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Report to the Congress

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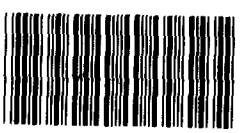
NUCLEAR WASTE

DOE's Repository Site Investigations, a Long and Difficult Task



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GAO

United States
General Accounting Office
Washington, D.C. 20548

Comptroller General
of the United States

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To the President of the Senate and the
Speaker of the House of Representatives

The Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101), as amended by title V of the Omnibus Budget Reconciliation Act of 1987 (P.L. 100-203), requires us to report to the Congress on the Department of Energy's civilian radioactive waste management program. This report responds to that requirement.

We are sending copies of this report to congressional committees with oversight of the Department's activities, the Secretary of Energy, the Chairman of the Nuclear Regulatory Commission, the Governor of Nevada, and other interested parties.

This work was performed under the direction of Victor S. Rezendes, Director of Energy Issues in the Resources, Community, and Economic Development Division. Other major contributors to this report are listed in appendix IV.

Charles A. Bowsher
Comptroller General
of the United States

Executive Summary

Purpose

More than 20,000 metric tons of highly radioactive wastes are stored in 33 states at about 70 civilian nuclear plant sites and 3 Department of Energy (DOE) nuclear facilities. Because these wastes will remain dangerous for thousands of years, the Nuclear Waste Policy Act of 1982 charged DOE with developing an underground repository for safe, permanent disposal of the wastes. Amendments to the act in 1987 required DOE to investigate only Yucca Mountain, Nevada, as a potential repository site. DOE estimates that this investigation will cost $6.3 billion.

This report, required by the 1982 act, focuses on (1) DOE's efforts to investigate Yucca Mountain since 1988; (2) DOE's efforts to ensure the early identification, primarily through surface-based tests, of any conditions that could disqualify the site; and (3) the effects of delays in DOE's obtaining environmental permits from the state of Nevada.

Background

In December 1988 DOE issued, as required by the 1982 act, its formal plan for investigating the site. Several commenters on the plan expressed concern that the plan did not adequately define the sequence of proposed studies so that, among other things, any disqualifying conditions present at Yucca Mountain would be identified early. In November 1989 the Secretary of Energy announced a new emphasis on early evaluation of the site's suitability, which was to include initial tests from the surface of the site.

Results in Brief

From fiscal year 1988 through 1991, DOE spent $523 million on the Yucca Mountain project. Key activities included developing (1) a program to ensure the quality of data to be used in a future repository-licensing proceeding before the Nuclear Regulatory Commission (NRC), (2) special technology for drilling boreholes and extracting rock samples, and (3) a new approach for an underground exploratory studies facility. NRC's partial acceptance of the quality assurance program in October 1990 and Nevada's issuance of an environmental permit in June 1991 enabled DOE to begin two limited surface investigations in July 1991.

DOE has not yet implemented the Secretary's strategy of conducting early surface-based tests to identify unsuitable site conditions. One project to rank tests, using site criteria contained in NRC's repository regulations, has been abandoned. Moreover, had DOE completed this project, it might not have produced results that would have been compatible with a project to develop a method for evaluating site conditions. The latter project, which will not be completed until mid-1992, is based on more restrictive criteria

contained in DOE's guidelines for evaluating potential repository sites. Furthermore, despite expressed public interest in early identification of unsuitable site conditions, DOE did not seek public participation in planning a surface-based testing strategy; instead, DOE is obtaining public comment on an initial report evaluating the site's suitability.

In 1989 Nevada enacted legislation banning storage of highly radioactive waste in the state and, on that basis, declined to issue three environmental permits that DOE had requested. After subsequent court decisions in DOE's favor, Nevada issued two of the permits in June 1991 and the third permit in March 1992. Had DOE had the permits in hand, it could have begun limited work at the site in October 1990. DOE is seeking, and Nevada opposes, legislation that would prevent Nevada from using the permit process to delay site investigations in the future.

Principal Findings

DOE Begins Field Work in Mid-1991

DOE had planned to begin implementing its site investigation plan early in 1989 but was unable to do so because it needed to resolve concerns raised by NRC and others. For example, DOE and its contractors first had to develop quality assurance programs that were acceptable to NRC. In October 1990 NRC accepted the quality assurance programs of two DOE contractors responsible for the first two planned site investigations.

Also, although the need for a fluid-free drilling and coring technology had been recognized for several years, DOE did not begin developing this technology until 1989. In the absence of an essential state permit, DOE developed the technology outside Nevada but planned to begin using the technology at Yucca Mountain in April 1992.

Finally, as a result of external technical comments on DOE's initial plans for an exploratory studies facility, in September 1991 DOE selected an alternative design for the facility that features access ramps rather than vertical shafts, more miles of underground tunnels, and a different construction method. This decision delayed construction of the facility until November 1992, and then budget constraints delayed construction for another year.

Slow Progress in Developing Site Study

DOE has not yet developed a cohesive approach to identifying conditions that, if present, could disqualify the site for a repository. DOE's first effort to identify high-priority tests and determine how to evaluate site conditions was based largely on "potential adverse [site] conditions" contained in NRC's regulations. After about a year, however, DOE decided to use its own guidelines to assess site suitability. These guidelines specify, as required by the 1982 act, qualifying and disqualifying conditions that must be either present or absent for a site to be suitable for a repository. DOE then decided to develop a site evaluation method based on its siting guidelines but continued to rank tests on the basis of NRC's regulations.

In March 1991 DOE issued a report ranking broad issues to be studied—rather than specific tests to be conducted—but subsequently decided not to continue this effort. Had DOE continued this ranking approach, tests that might have identified disqualifying conditions would not have been conducted early because these conditions were not assigned high priority. DOE expects to complete a new method for ranking tests in late 1992.

DOE's contractor issued a site evaluation report in February 1992. As yet, however, DOE has not determined if the proposed method for evaluating Yucca Mountain's suitability for a repository would implement DOE's siting guidelines in a way that is consistent with the 1982 act. Also, DOE has not, in line with its stated policy, afforded affected and interested parties opportunities to participate in developing approaches to ranking tests and evaluating the site. DOE has, however, sought public comment on the site evaluation report and, after considering these comments, intends to decide whether to adopt the proposed evaluation method.

State Permit Issue Could Cause Additional Delays

Nevada opposes the use of Yucca Mountain as a nuclear waste repository. Since 1987, therefore, the state has tried to prevent DOE from developing a repository at Yucca Mountain by banning nuclear waste storage within the state and by not acting on DOE's requests for three environmental permits. Following resolution of court cases that stemmed from these state actions, Nevada issued two of the permits in mid-1991 and the other early in 1992. Because DOE could not perform surface-disturbing activities until Nevada had issued one of the first two permits, the start of new investigations at the site was delayed from October 1990, when NRC accepted the quality assurance programs of DOE's contractors, until mid-1991. Out of concern that Nevada might delay action on future permit applications, DOE has proposed legislation that would exclude Nevada from the permitting

process. Nevada opposes such legislation and expects to challenge it if it is enacted.

Recommendations

To help build public confidence in its repository project and ensure that the project can withstand legal challenge, the Secretary of Energy should obtain and consider public comments on the proposed priorities to be developed for field investigations at Yucca Mountain and review the legal sufficiency of the proposed method for evaluating site suitability.

