mountain, it already is providing scientists with important information even before test facilities are completed. Project engineers are focusing primarily on the effects their activities may be having on the mountain. For

example, they test stress changes in the surrounding rock during excavation. Hydrologists are evaluating the possible presence of water; they are interested in whether any water detected within the starter tunnel

Once "launched" in September 1994, a tunnel boring machine will begin excavating the 5-mile Topopah Spring tunnel loop from north to south.

A tunnel boring machine, similar to the one to be used to excavate the Exploratory Studies Facility.

could be traced to seepage from recent rainfall. As the tunnel was excavated, geologists mapped geologic features, such as potential faults and fractures.

In October 1993, excavation began on the first test alcove off to the northern, or right-hand, side of the starter tunnel. Beginning about 42 meters (140 feet) inside the starter tunnel, the alcove will begin from a five-meter (17-foot) opening, and will extend 23 meters (75 feet) inside the mountain. Scientists and engineers will use the alcove to test the methods and equipment that will be used in site characterization deep within the Exploratory Studies Facility.

Interior of the starter tunnel, looking toward the portal, June 1993.

4

THERMAL LOADING: *A Cross-Cutting Issue*

One of the key decisions we will make in developing a permanent radioactive waste-disposal system is how “hot” our repository will be. The issue of heat levels, known as thermal loading, has wide-ranging implications on other system components, including waste package design, repository design, transportation, temporary storage, and waste retrievability.

Choosing a “hot” or “cold” strategy, or something in between, is not an easy decision. Fundamental disagreement among scientists regarding the consequences resulting from the various options and the validity of models designed to describe them continued to be evident this year at the March 1993 symposium on thermal loading convened by the Committee for the Advancement of Science at Yucca Mountain and at the July 1993 full Board meeting of the Nuclear Waste Technical Review Board.

What is Thermal Loading?

The radioactive decay of spent nuclear fuel produces substantial heat energy. The amount of heat can depend on many things, including how long the fuel was used in the reactor and how long it has been kept in dry or wet storage after it is removed from the reactor. Young spent fuel has an initial high rate of heat generation which decreases quickly during the first 60 years of aging, even though the fuel remains highly radioactive.

Spent fuel will continue to produce thermal energy long after it is placed in a repository. Heat will affect waste packages, the rock mass surrounding the waste packages, water moisture, and the chemistry of the rock for thousands of years. Scientists and engineers must study these effects and determine what temperature limits will be most advantageous to achieve long-term isolation of waste.

Thermal loading refers to the heat output of spent nuclear fuel and high-level waste emplaced in a repository. Once a "thermal-loading strategy" is devised, a repository can be designed to achieve the desired range of temperatures over a chosen period of time. While no decision has been made about high or low thermal loads, we are gaining knowledge about how thermal loads can be manipulated. Factors include:

- Burnup history of the spent fuel, or how long the spent fuel remains in the reactor. The longer the fuel is used, the higher the thermal output. The burnup level is controlled at the individual reactor sites.
- Age of the spent fuel, measured in years since removal from the reactor. Young spent fuel has a high initial thermal output.
- Amount of spent fuel placed in each waste package.
- Number of packages emplaced per acre. In general, less waste per acre means lower temperatures.
- How the packages are emplaced, in bore-holes or in drifts (horizontal passages).

What Are the Options?

High thermal loads and above-boiling temperatures for geologically short time periods – several hundred years – have been assumed in most discussions of potential repository concepts since 1957. The Site Characterization Plan prescribes a thermal-loading strategy where the temperature of the repository is to exceed the boiling point of water for a period of 300 to 1,000 years. This strategy's intent is that, during this period, the heat will remove from the vicinity of the waste packages the moisture that could lead to corrosion of the waste containers, degradation of the waste, or transport of radionuclides.

Since the Site Characterization Plan was published in 1988, further investigation has been done. Alternatives to the original thermal-loading strategy of 57 kilowatts per acre have been proposed, ranging from "hot" to "cold."

In the hot strategy, the thermal load is higher than the Plan strategy, more than 100 kilowatts per acre. This level is intended to be sufficiently high to boil the water that is present and keep the host rock dry for several

thousand years, minimizing the potential for the waste containers contacting any liquids.

A "hot" repository could accommodate more spent fuel, possibly eliminating or postponing the need for a second repository site. Before final emplacement, the spent fuel would have to be aged for approximately 60 years to reduce the high initial temperatures by storing the waste at the reactor site, in a temporary storage facility, or on a repository site. The spent fuel could then be packed more densely to maintain above-boiling conditions.

In the cold, or below-boiling, strategy, the thermal load is lower than the Plan strategy, about 20 kilowatts per acre. In this case, repository temperatures would be kept low enough to minimize disturbance to the surrounding rock and limit the uncertainties in changing geochemical conditions, rock characteristics, and waste package processes due to heat. The "cold" strategy provides a temperature regime where rock properties and behaviors may be more predictable. Stresses within the host rock from thermal expansion theoretically would be reduced. Below-boiling temperatures can be achieved by a combination of aging spent fuel, placing less waste in each package, and wider spacing of waste packages in the repository.

Thermal loading refers to the heat output of high-level waste emplaced in a repository. Heat will affect waste packages, the rock mass surrounding the waste packages, water moisture, and the chemistry of the rock for thousands of years.

Artist's drawing of waste packages emplaced in boreholes within a repository.

A specific thermal-loading strategy affects the selection of materials for and the design of the waste package. It also affects the design of a repository. Will boreholes or drifts be used to store waste packages? If drifts are used, the diameter is likely to be different for each strategy. Waste package handling, subsurface layouts, and ventilation concepts also are elements of repository design that are dependent on a specific thermal loading strategy.

The decision essentially revolves around interpretation of the effect of thermal loading on two

major geologic issues: ground water and rock characteristics.

Making the Decision

There are technical advantages and disadvantages associated with each thermal loading strategy. Examining the factors that affect thermal loading make it clear that any decision has an impact on most aspects of the waste management system, from accepting waste at a reactor site, to transporting the waste, to designing storage and transportation casks, to deciding on using multi-purpose canisters, to waste package design, and repository design. Each strategy's implications for other elements of the waste management system must be assessed.

For example, thermal loading may affect the magnitude and the content of the site characterization program. For cold strategies, a considerably larger area of the repository block and its extended areas may need to be investigated. If an above-boiling strategy is chosen, the content of the site characterization program may change to focus more on the impact of heat on the site's minerals and rock structures.

In the "hot" strategy, the heat level is intended to be sufficiently high to boil the water that is present and keep the host rock dry for several thousand years. The "cold" strategy assumes temperatures low enough to minimize disturbance to the surrounding rock.

Ground Water Considerations

The purpose of a geologic repository is to safely isolate spent nuclear fuel and high-

level radioactive wastes from the surface environment. We know that if radioactive materials are carried from the repository, they will move as either gases or

liquids. The fluid of primary concern is ground water which may ultimately become drinking water.

A key scientific issue is determining the extent to which thermal-loading strategies can increase or decrease the likelihood that ground water will come in contact with waste containers. Wet conditions are more likely to lead to waste package corrosion and failure, facilitating possible radionuclide release and transport to the accessible environment. Dry conditions may minimize these risks.

All loading scenarios, except very hot, apparently lead to wet conditions at times less than 1,000 years. Proponents of the hot strategy maintain that the absence of liquid water in the vicinity of the waste packages would eliminate the possibility that water-soluble contaminants may migrate toward the environment. Opponents argue that absolute dry-out is not possible, regardless of the thermal scenario used, and that liquid water may be retained in the rock even at high temperatures.

Host Rock Considerations

The reaction of the rock to the heat produced by emplaced nuclear waste also is a major concern. How well will the rock conduct heat away from the fuel? How will the rock physically react to heat? How will heat affect the rock chemistry?

The temperatures of the repository primarily will depend on two factors: the thermal load of emplaced waste and the repository's thermal conductivity, which is the ability of

Scientists examine tuff with electron microscopes to determine its properties.

surrounding rocks to dissipate heat. Conductivity is important to avoiding extreme temperatures that may fracture rock or damage the waste package. The higher the conductivity, the lower the repository temperature.

Other important rock characteristics are stability and plasticity. Many minerals in the rock may be changed by exposure to heat. For example, minerals such as zeolites and clays give off water when heated. The solubility of minerals may increase or decrease in heated water. Mineralogical changes to rocks at elevated temperatures may affect adversely

A key scientific issue is determining the extent to which thermal-loading strategies can increase or decrease the likelihood that ground water will come in contact with waste containers.

their sorptive properties, that is, their ability to remove dissolved material from solutions passing through them.

If temperatures rise enough, the strength of the host rock can be affected. We usually think of rocks as solids. But at elevated temperatures and pressures, rocks will actually flow. This plasticity may have both advantages and disadvantages. A rock flow may close fractures. However, if pushed too far, the rock may crack and not seal, resulting in additional or enhanced pathways for water flow.

In general, opponents of "hot" thermal loading are concerned that intense heat will alter geology or geochemistry and possibly degrade the natural barrier performance. Advocates maintain that high thermal loads may result in a decrease in fracture penetrability, reducing or eliminating potential pathways for radionuclide migration, and that the benefits from a drier environment outweigh potential geochemical changes.

Waste Package Considerations

Thermal loading will have a profound effect on any disposal device. Wet conditions in a repository require a robust corrosion-resistant, long-lived container. Dry conditions may or may not require such a container.

Selecting a hot strategy implies fewer but larger waste packages and a smaller repository area; a below-boiling strategy implies a larger area with smaller waste packages. The program is currently evaluating the use of multipurpose canisters within the waste management system. This concept may narrow the thermal load options because multipurpose canisters would hold several spent fuel assemblies, and the canisters may be hotter than disposal containers previously considered. Large capacity multipurpose canisters are compatible with an "extended hot" thermal strategy, and would require emplacement in drifts rather than in boreholes.

Other Considerations

There are other considerations to take into account. Opponents of the hot strategies feel that it may be harder to maintain operational safety and waste retrievability with high thermal loading because of the impact on support systems and possible instability of openings in rock that may be structurally altered by high temperatures.

Concerns also have been raised about the potential effects posed to the environmental and biological resources of the site, if ground-

performance standards that must be met to successfully license a repository. On the one hand, a hot, and presumably dry, repository may prove simpler and easier to license than

Diagram of heater test to evaluate the effects of intense heat on rock.

a wet repository, since a large part of the licensing defense of a wet repository must inevitably deal with mitigation of radionuclide releases as waste packages corrode. On the other hand, a hot strategy may make projections of long-term repository performance more difficult, because we may not be able to convincingly predict the effects on the repository's physical environment.

Evaluating the Strategies

The major considerations in the selection of a thermal strategy include:

- duration of time before corrosion of the waste packages by liquids could allow a potential release of radionuclides;
- avoiding additional uncertainties in the performance assessment of the engineered barrier system; and
- system implications of cooling spent nuclear fuel for long periods before disposal in a repository.

We have scientific studies underway to evaluate thermal effects on the natural and engineered barriers of the potential repository. The strategy is to develop and perform

Opponents of hot thermal loading are concerned that intense heat will alter geology or geochemistry and possibly degrade the natural barrier performance.

surface temperatures are elevated. Another issue involves the contention that an increased heat load would promote the migration of gas-borne contaminants.

There is particularly vigorous debate among project scientists and regulatory compliance specialists whose concerns are focused on the

laboratory analyses and both full-scale and limited-scale long- and short-term tests, both in the underground Exploratory Studies Facility and at the surface. These tests will provide data over a range of thermal conditions.

For years, rock samples from the Yucca Mountain site have been subjected to temperatures that might exist in a repository. The data gathered from these laboratory tests was used to create computer models which project the results of the rock's long-term reaction to high heat. Four thermal-loading scenarios – two in-drift emplacements and two vertical borehole emplacements – were modeled as input for the total system performance assessment activity conducted this year.

for later at-depth testing will be conducted in a small block cut from a rock outcrop at Fran Ridge. This site was selected because the 4.5-by 3-meter (15- by 10-foot) block can be constructed in the same type of tuff as the proposed repository. Heaters will be installed in holes inside the block of rock, and the temperature level will reach about 130 degrees Celsius (266 degrees Fahrenheit) within six months. Instruments inserted into the block will measure heat, moisture, and other variables.

In 1993, we began site preparation at Fran Ridge for blasting and rock cutting to construct the test block. The heater test at Fran Ridge is expected to begin in mid-1994 and last for two years.

A rock saw is being used to cut out a block at Fran Ridge in which to conduct heater tests in 1994.

Making a decision about the most effective thermal-loading strategy will require more than data obtained from site characterization; it requires an integrated evaluation of the impact of thermal loading on all components of the waste management system, from the acceptance of waste at the reactor sites to the emplacement and subsequent monitoring in a repository.

During 1993, we conducted a study evaluating both cold and hot thermal-loading scenarios to ensure that the impacts of each strategy on system components

Heater tests are designed to improve our understanding of how various thermal loading scenarios might impact fluid and gas movement in the repository block and the consequences of such movement to repository performance. Comprehensive heater tests inside Yucca Mountain will take place after the Exploratory Studies Facility is completed in four years.

Short-term heater tests to validate computer predictions about heat generation and behavior and to develop equipment and procedures

such as waste packages, multipurpose canisters, the engineered barrier system, and transportation system, were thoroughly analyzed. This study, completed in December 1993, was intended to focus the program's thermal-loading activities by identifying further analyses, model development and testing required to reduce uncertainties and by considering cost, safety and operability issues. This initial evaluation of thermal-loading systems integration provided a sufficient technical basis to narrow the loading options to be considered in fiscal year 1994.

To address the realities of at-reactor storage prior to Federal disposal, many stakeholders, including numerous utilities and the Nuclear Waste Technical Review Board, have recommended that the Department evaluate ways to standardize the handling and management of spent nuclear fuel prior to disposal. We responded.

We studied the feasibility of incorporating multipurpose canisters into the waste management system. The results were encouraging, so we proceeded with a conceptual design study, supported by systems studies and cost analyses.

At the time of this report's publication, we are proceeding with the next phase of the development program, including the acquisition of designs for submission to the Nuclear Regulatory Commission for certification. Canisters could be available for use by utilities near the 1998 goal.

MULTIPURPOSE CANISTERS:

5

Rethinking Our Strategy

The concept of developing one canister that can be loaded with spent-nuclear fuel rods and then used for storing, transporting, and disposing of radioactive waste is not a new idea. But support for the idea has been renewed as engineers and scientists reexamine multipurpose canisters as an option for waste package design.

In February 1993, we completed a feasibility study which merited proceeding with developing the idea. By September 1993, we had completed a draft conceptual design report, which takes into account information from possible vendors and comments from other interested parties. This draft report is being analyzed to determine whether multipurpose canisters are the best way to proceed. There still are many questions to answer, and our review has continued into 1994.

We held a public workshop in July 1993, soliciting comments and discussions from parties interested in the multipurpose canister. Participants said the near-term needs of

utilities for storage of spent-nuclear fuel should be considered before repository requirements. Participants also said the program should draw from current industry experience in designing the canister, and that utilities should be informed quickly of system interface requirements. We were told that cost should be a major factor in the design, manufacturing technique, and material selection of the multipurpose canister.

We held another public meeting in November 1993 to receive comments following release of the draft report. The participants discussed implementation strategies, as well as how the public can remain involved in developing this concept.

Our evaluations supported the view that the multipurpose canister concept offers significant advantages for a more integrated approach to spent fuel management at both utility storage sites and within the Federal waste management system. In February 1994, the Secretary of Energy directed us to proceed

Steps involved in using a multipurpose canister at a reactor site.

with the next phase of the multipurpose canister development program, including the acquisition of designs for submission to the Nuclear Regulatory Commission for certification.

What Is a Multipurpose Canister?