Agency Comments

GAO obtained written comments on a draft of this report from DOE, NRC, and the state of Nevada. These comments are incorporated in the report where appropriate and, except for a detailed attachment from Nevada, are reproduced in their entirety in appendixes I, II, and III.

DOE concurred with the intent of GAO's recommendations and added that it has already implemented a policy for obtaining comments on its approach to site characterization. GAO recognizes that DOE obtained public comment on its site characterization plans, as required by the nuclear waste act. However, DOE is seeking public comment on a proposed approach to early evaluation of the site 2 years after work on the approach began. DOE also noted that the site suitability evaluation report is a contractor report and is therefore not subject to formal DOE legal review before issuance. In GAO's opinion, a legal review of the methodology developed to evaluate site suitability would have been more timely before the initiation of a 2-year project culminating in a proposed detailed site evaluation method and report.

DOE disagreed that its initial efforts to rank tests and to identify potential disqualifying conditions early would have produced incompatible results. Because the proposed ranking method would have assigned relatively low priority to tests for disqualifying conditions, GAO continues to believe that the two efforts might have been incompatible; however, DOE has abandoned the test-ranking method and is now developing a new method.

GAO considered additional information that DOE, NRC, and Nevada provided concerning when DOE could begin new site investigation activities.

Contents

Abbreviations

DOE	Department of Energy
EPA	Environmental Protection Agency
GAO	General Accounting Office
NRC	Nuclear Regulatory Commission
OCRWM	Office of Civilian Radioactive Waste Management
NWPA	Nuclear Waste Policy Act of 1982
YMPO	Yucca Mountain Project Office
USGS	U.S. Geological Survey

Introduction

About 20,000 metric tons of highly radioactive wastes are temporarily stored at facilities in more than 30 states, and more such wastes are generated each year.[1] Coming primarily from about 110 operable commercial nuclear power plants at about 70 sites and from Department of Energy (DOE) national defense activities at 3 sites, these wastes will remain dangerous to humans and the environment for thousands of years. For this reason, these nuclear wastes must be permanently isolated from the accessible environment. In addition, DOE and the nuclear industry consider the safe, permanent disposal of nuclear waste essential to the continued viability of the nuclear power industry. In November 1990 DOE estimated that the program would cost about $26 billion if one repository were built and $34 billion if two repositories were built (1988 dollars).

Initial Implementation of Nuclear Waste Legislation

To dispose of highly radioactive waste permanently and safely, the Congress passed, and on January 7, 1983, the President signed into law, the Nuclear Waste Policy Act of 1982 (NWPA). In passing the legislation, the Congress found that over the previous 30 years, federal efforts to solve the nuclear waste problem had not been adequate. The act's primary objective was the construction and operation of one or more mined, geologic repositories for disposal of these nuclear wastes. NWPA established the Office of Civilian Radioactive Waste Management (OCRWM) within DOE to carry out its provisions. Also, the act required generators and owners of civilian wastes to finance disposal program costs through fees based on the quantity of electricity generated by nuclear plants. The act directed the President to decide whether defense wastes should be disposed of in the repositories for civilian waste. In April 1985 the President decided in favor of disposing of defense wastes in the civilian repositories.

NWPA established procedures for identifying and selecting sites for at least two repositories and authorized DOE to construct one repository. To ensure that two repositories would eventually be developed, the act limited the amount of nuclear waste that could be stored in the first repository to 70,000 metric tons until a second repository was operational. For each repository, the procedures included (1) identification of at least five potential sites, (2) recommendation and selection of three candidate sites for characterization (scientific investigation), (3) site characterization, and (4) recommendation of one site for a repository by the Secretary of Energy to the President and subsequent recommendation

[1]As used in this report, highly radioactive waste, or "waste," refers to all high-level radioactive waste generated by commercial entities and the government. Most commercial waste is spent (used) nuclear reactor fuel, and most governmental waste comes from defense-related activities and is referred to as defense waste.

by the President to the Congress. The act required the Secretary of Energy to issue general siting guidelines as criteria to be used in recommending sites for repositories and also provided for the active participation of potentially affected states and Indian tribes in the process of screening and selecting the site.[2]

NWPA assigned important responsibilities to the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC). As required by the act, EPA issued, in September 1985, standards for protecting the general environment from releases of radioactive material beyond the boundaries of a repository site (40 C.F.R. 191).[3] As further required by the act, DOE must seek and obtain NRC authorization (a license) to construct a repository. To obtain this license, DOE must demonstrate that construction and operation of a repository at a selected site would comply with NRC's regulatory requirements and criteria (10 C.F.R. 60). These requirements and criteria may not be inconsistent with EPA's disposal standards for repositories.

Until such time as DOE applies to NRC for a license to construct a repository, NRC's primary program role is to provide DOE with regulatory guidance and program oversight. In 1983 the two agencies signed an agreement covering interagency consultations before licensing. The consultations are intended to encourage timely identification and resolution of potential licensing issues.

Even before the enactment of NWPA, DOE had been conducting preliminary studies of locations in several states as potential sites for the first repository. After the act's passage, DOE continued to study these locations, and on May 28, 1986, the Secretary nominated, and the President approved, three of them as candidate sites for characterization for the first repository. The three sites selected for characterization were located at Yucca Mountain, Nevada, adjacent to DOE's Nevada Test Site where DOE tests nuclear weapons; in Deaf Smith County, Texas; and on DOE's Hanford Reservation in eastern Washington. At the same time, the Secretary announced that DOE would defer the process of screening and selecting a site for a second repository because projections of decreasing quantities of nuclear waste indicated that a second repository would not be needed as soon as had been anticipated.

[2]DOE issued the siting guidelines in December 1984 (10 C.F.R. 960).

[3]In July 1987 the U.S. Court of Appeals (First Circuit) vacated and remanded the disposal standards to EPA for reconsideration. EPA had not reissued the standards as of December 1991.

The Congress Redirects the Nuclear Waste Program

In December 1987 the Congress redirected the civilian nuclear waste program because of mounting opposition from states in which potential sites were located and increasing estimates of the costs to characterize sites. Specifically, the Nuclear Waste Policy Amendments Act of 1987—contained in title V of the Omnibus Budget Reconciliation Act of 1987 (P.L. 100-203)—directed DOE to determine if the site at Yucca Mountain (see fig. 1.1) was suitable for a repository and, if so, to seek NRC's authorization to construct a repository at that site. DOE was to terminate all site-specific activities at the other two candidate sites.

Figure 1.1: Yucca Mountain, Nevada

Source: DOE.

If, according to the 1987 amendments, DOE determines that the Yucca Mountain site is not suitable for a repository, it must terminate activity at that site and provide the Congress with recommendations for further action to ensure the safe, permanent disposal of nuclear waste. Finally,

under the amendments, DOE is prohibited from conducting site-specific activities on a second repository and must report to the President and the Congress between January 1, 2007, and January 1, 2010, on the need for a second repository. The amendments did not alter the limit on the amount of nuclear waste that DOE could put in the first repository.

The 1987 amendments also created the Nuclear Waste Technical Review Board to evaluate the technical and scientific validity of DOE's civilian nuclear waste program activities, including the characterization of the Yucca Mountain site. The Board, which began operating in March 1989, is required to report on its work twice each year to the Congress and to the Secretary of Energy.

Activities Pertaining to Yucca Mountain

To build and operate a nuclear waste repository at Yucca Mountain, DOE must demonstrate, in accordance with the procedures set forth in NWPA, as amended, that the repository can permanently store nuclear waste while protecting public health and safety and the environment. To do this, DOE must undertake an investigation that officially began in May 1986, when the site was selected for characterization, and, unless the site is disqualified earlier, will not end until about 2001, when DOE anticipates that it might apply to NRC for a license to construct a repository at the site.

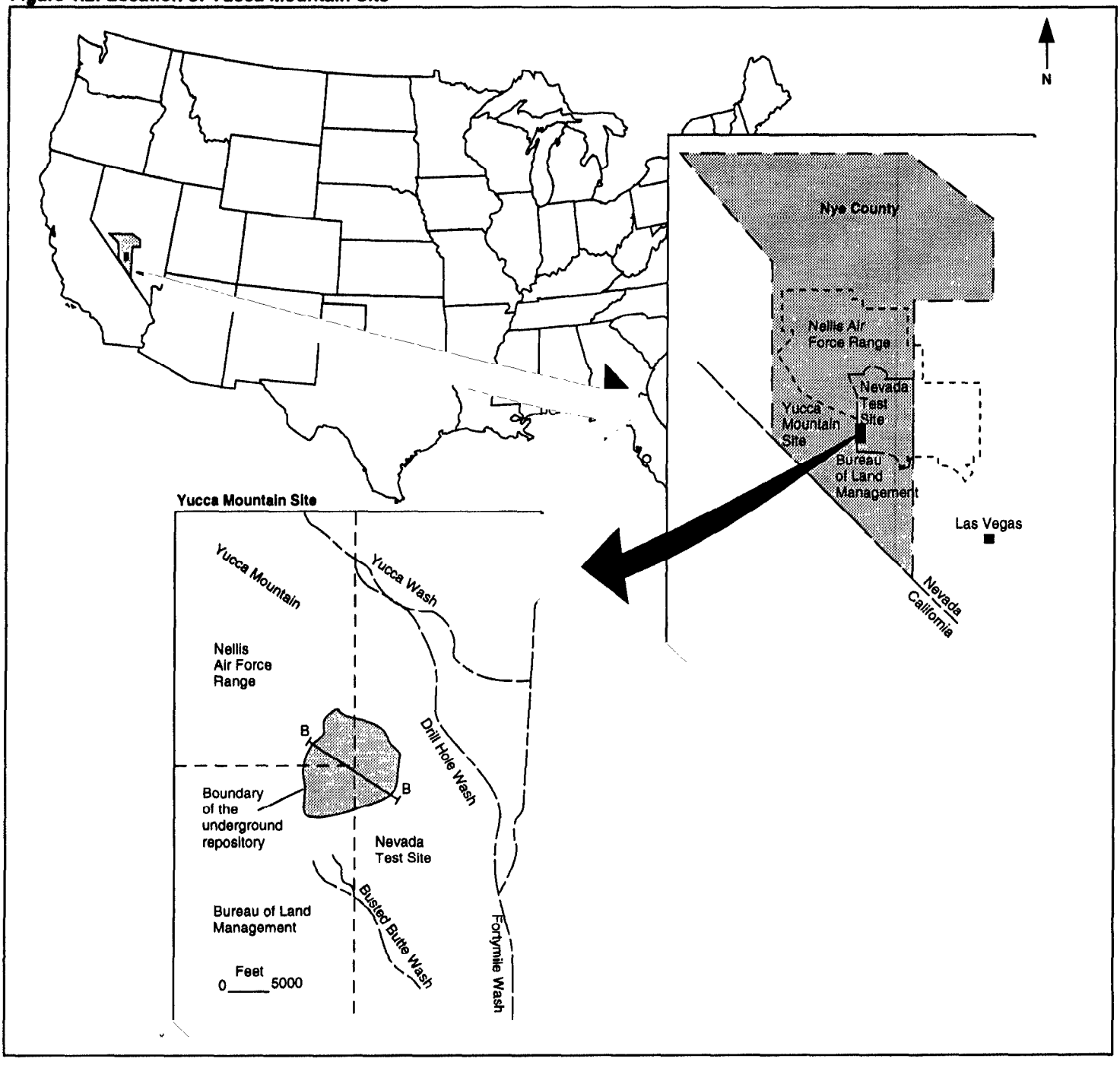
Site characterization includes extensive field and laboratory work to collect and evaluate geologic, hydrologic, geochemical, and other information. On-site work, for example, consists of surface-based activities, such as mapping, monitoring climate, and conducting geophysical surveys and seismologic and hydrologic studies. It also includes activities conducted in boreholes and trenches that will be used for ground water monitoring, core extraction, laboratory testing, and studies of the earth's geological structure and chemical composition and of underground water. Finally, studies will be conducted in the host rock through construction of an exploratory facility consisting of underground rooms and drifts (tunnels) excavated to and below repository depth through vertical and/or inclined shafts. In addition, DOE will design the repository and the waste package (the waste and the container in which it is packaged for disposal) and develop the information needed to support an application to NRC for a license to construct the repository.

Activities Predating Selection as a Candidate Site

DOE's interest in Yucca Mountain as a potential repository site predates NWPA. In the late 1960s, DOE began to explore the potential of several types of geologic media, including the volcanically produced rock, called tuff, in

the vicinity of the Nevada Test Site and the basalt under its Hanford Reservation, to host nuclear waste repositories. Other geologic media under study included various salt formations in Louisiana, Mississippi, Texas, and Utah. In 1977 the U.S. Geological Survey (USGS), a branch of the Department of the Interior and a participant in operations at the Nevada Test Site, recommended that DOE investigate the test site as a potential host for a repository. Subsequent screening of the test site led to selection in 1980 of the Yucca Mountain site. The site is located on the southwest part of the test site, on the Nellis Air Force Range, and on public land managed by Interior's Bureau of Land Management. (See fig. 1.2.)