A multipurpose canister would be made of metal and designed to hold spent-fuel assemblies from commercial nuclear reactors. As proposed in the draft conceptual design report, a multipurpose canister is a cylindrical shell with two lids. Inside is a basket that will contain spent-fuel assemblies. The basket provides structural support for the assemblies and is a conduit for the transfer of heat generated by the fuel. The shell of the cylinder provides more structural support. There are two top lids that provide containment of radioactive material. One of those outer lids also serves as a seal that meets specific safety regulations.

When a multipurpose canister goes into use, it will arrive at a nuclear facility with the bottom lid welded on. In order to load assemblies, each canister would first be put into a transfer cask and then lowered into a fuel pool where spent-fuel assemblies are stored. The canister would be loaded with fuel assemblies and the top covered with a shield plug and welded shut.

Overpacks are an important element of the multipurpose canister strategy. Casks, or overpacks, have been designed for each separate purpose: storage, transportation and disposal.

When a loaded canister is ready for storage, it will be put into a storage overpack and sealed. Canisters can be used to store fuel on-site at reactors until they are transported to either a temporary storage facility or geologic repository. Once an interim storage facility has received the multipurpose canisters, they will be either stored there or transported to a repository. If transported directly

to a repository, a canister in an overpack will be loaded on a dedicated train for shipment. At the repository, the canister will enter a waste-handling building where it will be unloaded from the transportation cask, transferred into a disposal overpack to be welded shut, and moved to its designated disposal room.

What Are the Advantages?

The multipurpose canister offers several potential advantages in the management of spent fuel:

- A multipurpose canister minimizes the routine handling of individual spent-fuel assemblies. Once assemblies are loaded mechanically into the canister, they do not

The components of a multipurpose canister.

need to be handled again before disposal, even though the loaded, sealed canister can be handled as many times as needed along its journey to disposal.

- The canister strategy allows storage containers to be standardized, which ensures compatibility when containers are transported from reactor sites to Energy Department facilities. Currently, utilities may use different types of containers for storage. If a standardized container is not developed and used for transportation and disposal, then fuel assemblies will be handled more frequently, and special equipment and precautions might be required.

- This approach is based upon existing technologies.

Fitting Into the Waste Management System

Multipurpose canisters as currently designed cannot be used at all reactor sites because of technical limitations at the commercial plants. Nineteen of 121 facilities will be unable to use the canisters because of limited facilities or equipment at reactor sites. Spent fuel from these sites will be shipped in smaller casks.

The number of spent-fuel assemblies that can be loaded into a multipurpose canister is limited by four factors:

- the facilities and equipment available at the reactor site where transfer begins,
- access to a railway,
- weight limits for rail transportation, and

Transportation cask carrying a multipurpose canister.

- the temperature level selected for the repository. (Chapter 4, *Thermal Loading*, describes this technical issue in greater detail.)

Canisters are designed in two sizes – large and medium. The large multipurpose canister would have a capacity of between 21 and 40 assemblies, according to the type of reactor from which the assemblies are taken. The large canister would weigh up to 125 tons.

The medium-sized canister would weigh up to 75 tons and include between 12 and 24 assemblies, depending upon reactor type.

Any criteria that are known about the repository have been incorporated into the conceptual design. A final determination on the repository's thermal load, one of the key criteria that may affect the final design of a multipurpose canister, has not yet been made. Thermal loading refers to the heat output of radioactive waste emplaced in a repository.

The two main strategies are "hot," or above-boiling conditions, and "cold," below boiling.

Although no decision has been made about a thermal-loading strategy, the current multipurpose canister design provides the flexibility to accommodate either a hot or cold approach.

If the current design of multipurpose canisters is used, then changes will be required to the conceptual design of the monitored retrievable storage facility, as reported in November 1992. Among the changes are increasing the number of storage spaces; increasing the site area; and reconfiguring the transfer facility to accommodate multipurpose canisters as well as bare spent fuel.

Regulations and Licensing

The multipurpose canister and overpack would be designed to rigorous standards that would satisfy Nuclear Regulatory Commission regulations for any container used to transport waste. To ensure that radioactive contents would be contained, and the health and safety of workers, the public and the environment protected, a series of analyses would be conducted, including one that requires the transport container to remain intact when dropped 30 feet onto an unyielding surface.

The Nuclear Regulatory Commission will be responsible for certifying the multipurpose canister system which includes transportation, storage, and disposal casks. Licensing will involve the utilities for at-reactor storage and cask-to-cask transfers, the vendors of casks and canisters, and the Department of Energy for a storage facility and repository.

Four sets of regulations govern licensing the system, and applications will be processed by different branches of the Nuclear Regulatory Commission. In order to meet current scheduling expectations, the Department of Energy will work with the Nuclear Regulatory Commission to identify and resolve technical issues before the formal licensing process begins.

Prior to deciding whether to fabricate and deploy multipurpose canisters, the program will prepare an environmental impact statement as input to that decision. We have determined that an environmental impact

Cross-section of a large (125-ton) multipurpose canister.

statement is required to satisfy our obligations under the National Environmental Policy Act. Public participation in this process will provide valuable input to the program.

We have reached a time when general education for Americans and for world citizens is a necessity. We have within our grasp the ability to solve a global concern – disposing of radioactive waste. But we all must understand the problems and their complexity before we can reach consensus about the solutions. We are heartened by an increase in the public's interest in our program, and we are taking steps to ensure continued participation in our decision-making processes.

Our program has scores of educational opportunities, from classroom curriculum to scholarship awards. We also participate on an international level in research efforts. We are sharing information, some of which reveals problems; some, solutions. But the point is that we are communicating globally.

6

PUBLIC INVOLVEMENT:

Making Informed Decisions

Recognizing that nuclear waste management is a matter of justifiable public interest and concern, the architects of the Nuclear Waste Policy Act drafted legislation with explicit instructions that the public have opportunities to be involved in the program.

Identifying Our Audience

There are many public interests to be considered in the nation's waste-management program – people who will live near transportation routes or potential storage or disposal sites; State, local and Tribal governments on whose land shipments may pass or will be stored; Federal agencies; Congressional representatives; the utilities and ratepayers; environmental groups; labor unions; community organizations; and the general public.

With interests this diverse, it is difficult to meet all public involvement and information needs. We recognize, however, that communication is the mainstay of our efforts. Without an informed public, we cannot make

sound decisions that take into consideration all these constituents.

This program has been criticized because our interactions with external parties have sometimes fallen short of expressed needs and desired goals. Our goal is to seek out new opportunities for interacting with a broader spectrum of the public and to encourage all who express an interest to join in a dialogue about the nation's radioactive waste management program.

Increasing Public Involvement

The Secretary of Energy and the Director of the Office of Civilian Radioactive Waste Management are committed to an open, responsive, and accountable program. One of our key initiatives this year has been to enhance public involvement and to provide forums for dialogue that offer opportunities for meaningful interaction. We made a concerted effort to involve the public on a larger scale than previously done in a number of important program initiatives.

803 Report

Section 803 of the Energy Policy Act of 1992 instructed the Secretary of Energy to report to the Congress and the President on the adequacy of current nuclear waste management plans to manage waste from new nuclear power plants. The Department was directed to perform this study, to write an analysis, and to present its findings to the public for review and comment. The final report, which we plan to submit to the Congress in 1994, followed an evaluation process that invited substantive public involvement at various stages.

An annotated outline was developed and distributed to external parties for comment and discussion at a public meeting held in February 1993. Drafts of the report were discussed in two public meetings in July 1993 in Las Vegas, Nevada, and in Washington, DC. Comments made during the meetings and in letters to the Energy Department were addressed in the final report.

Multipurpose Canister Workshops

As part of the process for evaluating the potential use of multipurpose canisters within the waste management system, we held two public workshops to increase the involvement in, and understanding of, the concept by

stakeholders, such as utilities, vendors, State and local governments, and other interested parties. The first two-day workshop was held in July in Crystal City, Virginia, and was attended by about 150 participants. The purpose of the first workshop was to give an overview of the multipurpose canister concept

and to identify issues that workshop participants have about the approach.

A second workshop was held in

Washington, DC, in November 1993, after the release of the draft multipurpose canister conceptual design report. This workshop was structured to demonstrate how issues raised in the earlier workshop had been addressed and to encourage participants to discuss openly the technical and institutional considerations of such a system. Our intent was to ensure that all issues and alternatives related to the implementation of such a concept are identified prior to a decision regarding use of the technology in the waste management system.

Transportation Groups

During the past year, we continued to work with numerous external organizations to study and resolve issues related to transporting radioactive waste. Transportation of radioactive waste is an issue that concerns the public in all areas of the country. The program consulted with States, Indian Tribes, and local governments, as well as a wide variety of professional and technical groups.

We continued to hold regular public forums on a variety of transportation issues. Transportation Coordination Group meetings continued to provide an effective forum for parties interested in the transportation program to interact with the Energy Department and each other. The June 1993 meeting in Arlington, Virginia, was the largest meeting to date, drawing more than 150 participants representing utilities, State, county and Tribal governments, vendors, regulatory agencies,

One of our key initiatives this year has been to enhance public involvement and to provide forums for dialogue that offers opportunities for meaningful interaction.

Transportation
Coordination
Group meeting,
June 1993.

Demonstrators at a public update meeting in Las Vegas.

and others. Meeting participants were updated on the program's status by staff, heard reports from the organizations that receive cooperative agreements, and participated in panel discussions on two important issues: full-scale cask testing and transportation risk assessment activities. Other issues discussed included the radioactive waste management program's Transportation Plan and routing strategies and methodologies. (Chapter 9, *Transportation*, discusses these issues further.)

Public Involvement Process Initiative

We held a one-day workshop and public forum in August 1993 in Las Vegas, Nevada, in an effort to improve our public-involvement process. The stated purpose of the workshop was to "develop and recommend a consultative process that will provide external parties with meaningful opportunities to participate in the program's direction and decisionmaking."

The workshop was divided into three sessions: presentations by Energy Department staff and workshop participants; breakout groups to discuss public involvement options; and a final group session where the results of

the breakout groups were presented. The workshop was followed in the evening by a public forum that included a summary of the day's events and the recommendations offered by the workshop participants. The meeting was then open for comments and responses from the public.

Although not all program stakeholders were able to participate and no consensus was reached on any one method for involving stakeholders in the civilian radioactive waste management program, the workshop laid the foundation for further dialogue with our stakeholders.

Participants held varied and diverse opinions but generally agreed that, to be effective, a public involvement process should be designed to:

- reach all affected people;
- ensure that the public understands which decisions can be affected by their involvement;
- require the Department to respond to public input in a timely manner;
- be responsive to Indian Tribal needs and interests;

Although no consensus was reached on any one method for involving stakeholders in the program, the workshop laid the foundation for further dialogue.

- be sensitive to differing approaches required depending on whether an issue has local, regional or national importance; and
- ensure that all meetings are scheduled in accessible places and at convenient times.

Other ideas discussed at the day and evening sessions were whether a "blue ribbon commission" should be established to review the program and whether a formal public comment process would be useful.

Workshop participants were given an opportunity to review and comment on the draft summary of the workshop prior to its being submitted to the Secretary of Energy in September 1993. Workshop participants and stakeholders who were not able to attend the workshop also received the final summary.

The program analyzed the workshop discussion and distributed the analysis for public review in March 1994.

Outreach to Affected Communities

By increasing our opportunities to interact with the public, we seek to build a greater understanding of our program and to increase our own awareness of the public's perceptions and concerns.

Over the past three years, we have increased our public information and outreach activities in Nevada where site characterization activities for a geologic repository are taking place. Two sets of public update meetings

The question-and-answer session during the May 1993 public update meeting.

about the Yucca Mountain Project have been held each year to provide the public with an overview of current developments. Meetings have been held in Nye and Clark counties and in northern Nevada. These meetings have allowed unique opportunities for citizens to ask questions of the scientists doing the studies at Yucca Mountain.

To encourage and promote greater involvement of important constituent groups in the program's decision-making processes, the Yucca Mountain Project initiated a series of regularly scheduled meetings in Summer 1993 with the State of Nevada and the ten county governments designated as "affected" because of their jurisdiction over, or proximity to, the Yucca Mountain candidate site. These meetings are held bimonthly and serve as forums to foster open communication and free exchange of ideas among participants. The October and December 1993 meetings focused on identifying opportunities for increased predecisional involvement in issues such as site suitability. The participants were also asked to play a substantive role in reviewing the Yucca Mountain Project Public Participation Program and Guidance document, which will serve as the basis for a formal public involvement process.

Public tour of the Yucca Mountain site.

In 1993, Yucca Mountain Project staff gave more than 400 presentations to more than 26,000 people in civic, educational, business, and professional groups. Our monthly speaker series on technical and community-related issues continued to attract large audiences.

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Some of the topics covered included: the risks and benefits of radiation, a naturally occurring phenomenon; the history and culture of southern Nevada Native Americans; and ongoing studies investigating the habitats and movements of the desert tortoise, a threatened species.

The Yucca Mountain Project Office hosts public science centers in Las Vegas, Beatty, and Pahrump, Nevada. These centers serve as resources for information about the Yucca Mountain project, providing interactive and display exhibits, science education resource materials, and educational lectures. Additionally they serve as community centers for educational programming, averaging over 15,000 visitors per year.

The Yucca Mountain Project continued to offer monthly open houses and tours of the Yucca Mountain site. Citizens have the

opportunity to see first-hand the characterization work in progress and to talk to the program's scientists. In fiscal year 1993, more than 140 tours were conducted for over 6,000 guests. Tour participants go to the top of the mountain where they receive an overview of the site characterization program, a geologic orientation to the area, and a discussion of regional hydrology.

Other outreach initiatives sponsored by the Yucca Mountain Project in 1993 include developing a rural outreach program for individuals, groups, and media representatives outside the urban centers of Nevada and working with the Boy Scouts and Girl Scouts of America. The Yucca Mountain Project also has an ongoing program to enrich science and math education in area schools.

During July and August 1993, three Indian Tribes involved in the feasibility study process for a monitored retrievable storage facility and their surrounding communities received a first-hand look at an actual transportation cask for spent nuclear fuel. Approximately

800 visitors viewed the display at locations on the Mescalero Apache reservation in south central New Mexico, the Skull Valley Band of Goshutes reservation in Utah, and the Ft. McDermitt Paiute and Shoshone reservation which spans the Nevada-Oregon border.

Public tour of the Yucca Mountain Hydrologic Research Facility.

The cask also was displayed at seven other locations in Oregon and Nevada. The cask display included a general exhibit on the program, and staff answered questions relating to safety, the voluntary siting process, and technical aspects of spent nuclear fuel.

Increasing Access to Information

A wide range of external audiences – from the general public, educators, and students to journalists, legislators, and utility representatives – continues to express a keen interest in learning about and staying informed on our program's progress. Building on past efforts, we strengthened our public awareness activities in fiscal year 1993 so that more people could obtain the most current program information in a timely fashion.

Our exhibit, "Managing the Nation's Nuclear Waste," is shown at conferences and technical meetings all over the country.

In 1993, to broaden the involvement of stakeholders and other interested parties, we issued a policy statement that all meetings sponsored by the Office of Civilian Radioactive Waste Management, with the exception of staff meetings or those involving proprietary information, are open to the public. For the first time, the OCRWM Calendar was distributed widely among external parties, providing early information about program-related meetings to encourage further opportunities for meaningful public participation.

We continued to operate INFOLINK, a publicly accessible, interactive database that allows computer users to access the OCRWM Calendar, news releases and speeches, review information products, place publication orders, and communicate with other users. We continued to publish the OCRWM Bulletin, our quarterly newsletter which provides information about our program's activities, milestones, and events to more than 60,000

readers. This year, we expanded the *Bulletin* to provide "Of Mountains and Science," a special section that details local events in Nevada and activities at the Yucca Mountain site. Additionally, new publications and fact sheets were developed to inform the public on the latest program developments. (See Appendix D for a list of fiscal year 1993 program publications.)

Our national Information Center System enjoyed a successful second year, receiving more than 8,700 public inquiries and distributing more than 554,000 publications. Since its opening in September 1991, our toll-free number has provided more than 20,000 callers with quick access to program information. Callers can speak directly with information specialists weekdays from 9:00 a.m. - 7:00 p.m. EST at 1-800-225-NWPA (6972). The OCRWM Information Center is the principal information and distribution point for all program documents, reports, newsletters, fact sheets, exhibits, educational materials, and videotapes.

To inform interested parties about the program and provide an opportunity for individuals to gain information on a one-to-one basis, we have developed several exhibits for presentation at technical and nontechnical

We strengthened our public awareness activities so that more people could obtain the most current program information in a timely way.

meetings, and at regional and national education conferences and events. Our outreach at conferences continues to grow: attendance in 1993 for exhibits was more than 330,000 in 21 states at 146 events.

7

INTERNATIONAL PROGRAMS:

Sharing Information Globally

All countries with nuclear power capabilities are considering many of the same issues, including waste disposal options. International cooperation can be a key to making the best decisions about managing spent fuel and high-level radioactive waste. Our participation in international activities provides the waste management program with many benefits, including cost savings from shared research and development and access to unique research facilities and professional expertise. Longer-term benefits may result in developing consensus for resolving common technical issues.

In 1993, we continued efforts to cooperatively research and develop radioactive waste management technology, to identify existing experience in other countries that would improve our efforts, and to promote international understanding and consensus on radioactive waste issues. Most of our activities focus on developing repository site characterization and performance assessment technology, including instrumentation and models

for site characterization, and providing experience in underground laboratory testing.

We continued to monitor developments in waste management programs abroad and formally disseminate this information monthly throughout the program. Additionally, we periodically perform a review of the trends apparent in the design and management of foreign waste programs, as well as their technical approaches and strategies. We anticipate completing the current trends document in 1994. During the past year, we updated a fact book containing information on the waste management program organizations in other countries.

Participating in International Forums

Two agencies provide the most active forum for international information-exchange and consensus-building efforts on nuclear waste management activities. Through the Organization for Economic Cooperation and Development

opment/Nuclear Energy Agency and the International Atomic Energy Agency, scientists from our program meet with peers from other countries to discuss common technical challenges and to share expertise and experience.

The Nuclear Energy Agency's goals include initiating and coordinating international cooperative work in radioactive waste management. The United States is actively involved in and serves on the Radioactive Waste Management Committee, which directs Agency activities and is a forum for discussion of radioactive waste management. We participate with other groups on specific technical issues, including the Performance Assessment Advisory Group and the Coordinating Group on Site Evaluation and Design of Experiments for Radioactive Waste.

We have been involved in the Thermochemical Data Base project, another collaborative initiative which represents an eight-year effort to compile thermochemical data on important radioactive elements for use in safety assessment and laboratory work. We also participated on the Committee on Radiation Protection and Public Health which represents the Nuclear Energy Agency in consulting with

the International Conference on Radiation Protection on radiation standards.

The United States is a member of the International Atomic Energy Agency, which focuses on developing safety standards, guidelines, and codes of practice regarding spent fuel and high-level waste transportation, storage, and disposal.

Our participation in international activities provides the waste management program with many benefits, including cost savings from shared research and development and access to unique research facilities and professional expertise.

We participate in the Commission of European Communities Natural Analogue Working Group and will sponsor the group's sixth workshop in 1994. The Working

Group has been developing a consensus on the role of natural analogue studies in safety assessment. A natural analogue is an existing geologic system in which processes similar to those that may exist at a potential repository site have been operating over long time periods. Results from natural analogue studies can be applied to several areas of research within repository programs, including: surface and underground stability, ground water movement, tectonic impact, spent nuclear fuel and high-level radioactive waste behavior, and radionuclide migration.

In 1993, we joined a multinational project to produce an educational video depicting the importance of natural analogues in nuclear waste disposal research. The 52-minute video, entitled *Traces of the Future*, was completed by Spring 1994 and premiered in late May at the Fifth Annual International High-Level Radioactive Waste Management Conference.

The video was produced by the Swiss Cooperative for the Storage of Radioactive Waste (NAGRA), which is joined by Belgium, Canada, Sweden, Spain, the United Kingdom, the United States and the Commission of European Communities. The video contains footage from Africa, Spain, Italy, Scotland, England, Canada, Switzerland, and Brazil.

A former Soviet Union expert in reactor safety and operations views the control station at the historically preserved B reactor at Hanford during his group's DOE-sponsored visit in September 1993.

Nuclear waste disposal programs in OECD countries.

Another multinational consensus development project is INTRAVAL, which explores the practical extent and limitations of model validation through laboratory and field case studies, an important issue in licensing.

We also routinely exchange information with other countries on radioactive waste management activities. During the past year, we sponsored two visits to the United States by nuclear engineers and scientists from the former Soviet Union for the purpose of exchanging waste management and environmental remediation information and discussing the possibilities for cooperative technology development. In conjunction with these visits, we arranged for both groups to exchange information with staff from the Congressional Office of Technology Assessment. In addition, we hosted a number of meetings with foreign delegations, including China, Thailand, and Spain, to exchange general information on respective program developments.

Bilateral Agreements

In addition to participating in multinational collaborative projects, the United States enters into one-on-one formal agreements with other countries for technical information and personnel exchanges, and collaborative efforts in technology development. These activities allow us to use unique facilities unavailable in the United States for technology development. Our project agreements include collaborative efforts on underground and surface-based field testing, instrumentation development, laboratory testing, natural analogue studies, computer modeling, and data analysis.

Sweden

We initiated an agreement with Sweden in January 1993 to participate in technical activities at the Hard Rock Laboratory, an underground testing facility being built in Sweden to conduct research and development in a realistic and undisturbed under-

ground rock environment at a depth equivalent to a geologic repository. Through this agreement, our scientists are obtaining valuable first-hand experience in designing and coordinating underground testing.

Cross section of Canada's Underground Research Laboratory in Manitoba.

We are also developing with Swedish scientists a ground water flow model, which will be used in characterizing fractured rock at Yucca Mountain; and investigating techniques for geophysical testing, ground water tracing, and geochemical modeling. If successfully proven, these techniques will be used in our site characterization program.

A major benefit of this agreement for both countries is to provide a mutual peer review of the techniques and models being developed for application at the Hard Rock Laboratory and in characterizing the Yucca Mountain site.

Canada

In 1993, the United States and Canada extended the bilateral agreement between the two countries and continued collaborative

research and development work that complements our current site characterization activities at Yucca Mountain. This agreement provides additional experience in designing and executing field and laboratory tests on water flow and transport in fractured rocks. The cooperative project provides our scientists access to unique facilities, including the Underground Research Laboratory in Manitoba, to develop, modify, and test field instruments to be used at Yucca Mountain. We are able to test waste package components and engineered barrier materials at the elevated temperatures expected in a repository and study the migration of radionuclides – radioactive atoms – in rock fractures.

Switzerland

The ongoing project agreement between the United States and Switzerland is aimed at developing site-characterization techniques for future geologic repositories. The agreement covers joint research at the Swiss Grimsel Pass underground research facility in the Alps, one of the few established underground laboratories in the world dedicated to nuclear waste repository research.

The Grimsel research is valuable for our program because it is located in rock with hydrologic characteristics similar to the rock at Yucca Mountain. These similarities are contributing to the development of technology for characterizing ground water flow and vapor phase conditions, developing an advanced borehole-based technique for studying ground water flow, and improving instruments and analytical tools for characterizing rock masses, as well as collaborative laboratory studies on fundamental aspects of radionuclide sorption—how radioactive atoms are removed from solutions by passing through materials.

Spain

A new bilateral agreement between the Department of Energy and the Spanish Nuclear Waste Management Company (ENRESA) was announced in December 1992. The two countries will exchange information on radio-active waste manage-

ment technologies and other topics such as characterizing geologic formations, repository design and operational issues, transportation issues, and surface and subsurface storage of radioactive waste.

The first meeting was held in Washington, DC, in July 1993. Staff from the two countries held topical discussions on storage and transportation issues. After the meeting, ENRESA officials traveled to Las Vegas, Nevada, to attend meetings with Yucca Mountain Project staff on site characterization, waste package, and performance assessment activities, and to tour the Yucca Mountain site.

Countries with radioactive waste management programs recognized that educational initiatives are key to implementing waste management solutions.

International Collaboration in Education

The United States meets annually with the Radioactive Waste Public Information Informal Working Group, established in 1987 by the Nuclear Energy Agency. Participants include representatives from 12 countries which have radioactive waste management programs – Belgium, Canada, Finland, France, Germany, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The objectives of the working group are: to exchange information on effective public information programs; to recognize public concerns and exchange lessons learned; to provide support and resources among member countries; and to enter into joint projects for these purposes.

In April 1992, the International Alliance for Education in Radioactive Waste Management was established, following the success of the first International Workshop on Education in the Field of Radioactive Waste Management

in June 1991. Recognizing that education is the foundation to understanding and effective participation in radioactive waste management solutions and decisions, representatives from Working Group countries determined that a formal international working group was needed to plan and develop educational strategies internationally for use nationally.

The Alliance fosters science literacy in radioactive waste management through international collaboration by:

- encouraging national commitment and participation for international collaboration efforts in education;
- establishing an international framework and strategies to support national programs;
- enhancing national radioactive waste management through consideration of science, technology, and society issues;
- establishing national and international clearinghouses for information and education materials;
- exchanging experiences, materials and information on education strategies; and
- supporting and developing a basis for informed societal decision making.

At the third meeting of the International Alliance for Education in Radioactive Waste Management, held in Amsterdam in September 1993, Alliance participants completed a draft of an international catalogue of education and information resources and discussed plans to update each country's brochures on radioactive waste management programs.

The International Catalogue of Selected Education and Information Resources Related to Radioactive Waste Management will describe educational materials available from each country, including their intended audience, subject areas, synopses, and teaching aids. The Catalogue is scheduled for publication in 1994.

EDUCATION PROGRAMS:

Preparing For Our Future

Education programs are a significant part of a long-term strategy to help us achieve two goals critical to the future of the radioactive waste management program: an informed public and a qualified work force.

An informed public conversant with technology and scientific issues can become partners with the Department of Energy in solving the complex technological and societal issues involved in managing this Nation's radioactive waste. Successful long-term implementation of the waste management program depends on our ability to recruit qualified individuals educated and trained in science and engineering fields.

Informing the Public

We contribute directly to the growth of the public's general science literacy by providing balanced, accessible information that fosters community-wide discussion about nuclear waste management. In 1993, the League of Women Voters Education Fund published a

revision of *The Nuclear Waste Primer*, a preeminently popular information handbook for the lay reader. The League was able to produce this publication through a five-year cooperative agreement with the Office of Civilian Radioactive Waste Management initiated in 1992. The revised *Primer* updates information about the civilian radioactive waste management program and incorporates information on the Energy Department's environmental restoration programs. The League of Women Voters worked with utility, environmental, and grassroots citizens groups to ensure the objectivity of the *Nuclear Waste Primer*.

As part of its cooperative agreement, the League of Women Voters is planning a national training workshop for community education on the management and cleanup of nuclear waste from civilian and defense sources. Following the workshop, the League will fund and monitor six local and state League community education projects, as well as produce educational materials. The work-

shop will train participants to organize community-level educational programs and facilitate nuclear waste management discussions in their communities. The six projects will be tailored to the specific needs of the local community. The first workshop is scheduled for May 1994 in Denver, Colorado.

An informed public conversant with technology and scientific issues can become partners with the Department of Energy in solving the complex technological and societal issues involved in managing this Nation's radioactive waste.

Looking to Our Future

In 1993, over 1,900 scientists, engineers, technicians, and skilled workers were employed by the Office of Civilian Radioactive Waste Management, including personnel at Department of Energy Headquarters, the Yucca Mountain Project Office, the U.S. Geological Survey, Sandia, Los Alamos, and Lawrence Livermore national laboratories, and other technical support contractors. We will continue to need a technically qualified work force well into the next century as we carry out the phased development and implementation process of the waste management system prescribed by Congress: repository site characterization, licensing of any such facility by the Nuclear Regulatory Commission, construction, operation, and finally sustained performance monitoring.

Disposal of high-level radioactive waste is a challenging and technically complex endeavor that for decades will require the skills of thousands of individuals trained in a variety of scientific, engineering, and technical disciplines including: geology; hydrology; meteorology and climatology; mathematics; biological sciences; computer science; health physics; environmental science; and nuclear, mechanical, mining, and other engineering fields.

Those who will play major roles in this program over the next several decades are now in secondary school, primary school, or even younger. Most recently, we have emphasized developing educational initiatives that target middle and secondary students whose interest and enthusiasm must be sparked now to encourage them to enter and pursue studies in science and engineering.

These middle and secondary students are a crucial group, because it is during these years that students tend to make choices to take more than basic science and math courses. Once they do not select math and science, because these courses are "hard" or "boring," or because students don't see how the information will ever be useful, these students may be lost to the science and engineering community.

This process of selecting against science and math options continues beyond high school. Recent National Science Foundation statistics show that only approximately four percent of all bachelor degrees awarded to 22-year-olds

A Yucca Mountain Project scientist talks to a student at a Project open house.

are in the fields of natural sciences – physical, biological, mathematical, and environmental sciences – and engineering. It is from this diminishing pool of students that we must draw the necessary numbers of highly trained individuals to design and make decisions about our waste management system.

Educating Our Children

One of the most promising initiatives is our new secondary curriculum, *Science, Society and America's Nuclear Waste*. Developed over six years, this curriculum was field-tested with nearly 1,000 students in eight schools in seven states during the 1991-92 school year. The curriculum was revised following the field test to incorporate comments received from students and teachers, and was made available nationwide in August 1992.

To better enable interested teachers to utilize this curriculum, training sessions have been conducted through televised workshops broadcast nationwide by satellite, and in other

Geology
Discovery Day
at West Las
Vegas Boys
and Girls Club.

Evaluations and comments received from both broadcasts indicated a keen interest in regular broadcasts. The next annual satellite broadcast is scheduled for Summer 1994.

This program has been met with great enthusiasm. Since the curriculum became available, more than 6,600 sets of curriculum teacher guides and 48,000 sets of student readers have been requested, while the curriculum has been available for teaching in nearly 600 classrooms in all 50 states and 35 countries.

One of the real successes of the curriculum has been to make students aware of the scope of professional skills required in the field of nuclear waste disposal and awaken their interest in continuing to study these fields. Exposure through the curriculum is often the first time these students have heard of career disciplines such as geology, geochemistry, hydrology, health physics, and mining engineering, and some of their applications.

Opportunities for College Students

We plan to establish an undergraduate scholarship fund to take advantage of interest evidenced when such middle and secondary school students participate in the *Science, Society, and America's Nuclear Waste* curricu-

Successful long-term implementation of the waste management program depends on our ability to recruit qualified individuals educated and trained in science and engineering fields.

training sessions held around the country by educators, education centers, national science and social studies teacher associations, and other interested groups. In July 1992, the first satellite workshop was received by approximately 3,000 participants at almost 200 locations in 50 states. The second annual workshop, held in April 1993, was received at almost 300 locations in 50 states, carried by eight cable systems. The broadcast reached an estimated two million viewers.

lum and become interested in the science, technology, and societal issues surrounding nuclear waste disposal. When available, the scholarship program will be open nationwide and will offer four-year scholarships to high school students of merit who have studied in the curriculum and intend to pursue the study of science and mathematics in college.