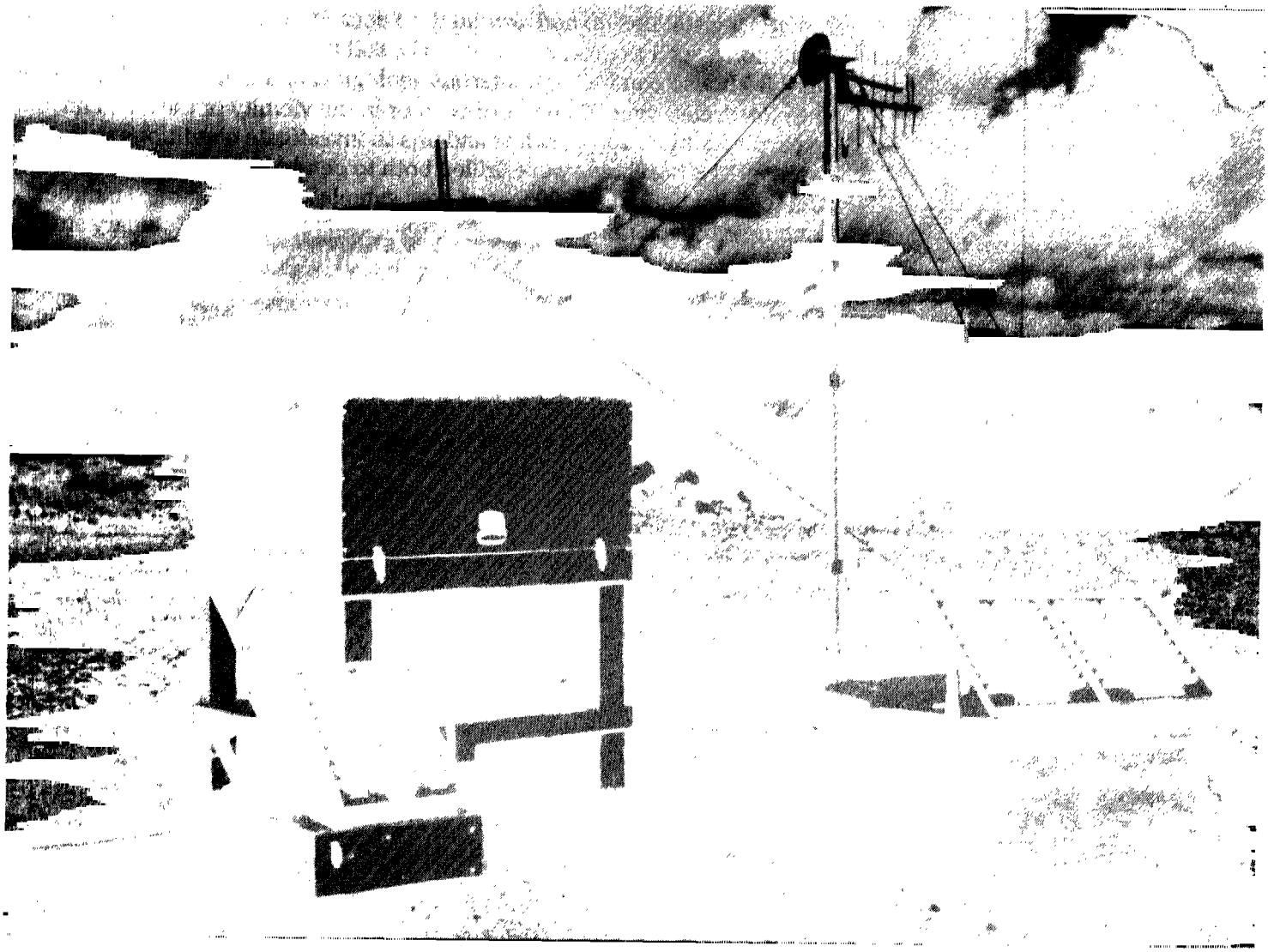
Figure 1.2: Location of Yucca Mountain Site



Source: DOE.

From 1977 until early 1986, DOE established nearly 600 environmental monitoring stations on and around the Yucca Mountain site to monitor site conditions, such as ground water levels, soil moisture, and climate. (See fig. 1.3.) It also conducted numerous geological and hydrological studies of the site, drilled over 200 boreholes on or in the vicinity of the site, and excavated almost 100 trenches and pits to investigate conditions such as faulting. The boreholes were drilled both to conduct studies in the holes and to collect about 37,000 feet of core samples of the underground rock for study in the laboratory. These activities and related preliminary studies of the site provided much of the information that DOE used to prepare, as required by NWPA, an environmental assessment. This assessment provided the basis for the Secretary of Energy's May 1986 recommendation to the President that the site be selected as a candidate for characterization.

Figure 1.3: Environmental Monitoring Station



Source: DOE.

Activities After Selection as a Candidate Site

Following the selection of the Yucca Mountain site as one of three sites to be characterized, DOE, as required by NWPA, began preparing a site characterization plan. The act required DOE, before sinking exploratory shafts at a candidate site, to, among other things,

- prepare a general plan for site characterization activities, including a description of (1) the candidate site, (2) characterization activities, and (3) criteria for determining the suitability of the site for a repository, developed in accordance with the siting guidelines;
- describe the possible form, or packaging, for the waste to be placed in the repository;
- prepare a conceptual repository design that took into account the likely site-specific requirements;
- submit the general plan, description of the waste form, and conceptual repository design to the governor and legislature of the affected state, or to the governing body of the affected Indian tribe, for their review and comment; and
- make the site characterization plan available to the public and hold public hearings near the site to inform residents of the plan and to receive their comments.

DOE issued a draft plan in January 1988 for the purpose of obtaining comments, primarily from the state of Nevada and NRC. The final plan was issued on December 28, 1988. The activities and studies formally conducted at or about the site formed much of the basis for the site characterization plan as well as for the earlier environmental assessment. Also, the plan identified 106 further detailed scientific studies that would be required to gather the information necessary to determine whether the site was suitable and whether a repository built at the site would be likely to comply with EPA's disposal standards and NRC's regulations for nuclear waste repositories. DOE planned to gather information by means of concurrent surface-based and underground investigations.

When DOE issued the final plan, it expected to begin the surface-based investigations and the construction of the exploratory shaft facility (now called the exploratory studies facility) later in 1989. However, NRC, Nevada, and others, in commenting on the draft and final site characterization plans, raised numerous concerns about DOE's scientific and technical approach to investigating Yucca Mountain. NRC said that, as a result of these concerns, it had a broad programmatic concern that the pressure to meet unrealistic schedule milestones might leave DOE too little time to plan for gathering, and to gather, information. Also, in August 1989 the Nuclear Waste Technical Review Board raised questions about DOE's design of the exploratory studies facility and other issues. Finally, beginning in March 1987, Nevada excluded the Yucca Mountain area from renewals of environmental permits that it periodically issued to DOE for operation of the Nevada Test Site. Subsequently, the state declined to act on three

applications from DOE for permits for the Yucca Mountain repository project, the first of which was submitted in January 1988.

In response to a directive of the House Committee on Appropriations, the Secretary reassessed the program and issued a report to the Congress on the results of this reassessment in November 1989.[4] In this report the Secretary said, among other things, that DOE was changing its approach to site characterization to emphasize early surface-based testing—testing in advance of constructing an exploratory studies facility—to evaluate conditions that might make the Yucca Mountain site unsuitable for a repository. This change would lengthen the time allotted for site characterization, extend the scheduled start of repository operations from 2003 to 2010, and require DOE to alter its management structure for the nuclear waste program. Early surface-based testing was to begin about 2 years before DOE began constructing the exploratory studies facility. The Secretary also said that DOE would challenge Nevada's inaction on its permit applications in court and, if successful, begin surface-based testing in January 1991 and construction of the exploratory studies facility in November 1992.

Objectives, Scope, and Methodology

Our objectives were to review (1) DOE's preparations to begin new site characterization work at the Yucca Mountain site following issuance of the site characterization plan in December 1988, (2) DOE's efforts to ensure the early identification of any conditions that could disqualify the site, and (3) the effects on DOE's site characterization program of delays in obtaining environmental permits from Nevada.

In carrying out our work, we reviewed documents relating to site characterization and the Yucca Mountain project, such as (1) DOE's records, correspondence, and progress reports relating to the program's status; (2) correspondence between DOE and NRC relating to program matters, such as DOE's quality assurance program; and (3) documents and reports by other groups, such as the Nuclear Waste Technical Review Board, the state of Nevada, and USGS. As a "contractor" to DOE on the Yucca Mountain project, USGS is responsible for many of the activities that characterize the site's geology, hydrology, tectonics, and seismicity.

We interviewed officials from DOE, NRC, Nevada, USGS, and the Nuclear Waste Technical Review Board. Because DOE's Office of the Inspector

[4]We discussed DOE's Report to Congress on Reassessment of the Civilian Waste Management Program (Nov. 1989) and the comments received thereon in our report Nuclear Waste: Quarterly Report as of March 31, 1990 (GAO/RCED-91-55, Feb. 15, 1991).

General was auditing the nuclear waste program expenditures at the time of our review, we did not examine this area except to obtain some budgetary and expenditure data.

Our review was conducted primarily at DOE's Yucca Mountain Project Office (YMPO) in Las Vegas, Nevada, and at OCRWM's headquarters office in Washington, D.C. We also obtained information from other agencies and groups, such as NRC, in Washington, D.C., and Las Vegas, Nevada.

We obtained written comments on a draft of this report from DOE, NRC, and the state of Nevada, which are incorporated in the report where appropriate and, except for a detailed attachment from Nevada, are reproduced in their entirety in appendixes I, II, and III. We performed our review from May 1990 through October 1991 in accordance with generally accepted government auditing standards.

DOE Completes Prerequisites for Beginning New Site Characterization Work

DOE spent about $523 million on the Yucca Mountain project during fiscal years 1989 to 1991. More than one-half of these funds were spent on activities related to project management and preparations for new site investigations. Although DOE could not begin any new work at the site to support a potential license application until after it received a permit from Nevada in June 1991, DOE's inability to obtain the permit sooner did not significantly affect program progress because DOE needed to complete certain tasks before it could begin to comprehensively implement its December 1988 site characterization plan.

First, DOE could not begin any new site investigations to obtain data for use in a repository-licensing proceeding until NRC had accepted the related quality assurance programs of DOE and its major contractors. If DOE had had the necessary state environmental permits, some new site investigation work could have begun in October 1990, when NRC either fully or partially accepted the programs of DOE's major contractors. The programs of OCRWM's headquarters and field offices were accepted for limited new work in March 1991. NRC accepted, without condition, all participants' quality assurance programs in January 1992.

Second, DOE was not ready to begin drilling certain deep boreholes extensively and extracting core samples from these boreholes because it first needed to finish developing technology for dry drilling. This drilling is expected to begin in the spring of 1992; however, other types of drilling, such as wet drilling in saturated rock, have already begun.

Third, DOE could not begin its underground testing program because it decided to redesign the exploratory studies facility in response to external comments on the original design of the facility. DOE does not expect to begin constructing the facility until November 1993; however, DOE attributes a part of this delay to fiscal year 1992 budget constraints.

Costs and Types of Site Characterization Activities Performed to Date

According to DOE, the agency has spent about $1 billion on the Yucca Mountain project through the end of fiscal year 1991 and expects to spend an additional $5.3 billion to complete its site characterization program. These amounts include grants and benefit payments to state and local governments of about $1 billion. From the beginning of fiscal year 1989, shortly before the site characterization plan was issued, until the end of fiscal year 1991, DOE spent about $523 million on the Yucca Mountain project. As table 2.1 shows, the largest cost categories, by far, were project

management and site investigations; these cost categories accounted for 27 and 24 percent, respectively, of total expenditures.

Table 2.1: Yucca Mountain Project Expenditures in Fiscal Years 1989-1991

Dollars in thousands

Category	Fiscal year 1989	1990	1991	Total	Percent of total
Project management	$ 46,001	$ 47,059	$49,133	**$142,193**	27
Site investigations	47,095	40,731	37,920	**125,746**	24
Regulatory/institutional	12,513	17,598	18,748	**48,859**	9
Systems	8,891	14,398	21,701	**44,990**	9
Exploratory shaft	17,966	12,419	13,441	**43,826**	8
Waste package	15,225	14,509	9,023	**38,757**	7
Financial and technical assistance	11,222	8,830	11,172	**31,224**	6
Repository	15,584	8,545	4,085	**28,214**	5
Field operations	0	4,734	4,408	**9,142**	2
Test facilities	1,656	1,126	1,416	**4,198**	1
Management & operating contract	0	0	5,337	**5,337**	1
Land acquisition	247	423	187	**857**	[a]
Total	**$176,400**	**$170,372**	**$176,571**	**$523,343**	**99**[b]

[a]Less than 1 percent.

[b]Does not add to 100 percent because of rounding.

Source: GAO analysis of DOE data.

Project management costs included all the costs needed to provide overall management of the Yucca Mountain project, including project control, quality assurance, and program integration. Administrative services, such as facility rents, telephone services, and records management, were also classified as project management costs. About 55 percent of project management costs were for task integration activities and administrative services; about 14 percent were for project control activities, such as operating and maintaining computerized cost and schedule data bases, collecting and reporting actual costs, and tracking financial performance; and about 30 percent were for developing and implementing a project quality assurance program.

The site investigations cost category includes all the costs of planning, conducting, and reporting site characterization and evaluation work. This

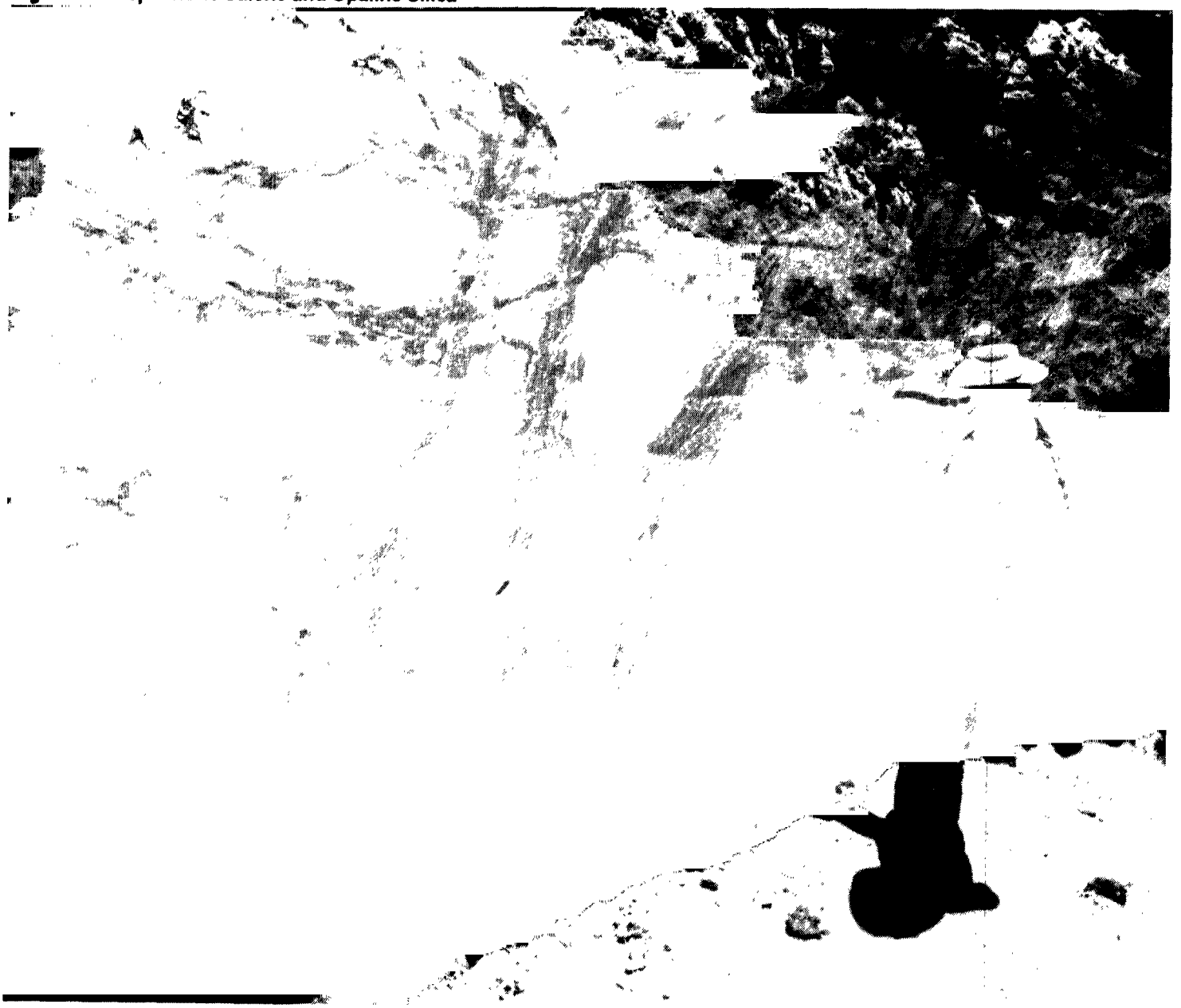
work includes ongoing activities, such as monitoring previously drilled wells, conducting seismic and meteorological monitoring, and monitoring for environmental studies. Another of the major site investigation activities under way is the development of detailed plans for the 106 studies that DOE needs to perform to determine whether the site is suitable for a repository. As of February 1992, DOE had written 67 study plans. Of these plans, 33 were under review within DOE. The other 34 plans had been submitted to NRC for its review, and NRC had accepted 19 of the 34 plans.