Our well-established graduate school fellowship program supports highly capable students pursuing graduate degrees in science and engineering fields related to high-level radioactive waste management, such as: health physics, environmental engineering, geology, chemistry, nuclear engineering, and radiation sciences. As part of the program, fellows are required

to spend a minimum of three months at Department of Energy Headquarters, a Department laboratory, or the Yucca Mountain Project Office. This

experience provides the fellows access to ongoing research and development programs and allows them the opportunity to interact with Department of Energy and contractor scientists and engineers. The program is also

Our well-established graduate school fellowship program supports highly capable students pursuing graduate degrees in science and engineering fields related to high-level radioactive waste management

designed to encourage universities to support and improve research activities and academic programs related to radioactive waste management.

Since the fellowship program's beginning in 1985, 61 fellowships have been awarded. In fiscal year 1993, 21 students participated in the program at eight universities.

Initiatives for Faculty

In addition to programs aimed at students, we also sponsor several initiatives for faculty.

We have sponsored research programs at Historically Black Colleges and Universities

since 1984 to broaden opportunities for faculty members at these institutions to participate in research related to radioactive waste sponsored by the

Department of Energy. Between 1984 and 1990, 11 subcontracts were awarded in response to 38 proposals for faculty research projects. We are currently supporting such projects as studying the diffusion of carbon dioxide through rocks in the proposed repository horizon and multi-solute sorption studies in tuff.

In March 1993, teachers from the Clark County School District in Nevada participated in teacher workshops sponsored by the Yucca Mountain Project. One group of workshops was conducted under the auspices of the LESSON (Lawrence Livermore National Laboratory Elementary Study of Nature) program and provided participants with 16 hours of State Board of Education-accredited professional

A Yucca Mountain Project staff member talks to a junior high school class.

training. Another workshop was developed and sponsored directly by the Yucca Mountain Project education program. These programs are designed to help teachers at the elementary through high school level use the research performed at Yucca Mountain and the issues raised by the Project as a launching point for science instruction in the classroom.

In September 1993, the Department of Energy and the Lincoln County, Nevada, School District signed a formal Memorandum of Understanding to improve science, mathematics, engineering, and technology education throughout Lincoln County. This formal educational agreement enables the Energy Department to use the scientific and technical resources of the Department and its contractors to help teachers in the Lincoln County School District find innovative teaching methods for educators, and increase interest and achievement in technical fields. The agreement also allows us to loan equipment, such as computers, to the primary and secondary schools throughout the County. We have similar agreements with the Clark and Nye County, Nevada, school districts and the University of Nevada system.

We participate in the Teacher Research Associate (TRAC) program sponsored by Department of Energy national laboratories and technology centers in which individual teachers work with mentors at the national laboratories to do original research. The Department launched TRAC in 1989 to give science teachers at the seventh-through-12th grade level nationwide an opportunity to participate in DOE research projects throughout the country. The hope is that the teachers would not only update their knowledge on current technology and scientific procedures, but would convey their experiences and enthusiasm to the potential researchers and engineers in their classrooms.

Five teachers participated in our TRAC program during Summer 1993. Four of the

five teachers were from Nevada. The teachers worked with a team of Yucca Mountain Project scientists to assist in surveying radiological and weather conditions at or near Yucca Mountain and worked in the Sample

One of the TRAC teachers logs and records characteristics of the rock samples at the Sample Management Facility.

Management Facility. As one of the participants, a high school biology teacher, put it, "This was a great way of getting a hands-on picture of what is happening in the world of science."

As an important side benefit of providing such scientific education programs, we find that we are effectively contributing to the growth of an informed public comfortable with science, technology, and societal concerns. Many of our education materials are made available to the public at information meetings, in public exhibits shown across the nation, and at educational and professional conferences.

Transportation is a crucial link in the effectiveness of the entire waste management program. The public continues to focus on transportation-related issues because of concern about the possibility of the release of radioactive material while radioactive wastes are being transported through their communities. Most people are unaware, however, that many kinds of radioactive materials are moved around our country each day. Shipments go to and from hospitals, nuclear power plants, government research facilities, industrial complexes, and other facilities. In over three decades, there has not been a death or injury because of the release of the radioactive contents during transport.

TRANSPORTATION:

Preparing for Safety

9

A major component of the radioactive waste management program is developing and managing a transportation network to move spent fuel and high-level waste from reactors and production facilities to our temporary storage and geologic disposal facilities. Establishing a transportation system involves developing an operating system, developing and procuring shipping casks, selecting methods of transportation, and identifying routes.

Preparing for Safe Transportation

Most waste-management-system operations, such as temporary storage facilities or a geologic repository, take place in a controlled environment with limited public access. The transportation system, on the other hand, operates in a public environment, using highways that are shared with the general public and rail lines, many of which pass through populated areas.

Emergency situations involving the transportation of radioactive waste are of particular

concern to State, Tribal, and local governments. Section 180(c) of the Nuclear Waste Policy Act of 1982, as amended, requires the Department of Energy to provide technical assistance and funds to States and Indian Tribes for training public safety officials in safe, routine transportation and emergency response procedures if spent nuclear fuel or high-level radioactive waste will be transported through their jurisdictions.

In November 1992, we issued the *Strategy for OCRWM to Provide Training Assistance to State, Tribal, and Local Governments*. We will begin providing assistance to jurisdictions along transportation routes leading to a temporary storage facility or a repository between three to five years before waste shipments to those facilities begin.

In June 1993, we released for public comment a draft policy options paper identifying and evaluating funding mechanisms currently used by the Energy Department and other Federal agencies to distribute grants to

States and Indian Tribes to provide emergency response training assistance. The paper also outlines other implementation issues where options exist, such as the use of funds and the eligibility of applicants to receive funds.

Department offices that ship, or plan to ship, radioactive and other hazardous materials from various sites around the country, including the Offices of Environmental Restoration and Waste Management and Defense Programs.

The Yucca Mountain Project's transportation manager talks to Nevada residents about transportation issues at a Project open house.

In February 1993, the Commercial Vehicle Safety Alliance, under a cooperative agreement with the Office of Civilian Radioactive Waste Management, held a course to train state commercial vehicle inspectors in new procedures for the inspection of spent nuclear fuel and high-level radioactive waste shipments. The Alliance had previously developed uniform safety inspection procedures for highway shipments of radioactive materials and a training curriculum for vehicle inspectors. The Alliance will conduct a 24-month pilot study on cesium capsule shipments from Colorado to Washington State.

Seeking Public Input

We continue to work with many external organizations to study and resolve issues related to transporting radioactive waste. (Chapter 6, *Public Involvement*, discusses the Transportation Coordination Group and our activities with regional groups.) We also work cooperatively with other Energy

In January 1992, the Department of Energy established the Transportation External Coordination Working Group to address Department-wide emergency-management issues and the legal requirements related to the transportation of radioactive materials. Group participants currently consist of State, Tribal, and local interest groups, industry, utility, and emergency management/emergency response organizations. Composition of the group is flexible to allow for program changes.

In 1993, the Working Group's mission expanded beyond emergency management to look at broader issues. It will provide the Department with expert comment on transportation-related activities, resolve outstanding issues such as route selection, enhance policy uniformity, and increase information dissemination regarding the Energy Department transportation system.

The transportation system, unlike other waste management system operations, operates in a public environment, using highways and rail lines that are shared with the general public.

Six areas of interest have been identified by the Working Group: public information and education; safe routine transport; inspection and enforcement; emergency management; training; and technical assistance. The Group's goal is to create a series of baseline

programs that will serve all Energy Department transportation programs.

The Working Group met in December 1992 and July 1993. Meetings are open to the public.

Routing Waste Shipments

The U.S. Department of Transportation has the main responsibility for regulating the safe transportation of all hazardous waste. Our shipments of spent nuclear fuel and high-level waste additionally must comply with other Federal regulations, as well as applicable State, local or Tribal requirements.

Route and transport mode selection are key decisions in providing a safe transportation system. The Department of Transportation regulates the routing selection of highway shipments of radioactive materials. Using criteria defined under this regulation, such as reduced time of transport and shortest distance, the Office of Civilian Radioactive Waste Management may identify more than one route for its waste shipments. We have committed to developing additional routing criteria to narrow the options further when more than one route is identified under Transportation Department requirements.

Spent fuel is transported in heavily shielded packagings.
Most radioactive shipments are made by truck.

During 1993, we prepared a draft *Strategy for Development and Implementation of an OCRWM Route and Mode Selection Policy, Criteria and Methodology*. This draft will be formally circulated to stakeholders as part of the process to solicit external viewpoints on routing issues. The routing policy will state the primary objectives in selecting routes and modes of transport – for example, minimizing radiological exposure or simplifying operations – and will prioritize the different factors.

Our shipments of spent nuclear fuel and high-level waste must comply with Department of Transportation and other federal regulations, as well as applicable State, local or Tribal requirements.

Stakeholder organizations will have the opportunity to participate on a task force designed to develop route selection criteria and methodologies for different transportation methods, such as highway or rail/barge.

Developing Casks

Shipping casks provide protection from excessive radiation exposure for both workers and the public while wastes are being transported. Spent-fuel casks are designed, built, and maintained to high standards to ensure the casks will contain their contents and provide radiation shielding, even in severe accidents. The designs are certified by the Nuclear Regulatory Commission.

In anticipation of shipments to either a temporary storage facility or a permanent repository, we are continuing to develop a system of casks, including high-capacity casks that will hold quantities of spent fuel greater than those currently available, therefore reducing the

number of shipments. Higher capacity is possible because the spent fuel to be transported has been out of the reactor longer, and will be thermally cooler. Additionally, these casks will require less shielding because the fuel will be less radioactive.

The design for a high-capacity cask for highway transport is proceeding toward final review and certification. The final design is anticipated in fiscal year 1994.

Approximately 800 residents in four western states viewed an actual transportation cask for spent nuclear fuel in Summer 1993.

In the event that advanced technology casks are not available for initial waste shipments, the cask-development program is prepared to initiate procurement for shipping casks based on existing technology. A request for proposal was completed this year; however, the Department of Energy will solicit proposals and award a contract only after a temporary storage site is identified.

Evaluating Transportation Impacts

We are developing a transportation risk management program which will address the areas of risk assessment, risk management, and risk communication. A key component will be to establish transportation program objectives to avoid or reduce risks to the environment, and protect the safety and health of workers and the public. As with

other aspects of the transportation program, we will involve and obtain input from the public.

To develop a safe transportation system, we must consider the potential risks associated with selecting specific transport routes.

This year, Argonne National Laboratory completed two computer risk-assessment models for the radioactive waste management program. Computer modules were developed to enhance the route-specific analytical risk capabilities of RADTRAN IV, the computer code used to assess the radiological risks from transporting radioactive materials. These modules are based on databases and methodologies specific to commercial light-water reactor spent nuclear fuel and to state-level data, such as traffic accident statistics, agricultural land use, and meteorological conditions. These modules are part of a computer system that generates information in the RADTRAN format and can perform route-specific risk calculations by incorporating these state-level databases.

The second computer model developed is RISKIND, designed to estimate potential radiological consequences and health risks to individuals and the collective population from exposures associated with the transportation of spent nuclear fuel. RISKIND can be used in conjunction with the RADTRAN IV code, or its updates and enhanced data modules, to perform a full-scale risk assessment for transporting spent nuclear fuel.

As the first Energy Department nuclear program subject to external regulation, the civilian radioactive waste management program is one of the most closely reviewed programs ever undertaken by the Federal government.

Each element of the waste-management system – a geologic repository, a temporary storage facility, waste acceptance, transportation, and operations – must comply with a complex set of statutory and regulatory requirements.

Successful implementation of this program will solve one of the greatest environmental challenges facing us – the safe, permanent disposal of spent nuclear fuel and high-level radioactive waste. We are committed to conducting the process itself in a manner that will protect the public health and safety of current and future generations while preserving the quality of the environment.

ENVIRONMENTAL PROGRAMS:

Protecting the Present and the Future

Our program's mission is based on a long-term goal: isolating radioactive waste from the human environment. When we meet that goal, we will have made the environment safer for future generations. But, in the meantime, we will go about this mission in a way that protects the health and safety of the public and our workers on a day-to-day basis in the current environment.

The civilian radioactive waste management program operates within an intricate regulatory framework that establishes a network of environmental health and safety standards. The entire program 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, such as the National Environmental Policy Act, the Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act. Additionally the program must comply with Federal, State and local regulations and standards. (*Appendix C, Key Federal Regulations*, describes many of these laws and regulations.)

Repository Performance Standards

An important, ongoing regulatory issue concerns the Environmental Protection Agency's standards for radiological release from a geologic repository (40 CFR 191, *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Wastes*). A fundamental requirement of these standards is that the disposal system be designed to provide a reasonable expectation that cumulative releases of radioactive isotopes to the environment will be kept within specific limits for 10,000 years after disposal. In 1987, portions of these standards were remanded to the Environmental Protection Agency by the U.S. First Circuit Court of Appeals, which found some requirements overly stringent and others inconsistent with the law. The Environmental Protection Agency worked for several years to revise these standards with assistance from a variety of sources, including the Department of Energy.

The Energy Policy Act of 1992 directs the National Academy of Sciences to provide the Environmental Protection Agency with "findings and recommendations on reasonable standards for protection of public health and safety" that would govern the long-term performance of a high-level nuclear waste repository, should one be built at the Yucca Mountain site. These findings may change our regulatory framework substantially.

During fiscal year 1993, members of the National Academy of Science's Committee on the Technical Bases for Yucca Mountain Standards held two of at least four planned hearings to receive public input as part of its evaluation. Comments from the hearings are to be used for reevaluating existing safety and health standards intended to govern the long-term performance of a high-level nuclear waste repository. The Department of Energy established a task force to support the Department's liaison to the Committee.

Some issues that the Committee is addressing include:

- the scientific bases for different formulations of the health standards,
- the scientific bases for assuming that a repository would remain geologically isolated for 10,000 years, and
- the possibility and prevention of human intrusion during that period.

Kit foxes in a culvert on the Nevada Test Site.

The Committee plans to complete its findings and deliver its report to the Environmental Protection Agency by December 1994. The Agency is required to issue new standards applicable to the Yucca Mountain site within one year of receiving these recommendations.

The civilian radioactive waste management program operates within an intricate regulatory framework that establishes a network of environmental health and safety standards.

The Nuclear Regulatory Commission will, within one year after the EPA promulgates its standards, modify its technical requirements and criteria consistent with these standards.

Site characterization at Yucca Mountain will continue under the current standards during the review and reissuing of environmental standards. A different standard clearly will change the site characterization program, particularly in the area of performance assessment.

Assessing Environmental Impacts

Based on Energy Department and Council of Environmental Quality regulations, any major Departmental action is required to comply with the statutory and procedural requirements of the National Environmental Policy Act of 1969. The Act requires that an agency adequately consider and disclose the environmental impacts of any major proposed Federal action significantly affecting the quality of the human environment.

An environmental assessment is often made for an activity when the potential impacts are uncertain. If the assessment determines there may be significant environmental impacts, an environmental impact statement is written which contains an in-depth analysis of the potential impacts.

We are developing a multipurpose-canister system for storing, transporting, and disposing of spent-nuclear fuel rods from nuclear

reactors. (Chapter 5, *Multipurpose Canisters*, discusses this concept in detail.) As we proceed to implement the multipurpose canister system, we will have to file for certification from the Nuclear Regulatory Commission under its regulations for both storage and for transportation.

We will prepare an environmental impact statement for the multipurpose-canister system to provide an appraisal of environmental impacts due to the fabrication, storage, and transportation of the canisters.

Environmental Programs at Yucca Mountain

We are committed to conducting the site characterization of Yucca Mountain with as little negative impact on the physical, human, plant, and animal environment as practicable. The area has a fragile desert ecology that is home to at least one threatened species – the desert tortoise. Site characterization involves preparing for and performing surface and underground activities to gather information describing the physical condition of the site. Effects from these land-disturbing activities range from minor disturbances caused by our off-road vehicles to major disturbances such as earth-moving operations for Exploratory Studies Facility construction.

Before it can conduct many site characterization activities, the Yucca Mountain Project must obtain permits and approvals from

other Federal and State of Nevada regulatory agencies. This year, the State of Nevada issued several air quality permits for drill rigs and other equipment on the site as well as three temporary water appropriation permits.

In 1993, the Yucca Mountain Project issued a revised Environmental Protection Implemen-

tation Plan to ensure that its facilities are operated and managed in a manner that will protect, maintain, and restore environmental quality; minimize potential threats to the environment and the public health; and comply with government regulations and Energy Department policies. This plan applies to all Yucca Mountain Project activities, including management, administration, planning, design, construction, and operation. The implementation plan calls for:

- notifying management of unusual occurrences related to the environment, safety,

and health, and documenting these occurrences;

- developing pollution abatement plans, if appropriate; and
- preparing annual site environmental reports.

In June 1993, we published the second Site Environmental Report, which summarizes the status of the Yucca Mountain Project's environmental program, confirms compliance with

Meet One Of Nevada's Oldest Residents.

Join us for a discussion that's sure to bring even the shyest out of their shells. Meet one of Nevada's oldest and most controversial residents during "Desert Tortoise: Ecology and Conservation," sponsored by the U.S. Department of Energy. Danny Rakestraw and Kurt Rautenstrach, Ph. D., ecologists with EG&G Energy Measurements will be your guides. See a live tortoise and learn how these two men are sticking their necks out to help study and preserve them.

- Tuesday, August 24, 7 p.m., 4101-B Meadows Lane, Las Vegas.
- Thursday, August 26, 6:30 p.m., U.S. 95 & State Route 374, Beatty.

Make plans now to see some living history by calling the Yucca Mountain Information Office at 295-1312.

**YUCCA
MOUNTAIN
PROJECT**

Studies

environmental requirements, and highlights the year's accomplishments and efforts.

In September 1993, the Yucca Mountain Project issued its fourth annual Environmental Monitoring and Mitigation Progress Report, describing activities that occurred

We are committed to conducting the site characterization of Yucca Mountain with as little negative impact on the physical, human, plant, and animal environment as practicable.

during the previous months. While site characterization activities are not expected to create potentially significant adverse environmental impacts in the Yucca Mountain region, the actual extent of impact can be verified only by continuously monitoring a range of activities.

Our monitoring programs focus on those environmental resources considered vulnerable to site characterization activities.

Desert Tortoise Program. The Mojave desert tortoise has been listed as "threatened" by the U.S. Fish and Wildlife Service. The goals of the desert tortoise program are to develop a better understanding of the biology and status of the desert tortoise population at Yucca Mountain, assess impacts of site characterization activities on the tortoise population, and minimize any impacts that may be adverse. Areas of proposed site characterization disturbances are surveyed, and tortoises in the area are identi-

fied and may be temporarily moved or relocated. We have continued to attach radio transmitters to some hatchlings and older tortoises to monitor their movements. By the end of fiscal year 1993, 119 radiomarked tortoises were being monitored.

Reclamation Studies. We are dedicated to restoring areas that are disturbed in the course of our site characterization activities, including drilling, trenching or clearing. This process is called reclamation. To reclaim the mountain, scientists must find ways to repair any harm done to soils that have been disturbed. They also must develop the means to plant over any sites that have been disturbed. Because so little is known about restoring a desert environment to its natural state, the Energy Department has drafted an extensive Reclamation Feasibility Plan. Its purpose is to ensure that all feasible steps will be taken to restore Yucca Mountain to its former state whether or not it proves suitable as a repository site.

Project scientist measures a desert tortoise near the Solitario Canyon trench.

Air Quality. We are concerned principally with air pollution from particles generated or released from a variety of activities, such as construction at the Exploratory Studies Facility. Any major movement of earth, especially in so dry a region, is likely to produce large quantities of dust.

This year, results from four monitoring locations demonstrated that particulate concentrations remain well below ambient air quality standards.

We also monitor air quality for gaseous pollutants such as sulfur dioxide, oxides of nitrogen, and ozone. Other monitoring

Meteorological monitoring equipment on site at Yucca Mountain.

showed that site characterization activities have generated no airborne radiological emissions. Additionally radon levels to date have not exceeded normal background concentrations.

Water Resources. We monitor water resources in the region to detect and document natural fluctuations in ground water or springflows, to identify potential impacts of water withdrawals from wells on ground water and springflows, or to measure any changes in water chemistry. Our extensive surface- and ground-water network became operational in 1992. Water levels or discharges at 35 wells and discharge measurements at five springs are being monitored as part of the network plan.

Archaeological and Cultural Resources and Historic Sites. We conduct pre-activity surveys to identify new archaeological resources and historic sites and evaluate whether site characterization activities will have any effect. Site activities that are determined to be potentially affecting must be modified to avoid damage. Previously known sites are revisited to evaluate possible damage

or deterioration. In 1993, 71 newly recorded historical properties were identified and evaluated, and archaeological studies were conducted in response to 59 site characterization activity requests.

Radiological Studies. We established radiological monitoring before we began surface-disturbing activities so that we can determine whether site characterization activities are elevating radiation levels. We are evaluating potential sources of radioactivity from samples of various materials, including soil and sediment, ground water, airborne particles, and plant and animal tissues. To protect the health of those who will be working in the area, we monitor the soil and air in all areas newly proposed for site characterization activities for radionuclides that may be present because of the long history of testing nuclear rocket engines and nuclear weapons in the Yucca Mountain area.

The Yucca Mountain Project experienced a substantial increase in requests for preactivity surveys of planned site characterization activities in 1993. Preactivity surveys are part of a review process required to determine whether the proposed work will significantly affect any biological or archaeological resources. Environmental scientists document the environment around Yucca Mountain as it exists before field work begins, and develop methods to mitigate effects from site characterization. This information helps protect plants and animals and their environment, cultural resources, air quality and water resources.

One of the more recent environmental initiatives within the program is waste minimization – decreasing the volume and toxicity of all wastes generated at the site. In 1993, the Yucca Mountain Project established a waste minimization implementation plan to define targets of waste to be reduced, to obtain current information on waste stream generation at the site, and to develop performance tracking systems. Our goal is to prevent environmental pollution to the

extent that mitigation or remediation is not required. In March 1993, the first progress report on our waste minimization program was issued.

Compliance Monitoring

Early in 1993, the Yucca Mountain Project established its environmental compliance audit program to provide assurances that environmental regulatory requirements are properly satisfied. Three formal audits were conducted this year to ensure that the organizations participating in operations at the Yucca Mountain site are conducting their activities in an environmentally safe and sound manner. The organizations audited included the Desert Research Institute and the United States Geological Survey. Additionally, unannounced surveillances are performed routinely at various work sites.

We are responsible for overseeing the implementation of program-wide regulatory compliance programs. In fiscal year 1993, two regulatory compliance audits were conducted. One of these audits focused on fire protection and safety in two buildings

located at the Yucca Mountain Field Operations Center. The second audit focused on Exploratory Studies Facility subsurface activities associated with the drill-and-blast phase of tunnel construction.

In 1993, we conducted internal audits of five organizations that perform work for the Yucca Mountain Project, using a self-assessment questionnaire developed in 1992 to obtain information on management systems for ensuring compliance with environment, safety, and health requirements. The findings of this audit indicated that environment,

safety, and health management systems are in place, operating, and well-documented.

The Office of Civilian Radioactive Waste

Environmental scientists document the environment around Yucca Mountain as it exists before field work begins, and develop methods to mitigate effects from site characterization.

Management's compliance with environmental regulations is subject to independent assessment by the Department of Energy's Office of Environment, Safety, and Health, which sets environmental policy for the entire Department. The Office of Environment, Safety, and Health's independent assessment includes review of environmental activities, evaluation of effectiveness, and conduct of investigations, if necessary.

REVIEW AND REGULATION: *Comprehensive Oversight*

With a task as critical as transporting and disposing of radioactive waste, our Nation will accept nothing less than comprehensive review and thorough scrutiny of the system that provides this service. The civilian radioactive waste management program is reviewed formally and informally for its technical expertise, scientific development, and compliance with laws and regulations, and for its reaction to public scrutiny.

In many cases, reviews are done formally through processes prescribed by law. The United States Congress sets policy and establishes the parameters in which we operate. The Nuclear Waste Technical Review Board, established by the Congress, provides expert evaluation and advice concerning the technical and scientific aspects of our program. The Nuclear Regulatory Commission, our principal regulator, has issued regulations with which the program must comply. Certain

bodies of government have been given special rights to oversee what we do.

Informal review is provided by other interested parties, such as public interest organizations, utility organizations, and environmental groups, who attend our meetings, review our documents, and provide their views independently or through other forums. We also request peer review of our findings and analyses by persons with technical expertise in the field who are not directly involved in the program.

Congressional Oversight

As the body that created the waste-management program through the Nuclear Waste Policy Act and its amendments, the Congress has the authority not only to oversee but also to authorize the program's activities. The Congress exercises direct and continuing

oversight through its committees of jurisdiction, the Office of Technology Assessment, and the General Accounting Office.

Through the Nuclear Waste Policy Act, Congress extended oversight authority to certain units of government designated as "affected" because of their jurisdiction over or proximity to a site being characterized for a potential geologic repository.

Currently, Nye County, in which the Yucca Mountain site is located, eight contiguous counties in Nevada and one in California have been designated as affected. These governments are eligible to participate extensively, including designating a representative to conduct on-site oversight activities at the Yucca Mountain site.

Secretarial Review

In April 1993, the Secretary of Energy provided an initial assessment of the civilian radioactive waste management program, emphasizing site characterization at Yucca Mountain. The Secretary stated that, "The program needs to refocus its efforts and improve in two broad areas: increased emphasis on the highest quality scientific work and the more effective inclusion of external parties in program development and implementation."

The Secretary identified specific areas for reconsideration or external consultation. These areas include: an approach for commencing waste acceptance in 1998, including possible alternatives for funding utility onsite storage; a full range of options for the near-term storage of spent fuel pending

ultimate disposal; and alternative repository licensing strategies.

The Secretary's guidance also identified new activities and policies. To enhance the program's scientific credibility, the Secretary

committed to creating a Chief Scientist position to oversee scientific investigation at Yucca Mountain. To assure adequate and consistent financial resources will be available to

meet program needs, the Secretary has proposed establishing a new funding mechanism for the program.

The Secretary's review of the program is ongoing at the time of this report's publication. The main components are:

- an independent financial and management review of the Yucca Mountain Project. The review will encompass financial and business management techniques, the project schedule and credibility of project

The civilian radioactive waste management program is reviewed formally and informally for its technical expertise, scientific development, and compliance with laws and regulations

Some stakeholders have requested the Secretary to consider an independent "blue ribbon" commission to evaluate our program.

milestones, contracting practices, internal planning processes, and organizational effectiveness.

- consultations with the wide range of stakeholders interested in this program to develop a collaborative process for ongoing interactions with external parties. Shortly after her confirmation hearing in January 1993, the Secretary began meeting with interested parties, including State, local, and Indian Tribal government representatives, public utility commissioners, representatives of the utility industry, and environmental and public interest groups. In August 1993 a full-day public workshop with representatives from many of these stakeholder groups was held to identify more effective public involvement processes.
- an independent examination of published works and comments that have been made about the program over the last five years. In March 1994, an informed and independent observer completed and distributed a final report to the Secretary, incorporating comments received from public review of the draft report.
- a recommendation from the Secretary's Task Force on Alternative Program Strategy that the waste management program shift its goal from rapid, full-scale disposal of spent fuel and high-level nuclear waste in a repository to an approach that focuses on the early licensed demonstration of the capability for disposal. The rationale for the Task Force's recommendation is based on the fact that, 10 years after passage of the Nuclear Waste Policy Act, few, if any, key stakeholders believe there is any urgent safety need for immediate final disposal of spent nuclear fuel. The report drew on the Energy Department's exploration of program options with stakeholders over the past several years, as well as recommendations made by the Nuclear Waste Technical Review Board and the National Academy of Sciences.

- a report from a task force of the Secretary of Energy Advisory Board on public trust and confidence in the Energy Department's civilian and defense waste management programs issued in November 1993. The previous Secretary of Energy asked the Board to identify steps that could be taken to increase public trust and confidence, to consider whether these efforts affect other program objectives, and to consider how to implement its guidance and recommendations. *Earning Public Trust and Confidence: Requisites for Managing Radioactive Waste* offers more than 70 recommendations for strengthening public trust and confidence in the waste management program.

With input from these sources, the Secretary is expected to finalize decisions concerning the program.

A group from the Nuclear Regulatory Commission walks the length of an exposed fault at Busted Butte that lays out some 700,000 years of seismic activity in Paintbrush Canyon.

Federal Agency Review

Three Federal agencies have regulatory responsibilities concerning the program during various activities: the Environmental

Protection Agency, the Nuclear Regulatory Commission, and the Department of Transportation. The Environmental Protection Agency is responsible for developing public

The Nuclear Regulatory Commission will issue a license for a repository only after it is satisfied that its requirements for protecting the public, the workers, and the environment are fully met.

health and safety standards for the protection of the public from releases from radioactive materials stored or disposed of at the Yucca Mountain site. The Nuclear Regulatory Commission must issue technical requirements and criteria consistent with these standards. The Department of Transportation has the main responsibility for regulating the safe transportation of all hazardous waste.

The Nuclear Regulatory Commission also is responsible for licensing or certifying the elements of the waste management system, including transportation casks, a monitored retrievable storage facility, and the geologic repository. The Commission will issue these licenses or certificates only after it is satisfied that its requirements for protecting the public, the workers, and the environment are fully met. These requirements are set forth in 10 CFR Part 60, *Disposal of High-Level Radioactive Wastes in Geologic Repositories* and 10 CFR Part 72, *Licensing Requirements for the Independent Storage of Spent Fuel and High-Level Radioactive Waste*, and 10 CFR Part 71, *Packaging and Transportation of Radioactive Material*.

We seek input from the Nuclear Regulatory Commission through an issue-resolution process that is directed toward receiving

guidance and comment from Commission staff regarding characterization at the Yucca Mountain site. Areas that are discussed include definition and interpretation of regulatory terms, acceptability of methodologies, adequacy of planning, and acquisition and analysis of data.

As part of the issue-resolution process, we use annotated outlines to prepare for license applications. These outlines are evolving documents, updated periodically by the Energy Department and reviewed by the Nuclear Regulatory Commission. The annotated outline process is intended to identify and clarify technical and regulatory issues prior to submission of a license application if Yucca Mountain is found suitable as a repository site.

Lathrop Wells Cinder Cone, included in a recent report forwarded to the Nuclear Regulatory Commission summarizing a decade of volcanism studies.

In May 1993, we transmitted the second revision of the annotated outline for a geologic repository. This revision incorporated previous Commission comments and focused on performance assessment issues. The next revision will focus on the natural systems of the geologic setting. We are using a similar outline process for a monitored retrievable storage facility.

The Department also exchanges information with Nuclear Regulatory Commission staff through technical and topical reports on specific subjects and through formal technical interactions.

Independent Technical Review

In 1987 the Congress created an independent agency, the Nuclear Waste Technical Review Board, to provide expert review of the scientific and technical aspects of the program, including site characterization activities and activities related to waste transportation and packaging. The Board members are engineers and scientists, nominated by the National Academy of Sciences and appointed by the President of the United States.

The Board holds public meetings throughout the year with program representatives, contractors, other Federal agencies, the national laboratories, the State of Nevada, and interested organizations. These interactions include board meetings, panel meetings and workshops. The Board provides a forum in which affected governments and other interested parties can observe and contribute to the technical evaluation of the waste management program.