On July 8, 1991, DOE began the first new surface-disturbing site characterization work at Yucca Mountain since 1986. This work was dictated primarily by two of the completed study plans. The purpose of one study is to gather geologic data from Midway Valley, located east of Yucca Mountain, to evaluate the suitability of potential locations for surface facilities, such as the nuclear waste handling facility, and the potential for fault displacement on repository design. The data gathered will also be used in designing surface facilities.

In the second study, large, veinlike deposits of calcite and opaline silica, which occur in faults near the surface of Yucca Mountain, are to be investigated to (1) determine the source of the deposits (i.e., rain or ground water) and (2) the effects of hydrologic conditions and tectonics on the capability of the site to meet regulatory requirements.[1] (See fig. 2.1.) This study will help answer questions about whether the site was flooded from a rise in the underground water table years ago and, if so, whether such an event would be likely to recur. DOE considers this study important because if flooding were to occur, it could adversely affect the capability of the repository system to contain the radioactive waste.

[1]Tectonics is a branch of geology dealing with the broad architecture of the upper part of the earth's crust.

Figure 2.1: Deposits of Calcite and Opaline Silica



Source: DOE.

NRC Conditionally Accepts DOE's Quality Assurance Program in Early 1991

As a part of its draft (1981) and final (1983) repository-licensing regulations, NRC required that DOE develop and implement a quality assurance program intended to ensure the reliability for licensing of data obtained from studies and other activities. Hence, DOE could not begin site characterization activities that would directly support a future repository license application until it had developed, and NRC had accepted, a quality assurance program covering these activities. NRC unconditionally accepted the quality assurance programs of DOE and its contractors in January 1992. However, DOE could have begun some new investigations as early as October 1990 if Nevada had issued the three permits DOE had requested. In that month NRC accepted, either in part or without qualification, the quality assurance programs of six DOE contractors. The date when DOE could have begun new investigations has become important to DOE because it is using the delays in receiving permits from Nevada as justification for proposed legislation that would exclude Nevada from the permit process.

In March 1991 NRC accepted, for the purpose of work at Midway Valley and on the calcite-silica issue (Trench 14), the quality assurance programs of OCRWM and YMPO. DOE believes, however, that it had obtained sufficient NRC acceptance to begin gathering geologic data from Midway Valley and studying calcite and opaline silica deposits in Trench 14 as early as February 1990. However, because DOE did not receive environmental permits from Nevada until June 1991, it could not start this work until July 1991—a delay of 17 months. According to NRC officials, however, DOE could not have started this work until October 1990, when NRC accepted, either with or without exceptions, the quality assurance programs of six DOE contractors, or as late as January 31, 1991, when DOE certified that it had met NRC's conditions for accepting the quality assurance programs of DOE's OCRWM and YMPO organizations.

Also, because DOE placed little emphasis on quality assurance in the early years of the program, some of the information obtained from site drilling operations through early 1986 may not be directly usable for licensing and may therefore have to be reacquired during site characterization. To improve management of existing and future core samples, DOE constructed a new facility in 1989 for receiving, storing, and controlling core samples.

NRC Conditionally Accepts Quality Assurance Programs of DOE and DOE's Contractors

Licensing a repository for disposal of highly radioactive waste requires assessing whether the geologic setting and the engineered system will meet the performance objectives of NRC's regulations. Assessments required for licensing must provide reasonable assurance that long-term

disposal of the waste will not pose unreasonable risks to the health and safety of the public. Therefore, NRC requires that DOE and its contractors implement quality assurance programs to provide confidence in work performed in planning, designing, constructing, operating, and permanently closing a repository. NRC issued its initial quality assurance requirements in draft form in July 1981, or about 18 months before NWPA was enacted, and issued final requirements in 1983. Even before NWPA's enactment, NRC had responsibility for licensing and regulating DOE civilian high-level radioactive waste facilities under the Energy Reorganization Act of 1974.

NRC visited the Yucca Mountain site in September 1984 and began observing DOE's quality assurance audits of project contractors in 1985. DOE and NRC agreed, in 1985, that before DOE began key site investigations, it would obtain NRC's acceptance of its quality assurance program. Thereafter, however, DOE did not respond in a timely manner to quality assurance issues raised by NRC, apparently because DOE had assigned quality assurance a lower priority than developing the May 1986 environmental assessment report and the December 1988 site characterization plan.[2]

Without an accepted quality assurance program, DOE could not implement the site characterization plan. Therefore, after the plan was issued, DOE began to spend considerable time and resources on developing quality assurance programs at various organizational levels. For example, each principal project participant—OCRWM; YMPO; and project contractors, including USGS—had to develop written quality assurance plans and procedures and test the effectiveness of their programs before they could begin licensing-related work in their particular program area or areas. In its July 1989 comments on DOE's site characterization plan, NRC said that although DOE did not yet have an acceptable quality assurance program, the two agencies had agreed on a step-by-step approach to resolve this concern.