The Nuclear Waste Technical Review Board, chartered by Congress, provides expert evaluation and advice concerning the technical and scientific aspects of our program.

During the past fiscal year, there have been four formal Board meetings.

- In October 1992, the Yucca Mountain Project staff presented its research and modeling activities relating to predicting the potential releases from a geologic repository. The estimation of these releases, referred to as the source term, is essential to predicting the performance of a potential repository at Yucca Mountain.

Members of the NWTRB and staff on site at the north portal pad of the Exploratory Studies Facility in April 1993.

- In January 1993, the program participated in a Board meeting on the role of interim storage in the effective management of the nation's spent fuel. Others participating in the meeting were representatives of the utilities, industry groups, local and state governments, and the Nuclear Regulatory Commission.
- In April 1993, the Yucca Mountain Project staff presented its process for resolving difficult scientific issues, using ground water infiltration as an example.
- In July 1993, we presented our approach to selecting and validating a thermal loading strategy. These discussions focused on the integration of engineering and science to evaluate a range of thermal loading options prior to the selection of a preferred strategy.

In November 1992, Yucca Mountain Project staff participated in a three-day workshop sponsored by the Board's Panel on Structural Geology and Geoengineering. The workshop focused on alternative design concepts and construction strategies for the Exploratory Studies Facility.

At least twice each year, the Nuclear Waste Technical Review Board makes recommendations to the Congress and the Secretary of Energy. We formally respond to each of the Board's recommendations, and our responses usually are published in the Board's next report.

The Board released its *Sixth Report* in December 1992, and a *Special Report* in March 1993.

The *Sixth Report* recommended that the program improve its top-level systems analysis and the integration of the defense high-level waste into waste management system planning. We recognize the need for improvement in these areas and are working with the Board to resolve these concerns. Our formal response was issued in May 1993.

The Board's *Special Report* included three recommendations, to which we formally responded in November 1993.

- The program should develop a more flexible schedule because the unrealistic deadlines it is attempting to meet may force technical decisions to be made without adequate scientific analysis. In April, the Secretary of Energy directed that the Program will not be schedule driven, and that the program should refocus its efforts on the highest quality scientific work.
- The program should develop a comprehensive and well-integrated waste-management plan. We are putting a high priority on conducting top-level system studies, which are critical to understanding the interdependent behavior of the system components. These studies will provide a comprehensive evaluation of the key elements of the waste management system and include many of the studies identified by the Board.
- An independent evaluation of the program's management and organiza-

tional structure should be undertaken. The Secretary is conducting a review of the program and has committed to an independent review of the financial and business management of the Yucca Mountain Site Characterization Project. The need for further or more encompassing reviews will be considered after the results of these efforts are evaluated.

Many of the Technical Review Board's past recommendations have led to significant changes in the program, such as using inclined ramps rather than vertical shafts in the Exploratory Studies Facility. And we continue to address the Board's previous concerns as part of our ongoing program development. For example, this year we initiated advanced conceptual design work for the waste package as recommended in the Board's *Third*, *Fourth*, and *Fifth Reports* and conducted a workshop in September 1993 on engineered barrier system concepts as recommended in the Board's *Fourth Report*.

In response to a recommendation in the Board's *Fourth Report*, the Yucca Mountain Project sponsored a workshop in November 1992 to discuss the use of expert judgment as a decision support tool and in the resolution of scientific issues.

And, based on the importance the Board has placed on gaining early underground access to Yucca Mountain, we are moving ahead rapidly with the design and construction of the Exploratory Studies Facility. Many of the design changes to the facility we proposed at the July 1993 Board meeting incorporate past Board recommendations.

While ensuring technical excellence, health and safety of the environment, and informed public involvement, we must manage our resources well – whether people, time, or money.

FINANCIAL STATEMENTS:

Managing Our Program's Resources

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. The Office was established by the Nuclear Waste Policy Act (NWPA) of 1982, as amended, to dispose of spent nuclear fuel and high-level nuclear 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. Elements of the program, including sched-

ules, are currently under review by the Secretary of Energy to assure the Department of Energy is meeting its responsibilities under the Nuclear Waste Policy Act, as amended.

The civilian radioactive waste management program provides, 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 (Fund). In addition, it provides disposal services, in return for the payment of fees by the Federal Government, for high-level radioactive waste from atomic energy defense activities.

The Office of Civilian Radioactive Waste Management manages two major system acquisitions (MSAs), the Yucca Mountain Site Characterization Project (YMP) and the Monitored Retrievable Storage (MRS) Project. The Yucca Mountain Site Characterization

Project Office (YMPO) is located in Las Vegas, Nevada, while the MRS Project is being managed from Headquarters. As of September 30, 1993, the Office of Civilian Radioactive Waste Management employed approximately 209 Federal staff. In addition, support to OCRWM was provided by 23 Federal full-time equivalents (FTEs) at DOE Headquarters, 14 Federal FTEs at DOE Operations Offices and 2,382 contractor employees. The Program consists of eight offices as follows:

- Office of Quality Assurance, responsible for developing and overseeing compliance with a quality assurance program that meets the requirements of the Nuclear Regulatory Commission.
- Office of Strategic Planning and International Programs, responsible for strategic, long-range, and contingency planning and for managing relations with waste-management programs in other nations.
- Office of External Relations, responsible for managing intergovernmental relations and interactions with affected governments and interested parties and for managing an education and public information program.
- Office of Program and Resources Management, responsible for controlling the program's schedule and cost, managing the Nuclear Waste Fund, managing program budget activities, developing and maintaining information systems, and providing administrative support services, including the acquisition and development of human resources.
- Office of Geologic Disposal, responsible for directing the Yucca Mountain Site Characterization Project in the scientific evaluations needed to determine whether the Yucca Mountain site is suitable for a geologic repository and for waste-package and repository design and development.
- Office of Systems and Compliance, responsible for establishing systems requirements based on regulatory, legislative, and other external requirements,

conducting program self-assessments, providing systems integration, and overseeing regulatory compliance activities.

- Office of Storage and Transportation, responsible for directing the MRS Project in developing a multipurpose canister system for storage, transportation and ultimately disposal of spent nuclear fuel; supporting the Nuclear Waste Negotiator in siting an MRS facility, and developing a transportation system, shipping casks, systems for spent fuel acceptance, and systems logistics activities.
- Office of Contract Business Management, responsible for managing business relations with the Program's management and operating contractor and support services contractors and for consolidating contractor services.

The civilian radioactive waste management program (from inception through final decommissioning of waste management facilities) was estimated to span more than 100 years and cost approximately \$26 billion in 1988 dollars, as referenced in the single repository/no new orders case of the *Preliminary Estimate of the Total-System Cost for the Restructured Program* (DOE/RW-0295P, December 1990).

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

The Nuclear Waste Fund was established by the NWPA. It consists of fees paid to DOE by civilian nuclear power utilities to dispose of their spent nuclear fuel and by the Department for the disposal of its defense-related high-level radioactive waste, 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, 1993, cumulative revenue from fees totaled approximately \$7.676 billion, and cumulative

Office of Civilian Radioactive Waste Management

Office of Civilian Radioactive Waste Management organizational chart, fiscal year 1993.

interest earnings and other revenue and financing sources totaled approximately \$2.873 billion. Cumulative expenses totaled approximately \$3.893 billion. The Defense Nuclear Waste appropriation is used to cover the Department's share of costs incurred by the program for defense atomic energy waste disposal activities but these funds are not deposited into the Fund.

Limitations of the Financial Statements

The accompanying financial statements were prepared to report the financial position and results of operations of the Nuclear Waste Fund, 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 Nuclear Waste Fund 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 Nuclear Waste Fund, a sovereign entity; 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 Department of Energy.

Program Performance Measures

The Yucca Mountain Site Characterization Project has been funding-constrained since at least July 1991 when the then-pending environmental permits were issued by the State of Nevada. Program schedule performance is measured by comparing actual accomplishments to the Program schedule baseline. The following reflect the status of fiscal year 1993 Energy Systems Acquisition Advisory Board (ESAAB) and major Program-level milestones toward the objective of determining the suitability of Yucca Mountain, Nevada, as a site for a geologic repository:

- In October 1992, work was started on the repository and related waste package advanced conceptual designs. These events were started on the original baseline date.
- In November 1992, the Program received ESAAB approval to start site-preparation work for the Exploratory Studies Facility (ESF). Immediately after receiving ESAAB approval, site-preparation work started on the ESF north portal. This event was originally planned for June 1992, but because of funding constraints, was replanned to November 1992, and started as replanned.

Other significant fiscal year 1993 project-level accomplishments important to the success of site characterization at Yucca Mountain are noted below:

- In May 1993, the ESF tunnel-boring machine fabrication contract was awarded. The planned date was April 1993.
- In September 1993, the ESF north-portal tunnel-boring machine "starter tunnel" was completed as planned. The planned date was September 1993.

Success in meeting Program-level milestones for the Monitored Retrievable Storage (MRS) Project was hampered by lack of a suitable MRS site and budgetary constraints, which

led to deferral of, or significant reductions in, the level of effort for many activities. The Office of Civilian Radioactive Waste Management fully supported the efforts of the Nuclear Waste Negotiator, whose legislative mandate is to actively seek parties willing to consider hosting an MRS facility or repository and to negotiate an agreement that can be submitted to Congress for approval. The Negotiator, however, was unsuccessful in his attempts to identify a volunteer MRS host site by the baseline date of September 1992. As a result, existing plans were put on hold, and a new strategy and workaround plan were developed to enhance confidence in meeting the project's long-term goals. A decision was made that Safety Analysis Report (SAR) design and follow-on design activities for the MRS facility would be postponed until a site has been identified.

Work was initiated on the multipurpose canister (MPC) concept. The MPC system would minimize handling of spent fuel and provide integration of storage at both nuclear generating plant sites and Federal sites. The MPC system would provide a potential means to mitigate the cost impacts of continued at-reactor storage and could be deployed by 1998.

In addition, completion of final designs for advanced technology, high-efficiency truck and rail casks was deferred pending review of an independent assessment of the designs, which addressed numerous cask-utility interface issues. During fiscal year 1993 the truck cask design was restarted. Completion of final design is planned for fiscal year 1994, and submittal of an SAR to NRC is expected in fiscal year 1994.

The following fiscal year 1993 accomplishments relate to OCRWM's MRS Project:

- The voluntary siting initiative led by the Nuclear Waste Negotiator resulted in numerous expressions of interest in hosting an MRS facility by local governments and Indian Tribes. During fiscal year 1993, the Program awarded four

Phase II follow-on feasibility study grants to those jurisdictions interested in educating themselves and their constituent communities on issues related to the temporary storage and permanent disposal of nuclear waste. The fiscal year 1994 Congressional appropriation language prohibited the expenditure of fiscal year 1994 funds for MRS Phase II-B grants.

- In November 1992, the final conceptual design report for the MRS facility was issued. The main objectives of the MRS conceptual design report are: (1) to demonstrate the technical feasibility of several MRS design options; (2) to establish technical performance levels; and (3) to develop reliable cost estimates and realistic schedules. The report offers a complete design for each of six separate spent fuel storage concepts. The report concluded that a monitored retrievable storage facility can be designed and operated in compliance with all applicable Federal regulations, in a manner that protects public and worker health and safety and preserves the quality of the environment.
- In September 1993, the draft *Multi-Purpose Canister (MPC) Implementation Program Conceptual Design Phase* report was submitted for review and approval. This MPC system would minimize handling of spent fuel and provide integration of storage at both nuclear generating plant sites and Federal sites. The MPC system would provide a potential means to mitigate the cost impacts of continued at-reactor storage and could be deployed by 1998.

Financial Performance Measures

DOE is required to receive fee payments, invest excess cash and make disbursements from the Nuclear Waste Fund in accordance with the requirements of the NWPA of 1982, as amended. As of September 30, 1993, 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 Nuclear Waste Fund was performed with the following results:

Four late payments were received during fiscal year 1993. Two of these late payments, totaling \$68,783, resulted in lost interest to the Fund. The total interest lost from these late payments was \$2,925. After reviewing the circumstances surrounding the late payments, the Contracting Office determined that it was not appropriate to seek reimbursement for the lost interest.

The other two late payments, which totaled \$1,805,664, resulted in no lost interest to the Fund.

Uninvested daily cash balances

Investments of excess funds of the Nuclear Waste Fund, 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.

Financial Management Performance Measures

Although there were no specific performance measures identified in this area for the Nuclear Waste Fund, during fiscal year 1993 the Fund earned 7.85 percent from investments of intermediate-term Treasury bonds. As of September 30, 1993, the book value of Treasury notes and bills was about \$4.2 billion, at a market value of about \$4.5

billion. Earnings from investment activities in fiscal year 1993 were \$312 million, including \$288 million in interest earned on investments and gains from the sale of securities totalling \$25 million. 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.

Summary Findings

Both sound technical and financial management are essential to successfully meeting the Program's goals and objectives. Significant progress was made during fiscal year 1993 on the Yucca Mountain Site Characterization Project and modest progress, accompanied by a number of delays, on the MRS Project. The Program's performance is directly linked to the adequacy of resources made available to accomplish planned work. The need, during the last three fiscal years and, potentially, in future years, to defer and replan scheduled work because of budget constraints has been a primary concern to the Office of Civilian Radioactive Waste Management because of its legislative mandate and the nuclear utilities'

expectation that OCRWM perform in accordance with the Standard Contract executed between the utilities and the Department of Energy.

To provide higher and more predictable funding levels for the program, the Program's fiscal year 1995 Congressional budget request is based on a proposal for establishment of a special account within the Nuclear Waste Fund that would make available to the program for obligation without further appropriation an additional portion of each year's utility fee receipts. In addition to its baseline appropriation, the program would be able to use approximately 50% of the balance in the special account each year. OCRWM needs continued Departmental, Administration, and Congressional support to ensure that it has adequate funds and Federal manpower to make steady and visible progress year after year. In addition to technical and financial considerations, public trust and confidence continue to be vital to the success of the program.

[The previous text was prepared by the OCRWM Office of Program and Resources Management as an introduction to the audited financial statements.]

Certified Public Accountants

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, 1993 and 1992, and the related statements of operations and cash flows, for the years then ended and cumulatively from inception (January 7, 1983) to September 30, 1993, and the statements of budget and actual expenses for the years ended September 30, 1993 and 1992. 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*, 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, 1993 and 1992, 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

December 17, 1993

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

Statements of Financial Position

September 30, 1993 and 1992

(Dollars in thousands)

<u>Assets</u>	<u>1993</u>	<u>1992</u>
Financial resources:		
Fund balance with Treasury	\$ (60)	1,609
Current portion of accounts receivable from utilities, nonfederal (note 3):		
One-time spent fuel fees	3,036	3,808
Interest on one-time spent fuel fees	814	1,275
kWh fees, nonfederal	<u>130,587</u>	<u>125,495</u>
Current portion of accounts receivable from utilities, nonfederal	<u>134,437</u>	<u>130,578</u>
Current portion of accounts receivable, federal:		
Receivable from Department of Energy, current portion (note 1)	124,472	100,000
kWh fees receivable, federal agencies (note 3)	<u>2,091</u>	<u>3,523</u>
Current portion of accounts receivable, federal	<u>126,563</u>	<u>103,523</u>
Investments (note 2)	<u>4,177,810</u>	<u>3,718,793</u>
Other, nonfederal	<u>101</u>	<u>1,080</u>
Other, federal:		
Accrued investment interest (note 2)	94,588	87,433
Advances and prepayments	<u>268</u>	<u>30</u>
Other, federal	<u>94,856</u>	<u>87,463</u>
Long-term portion of accounts receivable from utilities, nonfederal (note 3):		
One-time spent fuel fees	878,847	886,547
Interest on one-time spent fuel fees	<u>909,504</u>	<u>857,729</u>
Long-term portion of accounts receivable from utilities, nonfederal	<u>1,788,351</u>	<u>1,744,276</u>
Receivable from Department of Energy, long-term (note 1)	<u>562,000</u>	<u>591,320</u>
Total financial resources	6,884,058	6,378,642
Non-financial resources - capital equipment, net (note 5)	33,574	32,080
Total assets	\$ <u>6,917,632</u>	<u>6,410,722</u>

See accompanying notes to financial statements.