DOE believed that it had obtained sufficient NRC acceptance of the quality assurance programs of the contractors that would perform the work at Midway Valley and Trench 14—Sandia National Laboratory and USGS—by the end of 1989. DOE based this opinion on letters in which NRC discussed its observations of DOE's earlier audits of the contractors' quality assurance programs. In these letters, NRC staff stated that they agreed with DOE's

[2]See our report Nuclear Waste: Repository Work Should Not Proceed Until Quality Assurance Is Adequate (GAO/RCED-88-159, Sept. 29, 1988).

preliminary conclusion that the contractors' quality assurance programs had adequate controls in place to permit the contractors to continue Yucca Mountain project work.

DOE could not, however, begin work at the site until it had received an opinion from the U.S. Fish and Wildlife Service that site characterization activities were not likely to jeopardize the endangered desert tortoise. DOE received this opinion on February 9, 1990. Therefore, according to DOE, it could have begun work at Midway Valley and Trench 14 on that date if it had had the necessary environmental permits from Nevada.

NRC officials do not agree that DOE could have begun new work at Yucca Mountain as early as February 1990 because, in their view, licensing-related work could not begin until NRC had accepted the related quality assurance programs of all DOE offices and DOE contractors involved in this work. In September 1990 DOE requested NRC's acceptance of the quality assurance programs of six of its major contractors, including USGS and Sandia. In October NRC accepted the programs of Sandia and one other contractor, and it accepted the programs of USGS and the other three contractors on condition that certain observed deficiencies be corrected. At a December 1990 briefing for NRC's commissioners, the OCRWM Director stated that OCRWM's quality assurance program had been submitted to NRC for acceptance and that OCRWM was ready to begin trenching Midway Valley and investigating the calcite-silica formations.

On January 18, 1991, NRC conditionally accepted DOE's headquarters and project office quality assurance programs for new site characterization activities associated with the Midway Valley and calcite-silica studies. As a condition of acceptance, however, NRC stipulated that deficiencies identified in an earlier audit of the quality assurance program should be corrected before related work began. After being informed by DOE on January 31, 1991, that the deficiencies had been corrected, NRC said, on March 11, 1991, that OCRWM's quality assurance program was adequate for DOE to begin limited new site characterization work. DOE began work on these two studies in July 1991, after receiving an environmental permit from Nevada in June 1991. To conduct all the site investigations called for by DOE's site characterization plan that are subject to quality assurance requirements, DOE had to gain NRC's full acceptance of all program participants' quality assurance programs. DOE gained this acceptance in January 1992, and on March 2, 1992, NRC closed out its objection to DOE's site characterization plan related to quality assurance programs.

According to NRC officials, DOE could have begun the Midway Valley and Trench 14 studies as early as October 1990, when NRC either fully or conditionally accepted the quality assurance programs of six DOE contractors. They said, however, that the contractors could only initiate work related to the accepted portions of their quality assurance programs and that their work could be done only if OCRWM and YMPO did not become involved in coordinating this work. If either OCRWM or YMPO would have been involved in a way that required application of either DOE organization's quality assurance program, these officials said, then the work could not properly have begun until the end of January 1991, when NRC accepted their programs.

Deficiencies in Quality Assurance May Affect Usefulness of Early Data

Between 1977 and 1986, DOE spent about $48 million to extract about 38,000 feet of core samples at, or in the vicinity of, the Yucca Mountain site. Drilling and core extraction operations were the responsibility of several of DOE's Nevada Test Site contractors. The core samples were sent to a central facility, managed by USGS, where all core samples taken at the Nevada Test Site were stored. In April 1983 a DOE contractor reviewed the Yucca Mountain drilling and coring operations for DOE, using NRC's 1981 draft quality assurance requirements as guidance. The DOE contractor reported numerous deficiencies in the drilling contractors' quality assurance programs and recommended many corrective actions.

During its September 1984 visit to Yucca Mountain, NRC also found that USGS had not properly documented, or maintained documentation of, core samples obtained from boreholes near the site. In February 1986 DOE's review of USGS identified 22 significant findings, and, as a result, DOE issued a stop-work order that was in effect from April 1986 to December 1987.

Despite the shortcomings in contractors' quality assurance programs identified from 1983 through early 1986, drilling and coring operations continued until they were suspended in April 1986. According to the project office, about 2,600 feet of core samples were added to the core inventory during this period.

In June 1986 DOE established a core library steering committee to assess whether data from existing cores could be used to support a license application and/or whether new boreholes would have to be drilled under more stringent quality controls. In October 1986 the committee reported that although data from existing cores probably could, to some extent, be validated using a peer review procedure issued by NRC, there was a risk

that such data could later be found unacceptable for licensing purposes. Also, the committee said that, given the uncertainty over the ability to validate data from existing core samples, it would be imprudent to rely solely on the data base developed from existing core samples for a repository license application.

In the January 1988 draft site characterization plan, DOE indicated that it intended to use existing core samples to establish certain essential geologic information about the site. In May 1988, however, a DOE quality assurance audit team reporting on the results of an "exhaustive" effort to review the possible uses of core samples and related data from boreholes drilled from 1981 to 1983 concluded that there had been a projectwide failure to implement quality assurance requirements and to understand the role of the quality assurance program in licensing. The report also said that the project's first priority must be to develop a fully implemented and effective quality assurance program because high quality technical work must be supported by equally high quality assurance for the site to be licensed by NRC for a repository. Finally, the report recommended possible ways that DOE might be able to validate existing borehole cores and related data for use in a repository-licensing proceeding.

If presently unqualified core sample data cannot be qualified to NRC's satisfaction for use in a licensing proceeding, the costs and timeliness of the repository program could be adversely affected. For example, in 1988 USGS identified three investigations that would be affected by the loss of any of the basic data from certain existing boreholes considered essential for use during NRC licensing. One such investigation was the construction of a three-dimensional model of the Yucca Mountain site. According to USGS, about 5 years would be needed to reestablish the level of geologic knowledge developed from existing data if these data could not be used in licensing. An official in OCRWM's geologic disposal office told us that it may be possible to corroborate borehole data in this case and, if so, it would not be necessary to redo all prior work. He also told us that DOE generally intends to use existing borehole data for corroborative purposes. To the extent necessary for this use, he said, these data would be qualified using NRC's guidance.

DOE Develops New Facility for Core Samples

In February 1987 DOE requested that its technical and support services contractor plan, consolidate, and develop a new sample management facility. By July 1989 DOE had constructed the $1.5-million facility and had approved new core-handling procedures. DOE then lifted the suspension of

drilling and coring activities. By that time, however, DOE was unable to drill new boreholes because it lacked necessary environmental permits from Nevada and, as discussed earlier, had not yet received NRC's acceptance of its quality assurance program.

The new facility will be used to store and control both the 37,000 feet of core samples that DOE has already extracted at Yucca Mountain and the new samples, estimated at more than 100,000 feet, that will be required to characterize the site. According to a DOE official, existing core samples are being released to project participants for scoping studies under approved quality assurance operating procedures.

DOE Is Developing Technology for Drilling Critical Boreholes

Since 1989 DOE has been developing a technology for drilling deep boreholes and extracting core samples without the fluids typically used in conventional drilling methods. But without environmental permits from Nevada, DOE has not been able to develop and test the modified drilling technology at Yucca Mountain.[3] Instead, DOE has tested this technology in Utah and Arizona. Modified drilling technology is necessary for drilling boreholes into the unsaturated (essentially dry) rock beneath Yucca Mountain, which extends from the surface to at least 600 feet beneath the proposed repository level, because conventional drilling technologies would introduce fluids into this rock. Dry conditions need to be maintained for sample analysis purposes.