FINANCIAL STATEMENTS

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

Statements of Financial Position, Continued

September 30, 1993 and 1992

(Dollars in thousands)

<u>Liabilities</u>	<u>1993</u>	<u>1992</u>
Funded liabilities:		
Accounts payable, nonfederal	\$ 10,231	7,379
Current portion of amounts due to utilities, nonfederal (note 4)	187,277	155,309
Accrued payroll and benefits	4,228	4,036
Other funded liabilities, nonfederal	28,003	20,471
Intragovernmental liabilities:		
Accounts payable, federal	4,867	4,080
Current portion of amounts due to utilities, federal (note 4)	6,259	5,176
Deferred investment revenue	1,606,260	1,300,662
Other funded liabilities, federal	297	17
Long-term portion of amounts due to utilities (note 4):		
Nonfederal	18,029	198,332
Federal	558	6,595
Long-term liabilities - contract holdback	446	2,296
Deferred fees revenue	<u>5,049,838</u>	<u>4,705,136</u>
Total funded liabilities	6,916,293	6,409,489
Unfunded liabilities - accrued leave	1,339	1,233
Contingencies (notes 3 and 10)		
Total liabilities	\$ <u>6,917,632</u>	<u>6,410,722</u>

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

Statements of Operations

Years ended September 30, 1993 and 1992
and cumulatively from January 7, 1983, date of inception
to September 30, 1993

(Dollars in thousands)

	<u>1993</u>	<u>1992</u>	<u>Cumulative</u>
Revenue and financing sources:			
Revenue from fees (note 3):			
One-time spent fuel fees:			
Public	\$ —	—	2,177,901
Intragovernmental	—	—	156,866
kWh fees:			
Public	576,856	537,407	4,620,418
Intragovernmental	14,140	18,889	135,803
Defense high-level waste fees, intragovernmental (note 1)	62,330	518,170	585,500
Interest on one-time spent fuel fees, nonfederal (note 3)	54,201	73,596	937,750
Interest, federal:			
Income on investments	287,841	269,879	1,603,168
Defense high level waste fees (note 1)	28,350	180,650	209,000
Other revenue and financing sources - net gains on sale of investments	<u>25,031</u>	<u>53,602</u>	<u>122,992</u>
	1,048,749	1,652,193	10,549,398
Less - deferred fee and investment revenue	<u>(650,300)</u>	<u>(1,279,756)</u>	<u>(6,656,098)</u>
Total revenue and financing sources	<u>398,449</u>	<u>372,437</u>	<u>3,893,300</u>
Expenses (note 11):			
First repository	232,228	202,485	2,587,988
Second repository	—	2	108,887
Monitored retrievable storage	42,328	37,363	232,110
Program support	93,459	84,417	733,236
Interest (notes 1 and 4)	7,274	24,914	130,196
Transfer appropriations (note 7)	<u>23,160</u>	<u>23,256</u>	<u>100,883</u>
Total expenses	<u>398,449</u>	<u>372,437</u>	<u>3,893,300</u>
Excess of revenue and financing sources 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, 1993 and 1992
and cumulatively from January 7, 1983, date of inception
to September 30, 1993

(Dollars in thousands)

	<u>1993</u>	<u>1992</u>	<u>Cumulative</u>
Cash flows from operating activities:			
Excess of revenue and financing sources over total expenses	\$ —	—	—
Adjustments affecting cash flow:			
Increase in accounts receivable	(41,654)	(758,743)	(2,611,351)
Increase in other assets	(6,414)	(699)	(94,957)
Increase in accounts payable	3,639	2,889	15,098
Increase (decrease) in amounts due to utilities	(153,289)	15,412	212,123
Increase in deferred revenue	650,300	1,279,756	6,656,098
Increase (decrease) in other liabilities	6,260	(1,745)	34,313
Depreciation expense	5,801	6,122	48,632
Amortization of premiums and accretion of discounts on investments	35,486	37,040	366,188
Net gains on sale of investments	(25,031)	(53,602)	(122,992)
Net book value of dispositions of capital equipment	<u>(153)</u>	<u>1,305</u>	<u>30,185</u>
Total adjustments	<u>474,945</u>	<u>527,735</u>	<u>4,533,337</u>
Net cash provided by operating activities	<u>474,945</u>	<u>527,735</u>	<u>4,533,337</u>
Cash flows from investing activities:			
Proceeds from sales and maturities of investments	430,323	1,213,024	5,855,412
Purchases of investments	(899,795)	(1,733,115)	(10,276,418)
Purchases of capital equipment	<u>(7,142)</u>	<u>(8,153)</u>	<u>(112,391)</u>
Net cash used in investing activities	<u>(476,614)</u>	<u>(528,244)</u>	<u>(4,533,397)</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>1993</u>	<u>1992</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 used in operating, investing and financing activities	(1,669)	(509)	(60)
Fund balances with U.S. Treasury, beginning of period	<u>1,609</u>	<u>2,118</u>	<u>—</u>
Fund balances with U.S. Treasury, end of period	\$ <u><u>(60)</u></u>	<u><u>1,609</u></u>	<u><u>(60)</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, 1993 and 1992

(Dollars in thousands)

	Budget				Actual	
	1993		1992		1993	1992
	Resources	Obligations	Resources	Obligations	Expenses	Expenses*
First repository	\$ 245,019	242,288	189,990	187,129	232,228	202,485
Second repository	—	(4)	—	(7)	—	2
Monitored retrievable storage	49,818	39,835	31,519	24,436	42,328	20,779
Transportation and systems integration	—	—	33,666	29,256	—	36,970
Program management	—	—	89,346	71,277	—	64,031
Program support	112,664	100,131	—	—	93,459	—
Interest	—	—	—	—	7,274	24,914
Transfer appropriations	—	—	—	—	23,160	23,256
	<u>\$ 407,501</u>	<u>382,250</u>	<u>344,521</u>	<u>312,091</u>	<u>398,449</u>	<u>372,437</u>

Budget Reconciliation

Total actual expenses \$ 398,449 372,437

Add:

Capital acquisitions	7,142	8,153
Proceeds from sale of capital equipment	48	65
Interest credits to utilities included in accrued expenditures	<u>909</u>	<u>805</u>
	<u>8,099</u>	<u>9,023</u>

Less:

Depreciation	5,801	6,122
Other non-fund adjustments	(47)	920
Interest	7,274	24,914
Transfer appropriations (note 7)	<u>23,160</u>	<u>23,256</u>
	<u>36,188</u>	<u>55,212</u>

Accrued expenditures, direct

\$ 370,360 326,248

* In fiscal year 1993, NWF recasted certain of its expense categories. The fiscal year 1992 expenses shown above do not reflect this recasting for purposes of comparability with 1992 budget amounts.

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)

September 30, 1993 and 1992

(1) Organization and Summary of Significant Accounting Policies

(a) Legislative Background

The Nuclear Waste Policy Act (NWPAct) was signed into law on January 7, 1983. The NWPAct 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 NWPAct 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 NWPAct, 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 NWPAct, 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.

(Continued)

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

Notes to Financial Statements

(Dollars in thousands)

On December 22, 1987, the President signed into law the Budget Reconciliation Act for fiscal year 1988 (Amendments Act), which contained amendments to the NWPA. 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 November 29, 1989, the Secretary of Energy submitted to Congress his *Report on the Reassessment of the Civilian Radioactive Waste Management Program*. At the direction of the Secretary, a comprehensive review of the schedule for repository-related activities was performed, based on realistic assessments of activity durations and past experience. This review resulted in a significant schedule slip for the expected start of repository operations from the year 2003 to approximately 2010. In developing the revised schedule, DOE was mindful that certain activities, such as the issuance of environmental permits by the State of Nevada and the NRC review of the license application, are outside the DOE's control.

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

Notes to Financial Statements

(Dollars in thousands)

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.

(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.

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.

(Continued)

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

Notes to Financial Statements

(Dollars in thousands)

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 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 total-system life cycle cost 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 total-system life cycle cost has been published since November 1990.

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, the Office of Environmental Restoration and Waste Management has not entered into an agreement with OCRWM for payment of fees and interest to the NWF on DOE's defense high-level waste share of costs. OCRWM has estimated that approximately \$794,500 of costs incurred to date by the NWF, including interest of \$209,000, 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 \$108,028 as of September 30, 1993. (See also note 12).

For fiscal year 1993, Congress appropriated \$100,000 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 \$100,000 fiscal year 1993 congressional appropriation. An additional \$3,739 of this appropriation had been obligated and expensed as of September 30, 1993. As of September 30, 1992, the NWF recorded the receivable from DOE for the defense high-level waste liability of \$691,320, representing the liability from DOE of \$703,820, less payments of \$12,500. Total revenue from defense high-level waste fees and interest was \$90,680 and \$698,820 in 1993 and 1992, respectively. For fiscal year 1994, Congress has appropriated \$120,000 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.

(Continued)

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

Notes to Financial Statements

(Dollars in thousands)

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 unfunded liabilities 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 1992 amounts have been reclassified to conform to the 1993 presentation.

(2) *Investments*

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

	1993		1992	
	Book value	Market value	Book value	Market value
Due within 1 year	\$ 19,881	19,881	32,413	32,414
Due after 1 year but within 5 years	2,044,844	2,249,437	1,720,396	1,882,417
Due after 5 years but within 10 years	<u>2,113,085</u>	<u>2,280,206</u>	<u>1,965,984</u>	<u>2,116,356</u>
	<u>\$ 4,177,810</u>	<u>4,549,524</u>	<u>3,718,793</u>	<u>4,031,187</u>

Accrued interest receivable on investments as of September 30, 1993 and 1992, totaled \$94,588 and \$87,433, respectively.

(Continued)

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

Notes to Financial Statements

(Dollars in thousands)

(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 revenues are being collected, the Secretary shall propose an adjustment to the fee to insure 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;
- (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 1993 and 1992, 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>1993</u>	<u>1992</u>
Option (1)	\$ 8,472	3,429
Option (2)	—	—
Option (3)	—	—
	<u>\$ 8,472</u>	<u>3,429</u>

(Continued)

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

Notes to Financial Statements

(Dollars in thousands)

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

	<u>1993</u>	<u>1992</u>
One-time spent fuel fees:		
Option (1)	\$ 146,567	155,039
Option (2)	<u>735,316</u>	<u>735,316</u>
	<u>881,883</u>	<u>890,355</u>
Kilowatt-hour fees	<u>132,678</u>	<u>129,018</u>
Interest on one-time spent fuel fees:		
Option (1)	149,878	143,058
Option (2)	<u>760,440</u>	<u>715,946</u>
	<u>910,318</u>	<u>859,004</u>
Total receivables from utilities	1,924,879	1,878,377
Less current portion	<u>(136,528)</u>	<u>(134,101)</u>
Total receivables from utilities, excluding current portion	\$ <u>1,788,351</u>	<u>1,744,276</u>

Federal and nonfederal receivables from utilities at September 30 of each year were as follows:

	<u>1993</u>	<u>1992</u>
Current portion of accounts receivable:		
Nonfederal	\$ 134,437	130,578
Federal agencies	<u>2,091</u>	<u>3,523</u>
	136,528	134,101
Long-term portion of accounts receivable - nonfederal	<u>1,788,351</u>	<u>1,744,276</u>
Total accounts receivable from utilities	\$ <u>1,924,879</u>	<u>1,878,377</u>

(Continued)

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

Notes to Financial Statements

(Dollars in thousands)

(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 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.

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, are to be made available for credit during the period from July 1, 1992 through September 30, 1994. In the second phase, additional accrued interest for the period April 1, 1992 through September 30, 1994, is to be calculated and made available for credit during fiscal year 1995. The Department estimates that the credits will be 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.

The NWF is in the process of finalizing verification of the revised calculations submitted by the utilities. Estimated fees to be credited total \$289,364 of which \$(685) and \$20,049 have been (credited) charged against kWh fees for 1993 and 1992, respectively. As of September 30, 1993 and 1992, the liability for unpaid fees was \$147,934 and \$267,791, respectively.

Interest expense for 1993 and 1992 on account of these overpayments was \$7,274 and \$24,914. Accrued interest payable as of September 30, 1993 and 1992, was \$64,189 and \$97,621, respectively.

(Continued)

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

Notes to Financial Statements

(Dollars in thousands)

Amounts due to utilities as of September 30, 1993 and 1992 consisted of:

September 30, 1993			
	Non - Federal	Federal	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>

September 30, 1992			
	Non - Federal	Federal	Total
Current portion:			
kWh fees payable	\$ 116,212	3,567	119,779
Accrued interest payable	<u>39,097</u>	<u>1,609</u>	<u>40,706</u>
	<u>155,309</u>	<u>5,176</u>	<u>160,485</u>
Long-term portion:			
kWh fees payable	143,616	4,396	148,012
Accrued interest payable	<u>54,716</u>	<u>2,199</u>	<u>56,915</u>
	<u>198,332</u>	<u>6,595</u>	<u>204,927</u>
Total	\$ <u>353,641</u>	<u>11,771</u>	<u>365,412</u>

(Continued)

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

Notes to Financial Statements

(Dollars in thousands)

(5) Capital Equipment, Net

Capital equipment and related accumulated depreciation consisted of the following at September 30, 1993 and 1992:

	<u>1993</u>	<u>1992</u>
Capital equipment	\$ 68,109	62,550
Work-in-progress	<u>1,276</u>	<u>895</u>
	69,385	63,445
Less accumulated depreciation	<u>(35,811)</u>	<u>(31,365)</u>
Net book value	\$ <u>33,574</u>	<u>32,080</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.

(Continued)

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

Notes to Financial Statements

(Dollars in thousands)

(7) *Transfer Appropriations*

During 1993 and 1992, 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>1993</u>	<u>1992</u>	<u>Cumulative</u>
Nuclear Regulatory Commission	\$ 21,100	19,962	83,582
Nuclear Waste Technical Review Board	2,060	3,294	11,342
Office of the Nuclear Waste Negotiator	<u>—</u>	<u>—</u>	<u>5,959</u>
	<u>\$ 23,160</u>	<u>23,256</u>	<u>100,883</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*

The employees of OCRWM of the DOE 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 1993 and 1992 was \$1,284 and \$1,219, respectively.

(9) *Transactions With Other Government Agencies*

The NWPA established the Office of Civilian Radioactive Waste Management within DOE to carry out the provisions of the NWPA 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 NWPA, DOE contracts for services with numerous contractors including other federal government agencies. Further, significant administrative services are provided by DOE.

(Continued)

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

Notes to Financial Statements

(Dollars in thousands)

As of September 30, 1993 and 1992, the NWF owed other government agencies \$3,458 and \$3,839, respectively, for services and costs provided to the NWF. For the years ended September 30, 1993 and 1992, the NWF had incurred costs of \$24,576 and \$23,713, respectively, for services and costs provided by other government agencies.

As discussed in note 1, the NWF is owed \$686,472 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. Resolution of this litigation is not expected to 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. In fiscal years 1993 and 1992, the DOE made payments of \$2,000 and \$1,000, respectively, to Nye County, Nevada, which represented a partial payment for fiscal years 1986-1992. The County request was \$109,000 for fiscal years 1986 through 1992. The total amount to be paid to Nye County is yet to be determined. Also in fiscal year 1992, the DOE made a payment of \$771 to Benton County, Washington. In November 1993, Benton County filed an appeal increasing its request to \$45,752. The DOE is continuing to work with Nye and Benton Counties to determine the amounts of payments-equal-to-taxes. These amounts are not expected to have a material effect on the financial statements.

(11) Expenses by Object Classification

The NWF's expenses by object classification for fiscal years 1993 and 1992 consisted of:

	<u>1993</u>	<u>1992</u>
Personal services and benefits	\$ 16,940	16,008
Contractual services	327,748	286,080
Other	23,327	22,179
Interest	7,274	24,914
Transfer appropriations (note 7)	<u>23,160</u>	<u>23,256</u>
Total expenses	\$ <u>398,449</u>	<u>372,437</u>

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

Notes to Financial Statements

(Dollars in thousands)

(12) Subsequent Event - 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, 1993, because the amount of fees, attributable to this waste, is not reasonably able to be determined until additional studies and information are received.

Certified Public Accountants

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, 1993, and have issued our report thereon dated December 17, 1993.

We conducted our audit in accordance with generally accepted auditing standards; *Government Auditing Standards*, 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, the Department of Energy (DOE), and DOE's Inspector General:

- 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 1993 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 Nuclear Waste Fund 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 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.

KDMG Peter Marwick

December 17, 1993

Certified Public Accountants

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, 1993, and have issued our report thereon dated December 17, 1993.

We conducted our audit in accordance with generally accepted auditing standards; *Government Auditing Standards*, 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 for the year ended September 30, 1993, 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 Inspector General 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 or irregularities 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.

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
- Plant and 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 would not necessarily disclose all matters in the internal control structure that might be 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 described 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 17, 1993.

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

December 17, 1993

FINANCIAL STATEMENTS

Civilian Radioactive Waste R&D Account
Office of Civilian Radioactive Waste Management
United States Department of Energy

Statement of Operations
Years ended September 30, 1993 and 1992

(Dollars in thousands)
(Unaudited)

Spent Fuel Storage and Development		
Operating Expenses	\$ 753	\$ 705
Plant and Capital Equipment	<u>0</u>	<u>0</u>
Subtotal	753	705
Program Management		
Operating Expenses	\$ 100	\$ 114
Plant and Capital Equipment	<u>0</u>	<u>0</u>
Subtotal	100	114
TOTALS		
Operating Expenses	\$ 853	\$ 819
Capital Equipment	<u>0</u>	<u>0</u>
Total Civilian Radioactive Waste R&D	\$ 853	\$ 819

Appendices

Testimony of Daniel A. Dreyfus
Before the Senate Committee on Energy and Natural Resources
September 22, 1993

Thank you Mr. Chairman. My name is Daniel Dreyfus. I appreciate the opportunity to appear before this committee to discuss my nomination for the position of Director of the Office of Civilian Radioactive Waste Management. I am honored that the President and Secretary O'Leary have asked me to serve in that position.

The Office of Civilian Radioactive Waste Management is charged with the responsibility of overseeing the long-term management and ultimate disposal of the spent fuel from the commercial nuclear reactors at some 77 sites in 35 states. Despite the emphasis on "civilian" in the title, the Office also has the responsibility for disposal of the high-level radioactive waste which will result from the cleanup of the nation's nuclear weapons program. That responsibility has been less prominent in the past. There is growing attention to the details of the cleanup of the weapons complex, however, and an emerging realization of the issues of the long term custody of radioactive materials that are excess to the weapons stockpiles. These aspects of the program promise to become more visible in the years ahead.

I believe that the long-term management of radioactive material is a profound responsibility for the Federal Government and for society. The technical and policy issues involved defy the capabilities of any individual. Contributions from many specialists representing diverse disciplines are necessary to implement the program. Regarding my own role, I have training and many years of experience that are directly applicable to the issues confronting us. I hold a degree in civil engineering and a Master's degree in engineering management, disciplines directly applicable to the responsibilities involved. I have had ten years of experience in field work and contract management in both

private and government construction projects. My Doctorate in public administration has a strong technical management emphasis. I served for 14 years on the professional staff of this committee, dealing with energy policy and natural resource issue areas, many of which are related to the program. I also served for 12 years as the Vice President for Strategic Planning for the Gas Research Institute. In that capacity, I participated in the planning of a complex research program and I established and supervised an analytical group which dealt with the full range of energy industries.

Over the decades of nuclear experience since the Manhattan Project, the United States has evolved a set of policies regarding the management of long lived, highly radioactive materials. In its essence, the current policy includes four key points. First, the Federal Government has accepted the responsibility for the long term management of these materials. Second, the commercial nuclear power industry, with strong Federal policy involvement, has chosen a "once through" fuel cycle that results in highly radioactive spent fuel which is not expected to be reprocessed. Third, the concept of deep geologic deposition has been adopted as the national strategy for ultimate disposal, and the Congress has designated the Yucca Mountain site in Nevada to be characterized to evaluate its suitability as a repository. Finally, high-level wastes resulting from some defense activities also will be processed into stable forms suitable for deep geologic disposal along with commercial spent fuel.

It is important to realize that this strategy is breaking new ground in both policy and technology. Nowhere in the world is there a complete, high-level nuclear waste disposal system in operation. A deep geologic repository for high-level radioactive waste has never been designed and built, to say nothing

of meeting the rigorous licensing requirements that will be applied to the U. S. program. We are engaged in an enterprise which has no precedent, and therefore it will continue to confront uncertainty.

One thing, however is certain. The radioactive waste exists. The decisions that created it have already been made, not only in the United States, but globally. As a recent Greenpeace poster graphically portrayed, some of it will still be here when many generations of our descendants have come and gone.

Whatever decisions society may make concerning the future use of nuclear energy for health care, industrial processes, power production or defense, we must have a sound strategy for the long-term management of radioactive waste. That strategy must consistently protect the health and safety of the workers who handle these materials and of the public at large, and it must control the environmental consequences of the handling and storage activities. The strategy must also assure the American people, and the international community, that we are progressing toward an acceptable and workable approach to the ultimate disposition of long lived radioactive materials. If we can achieve that goal for the United States, we will have the basis to advocate standards for the strategy that will be taken globally to address what is ultimately a global concern.

To improve the existing program, at least two considerations should be addressed quickly. The expectation has been that, beginning in 1998, the spent fuel at nuclear powerplant sites would begin to be accepted by the Federal Government and removed to a

federally operated facility. The Department of Energy has contracts with the nuclear electric utility companies concerning this expectation and the ratepayers of those companies have contributed over seven billion dollars to the Nuclear Waste Fund to support the waste management program. No site has been selected, however, for Federal storage. Utilities are at the point of planning and investing in alternatives for the management of the spent fuel. These will be costly decisions.

The utility managers, their investors and ratepayers, state and Federal regulatory bodies and the general public, who will live with and pay for the consequences of those decisions, need greater certainty of the intentions of the Federal Government in the event that the Federal action is delayed.

With regard to the repository, concerns have been expressed by both proponents and opponents of the Yucca Mountain site that the characterization project deserves a rigorous review of its management and scientific approach. Secretary O'Leary is in the process of reviewing the program, and she has agreed to initiate an independent financial management review. She has stated her commitment to the effective management of the project and to ensuring the scientific excellence, objectivity, and credibility of the results of the characterization.

I am in full agreement with the Secretary's objectives. If the Senate confirms my nomination, I will contribute my best effort to the management of the program.

I look forward to my association with this Committee and the Congress, and I will be pleased to respond to your questions.

Thank you.

Status of MRS Feasibility Study Grant Applicants (as of December 30, 1993)

Absentee Shawnee (Oklahoma) Phase I: Applied 3/31/92. Withdrawn 6/9/92.	Mescalero Apache Tribe (New Mexico) Phase I: Applied 10/11/91. Awarded 10/17/91. Phase IIA: Applied 3/13/92. Awarded 4/21/92. Phase IIB: Application in preparation. (8/4/93 request to Office of the Nuclear Waste Negotiator to enter into negotiations. FY 1994 grant funding eliminated by Congress 11/93.)
Akhiok Kaguyak (Alaska) Phase I: Applied 3/31/92. Denied 6/92.	
Alabama Quassarte Tribe (Oklahoma) Phase I: Applied 3/26/92. Withdrawn 2/24/93.	
Apache County (Arizona) Phase I: Applied 3/18/92. Denied 10/28/92.	Miami Tribe (Oklahoma) Phase IIA: Applied 3/31/93. Withdrawn 6/93.
Apache Development Authority (Oklahoma) Phase I: Applied 3/31/92. Inactive.	Northern Arapaho (Wyoming) Phase IIA: Applied 3/31/93. Denied 9/7/93.
Caddo Tribe (Oklahoma) Phase I: Applied 4/17/92. Withdrawn 7/16/92.	Ponca Tribe (Oklahoma) Phase I: Applied 3/31/92. Awarded 9/4/92.
Chickasaw Indian Nation (Oklahoma) Phase I: Applied 12/26/91. Awarded 2/14/92. Declined 3/31/92	Prairie Island Sioux Indian Nation (Minnesota) Phase I: Applied 12/20/91. Awarded 3/18/92. Phase IIA: Applied 3/31/93. Denied 6/10/93.
Eastern Shawnee (Oklahoma) Phase I: Applied 3/30/92. Awarded 9/9/92 Phase IIA: Applied 3/31/93. Denied 8/93.	Sac and Fox Nation (Oklahoma) Phase I: Applied 12/30/91. Awarded 2/19/92.
Fifield Development Corporation (Wisconsin) Phase I: Applied 3/92. Denied.	San Juan County (Utah) Phase I: Applied 3/27/92. Awarded 5/4/92.
Fort McDermitt Paiute Shoshone (Oregon/ Nevada) Phase I: Applied 5/27/92. Awarded 7/15/92. Phase IIA: Applied 2/19/93. Awarded 6/1/93.	Skull Valley Goshute Tribe (Utah) Phase I: Applied 3/17/92. Awarded 4/14/92. Phase IIA: Applied 10/27/92. Awarded 1/27/93. Phase IIB: Applied 8/93. (FY 1994 grant funding eliminated by Congress 11/93.)
Fremont County (Wyoming) Phase I: Applied 12/30/91. Awarded 1/23/92.	Tetlin Village (Alaska) Phase I: Applied 3/30/92. Denied 6/92.
Grant County (North Dakota) Phase I: Applied 11/18/91. Awarded 11/25/91.	Tonkawa Tribe (Oklahoma) Phase IIA: Applied 3/31/93. Awarded 9/30/93.
Lower Brule Sioux (South Dakota) Phase I: Applied 3/31/92. Inactive.	Ute Tribe (Colorado) Phase IIA: Applied 3/31/93. Withdrawn 8/9/93.
	Yakama Indian Nation (Washington) Phase I: Applied 12/20/91. Awarded 3/18/92.

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 conform to numerous Federal regulations from agencies such as the Nuclear Regulatory Commission, the Department of Transportation, and the Environmental Protection Agency.

The Nuclear Waste Policy Act

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

- *Geologic Repository Development.* The act establishes a framework for the siting, characterization, construction and operation of a permanent geologic nuclear waste repository.
- *Storage.* The act authorized provisions 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.
- 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 a monitored retrievable storage facility subject to certain conditions that link the construction and operation of the MRS 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 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 directs the Environmental Protection Agency to contract with the National Academy of Sciences to provide "findings and recommendations on reasonable standards for protection of the public

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

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 Environmental Protection Agency 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 Nuclear Regulatory Commission is then required to modify its technical requirements and criteria consistent with the Agency's standards.

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

Section 803 instructs 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 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.

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.

Under the *Hazardous and Solid Waste Amendments* of 1984 (HSWA), DOE is required to take corrective measures to address releases of hazardous waste or constituents at or from its RCRA facilities according to schedules specified by EPA.

Comprehensive Environmental Response, Compensation, and Liability Act (1980). The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as Superfund) sets another important national policy: governments and private interests must pay for the cleanup of hazardous substances that pose a threat to human health and the environment. The act provides the U.S. Environmental Protection Agency with the authority to assess contaminant releases from waste sites, categorize sites according to risk, and include them in the National Priorities List (NPL) if the agency or states considers their cleanup a national priority. This authority covers hazardous substances, which includes both radioactive and hazardous contaminants. In addition, the *Superfund Amendments and Reauthorization Act* (SARA) of 1986 explicitly includes federal facilities, such as the eighteen sites in the DOE complex on the NPL, under the applicable provisions of CERCLA.

Clean Air Act (1970). The Clean Air Act Amendments authorizes the Environmental Protection Agency (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.

Key Regulations

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 high-level 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 Yucca Mountain Project.

10 CFR 961 (DOE) *Standard Contract for Disposal of Spent Nuclear Fuel 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.* Although this specific regulation was remanded in 1987, standards for the management and disposal of spent nuclear fuel and high-level radioactive waste are being reworked. A separate set of standards is being developed for the Yucca Mountain Project, pursuant to section 801 of the Energy Act of 1992.

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

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."

OCRWM Publications FY 1993

<i>OCRWM Bulletin</i> (Summer/Fall 1992), October 1992 (DOE/RW-0372P)	<i>Drilling to Evaluate Movement Through Rock</i> (fact sheet), February 1993 (DOE/RW-0388)
<i>Strategy for OCRWM to Provide Training Assistance to States, Tribal, and Local Government</i> , October 1992 (DOE/RW-374P)	<i>An Overview of the Hydrologic Research Facility</i> (fact sheet), February 1993 (DOE/RW-0389)
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<i>Used Nuclear Fuel</i> , November 1992 (DOE/RW-0378P)	<i>Yucca Mountain Reclamation Plans</i> (fact sheet), February 1993 (DOE/RW-0398)
<i>Site Characterization Progress Report: Yucca Mountain, Nevada</i> (April-September 1992), December 1992 (DOE/RW-307P-7)	<i>Yucca Mountain Site Characterization Environmental Field Programs</i> (fact sheet), February 1993 (DOE/RW-0399)
<i>DOE's Yucca Mountain Studies</i> , December 1992 (DOE/RW-0345P)	<i>An Early Suitability Evaluation of Yucca Mountain</i> (fact sheet), February 1993 (DOE/RW-0400)
<i>Physical System Requirements – Store Waste</i> , Rev. 1, December 1992 (DOE/RW-0379P)	<i>Transportation: Overview of the Issues</i> (fact sheet), February 1993
<i>Of Mountains and Science</i> (newsletter), January 1993 (DOE/RW-0396)	<i>Nuclear Waste Repositories and Carbon-14 Emissions</i> (fact sheet), March 1993 (DOE/RW-0393P)
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<i>Project Research and Study Center</i> , January 1993 (DOE/RW-0404P)	<i>A Monitored Retrievable Storage Facility</i> , March 1993 (DOE/RW-0407)
<i>OCRWM Bulletin</i> (Winter 1993), January 1993 (DOE/RW-0405)	<i>Program Baseline Change Control Procedure</i> Rev. 0, March 1993 (DOE/RW-0409)
<i>Civilian Radioactive Waste Management System Requirements Document</i> , January 1993 (DOE/RW-0406P)	<i>Program Baseline Control Board Charter</i> , March 1993 (DOE/RW-0410)
<i>System Requirements Document – Mined Geologic Disposal</i> , January 1993 (DOE/RW-0404P)	

APPENDIX D

Technical Career Opportunities and Radioactive Waste, March 1993 (DOE/RW-0411)

1992 Annual Capacity Report, March 1993 (DOE/RW-0412)

1992 Acceptance Priority Ranking, March 1993 (DOE/RW-0413)

Drilling and Blasting the TBM Starter Tunnel (fact sheet), April 1993

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OCRWM Baseline Management Procedure, April 1993 (DOE/RW-0415)

OCRWM Baseline Management for Document Identifiers, May 1993 (DOE/RW-0416)

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1992 Acceptance Priority Ranking (Rev. 1), May 1993 (DOE/RW-0419)

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