For many years Yucca Mountain project participants have discussed the acquisition of a dry-drilling system, and some dry-drilling tests were conducted. For example, in 1984 and 1985, two deep boreholes were drilled using a technology that did not require fluids; however, the two tests were unsuccessful in recovering usable core samples from the required depths.

In July 1988 DOE sponsored a workshop for affected project participants to discuss dry-drilling and coring problems. Since then DOE has spent about $6.6 million to develop and demonstrate dry-drilling and coring technology for use at Yucca Mountain. Because Nevada did not grant DOE the environmental permits it needed for surface-disturbing activities, DOE has had to develop the technology in Utah and Arizona. DOE has moved a dry-drilling rig to Yucca Mountain and plans to begin dry drilling sometime in the spring of 1992. As part of the site characterization program, DOE

[3]DOE requested that Nevada modify the air quality operating permit for the Nevada Test Site to authorize prototype testing activities. Nevada, however, did not act favorably on DOE's request because the state has enacted legislation prohibiting the storage of high-level nuclear waste in Nevada.

intends to drill boreholes and extract core samples as deep as 2,750 feet. DOE plans to purchase up to four dry-drilling rigs at a per-unit cost of about $6 million.

DOE plans to begin dry-drilling operations at Yucca Mountain with the first drill rig in April 1992 and begin using the other drill rigs as soon as each is built. If four rigs are used, dry-drilling operations are expected to last until mid-1997. This schedule assumes that 90 days will be required to drill each planned borehole. According to the Chief of the Yucca Mountain Project Office's Site Investigations Branch, this 3-month period represents DOE's best estimate of the necessary time but may understate the actual time that will be required. After drilling, about 2 years will be required for each borehole to stabilize before accurate measurements can be taken in each hole. If 2 years are needed for stabilization and 2 years for data collection, the Chief said, usable data from the last boreholes drilled are not likely to be available until about the middle of 2001—just months before DOE's October 2001 target date for submitting an application for a repository construction license to NRC.

According to other OCRWM officials, however, this time frame may not delay application for a license because data from the last holes may be used only to confirm the results of data already obtained. Furthermore, the officials said that the site characterization plan could be revised and the final boreholes not drilled. Alternatively, they said, if an assessment of the data suggests that a license application cannot be supported without additional data, then the license application will not be submitted until these data have been collected. In this case, additional boreholes might be needed.

DOE Is Redesigning the Exploratory Studies Facility

Before halting work in mid-1989, DOE had completed about 30 percent of its detailed design of the surface facilities needed for an exploratory studies facility that featured two vertical shafts extending more than 1,000 feet below the surface, subsurface testing areas, and tunnels providing access to specific geologic features of the proposed repository area. In 1989 and 1990, however, the Nuclear Waste Technical Review Board recommended that DOE adopt a different strategy for designing and constructing the facility. The strategy recommended by the Board included extensive tunneling in the rock formation called Calico Hills. The choice of tunneling procedures for this formation is important because the formation is the major barrier to the movement of certain radionuclides from the repository area to the water table below. DOE had been

considering penetrating the Calico Hills with the exploratory studies facility but had agreed with NRC that it would not commit itself to such action until a satisfactory approach could be devised to protect the integrity of this barrier. In September 1991 the OCRWM Director, on the basis of a task force evaluation of various alternatives, adopted a new exploratory studies facility design and construction method.

Although DOE spent over $36 million in fiscal years 1988 and 1989 to prepare the original facility design, it is now redoing much of the original design work. Moreover, after deciding to redesign the facility, DOE postponed the expected start of construction by about 3 years, from November 1989 to November 1992. According to the OCRWM Director, the date for starting construction of the facility was subsequently further postponed to November 1993 because of budget constraints imposed by the Congress for fiscal year 1992.

Early Development of Design and Construction Method

In the early 1980's, DOE assigned its project contractors, who were also contractors at the Nevada Test Site, to design an exploratory studies facility and select a construction method from among the methods in use at the Nevada Test Site. The original conceptual design called for a single vertical shaft and a main test facility near the bottom of the shaft. By the end of 1984, however, a second shaft had been added to the design. In 1984 one of DOE's contractors had proposed that the facility have one vertical shaft and a ramp (inclined tunnel), but DOE rejected that approach because it wanted the basic facility design to be the same at each of the three candidate repository sites that would eventually be selected for characterization. In addition, DOE was concerned that a ramp might give the appearance that construction of a repository had begun. As discussed below, DOE currently plans to build two ramps and possibly one shaft.

The excavation method that DOE selected for the facility, called "drill and blast," was routinely used by DOE's mining contractors at the Nevada Test Site. With this method, holes are drilled for explosives and, after blasting, the rubble is removed. Initially, NRC was concerned that this method could preclude recovering information needed to characterize the site. Later, however, NRC informed DOE that it had no objection to the use of this method if the shafts were properly constructed and met the regulatory agency's standards for quality assurance.

In response to NRC's and Nevada's comments on the May 1986 environmental assessment report, DOE changed the design of the

exploratory studies facility by (1) relocating shaft surface openings, (2) relocating the main test level to the repository level and expanding the size of the testing area, (3) adding about 5,600 feet of tunnels to better investigate known faults and other geologic structures, and (4) expanding the diameter of the second shaft.

DOE Changes Exploratory Facility Design and Construction Method

In August 1989 the Nuclear Waste Technical Review Board recommended that DOE use a mechanical, rather than the drill and blast, method of excavating shafts and tunnels for the exploratory studies facility. Because the mechanical mining approach would reduce disturbance to the rock walls of the shafts, the Board said, the quality of the data obtained would be improved. The Board also said that this approach would shorten the time required to construct the exploratory facility.

The Board further recommended that DOE replace one of the shafts with a ramp to the proposed underground tunneling and testing levels. The Board believed that the ramp would cross a number of known faults, intersect most of the rock formations that had to be studied, and allow for additional excavations, if needed, at any point along the ramp. Finally, the Board recommended that DOE drill and tunnel into the Calico Hills barrier between the proposed repository and the underground water table.

In commenting on DOE's December 1988 site characterization plan, NRC and Nevada had also raised concerns about the exploratory studies facility. As a result of the Board's recommendations and these other concerns, DOE decided to reassess the design and construction method for the facility. Because of this decision, DOE pushed back the schedule for constructing the facility from November 1989 to November 1992 and established two task forces to reevaluate the design of the facility and study possible approaches to exploring Calico Hills.

In accordance with its January 1990 study plan, a DOE task force on exploratory facility alternatives evaluated the relative merits of various shaft and ramp configurations and construction methods. In parallel with that study, the other task force analyzed the trade-offs between the need to acquire data from Calico Hills and the need to preserve the integrity of this barrier so as to prevent radioactive materials from migrating to the underlying water table. The work of the latter task force was reported in January 1991 and integrated with the study of alternative approaches to the exploratory facility.

In its final report of June 1991, the task force studying exploratory facility alternatives ranked highest the alternative calling for two ramps to be mined from the surface to the proposed repository area using, as recommended by the Board, mechanical mining methods. Under this alternative, both ramps would be extended from the repository level down into Calico Hills, and about 20,000 feet of tunnel would be constructed in the repository area and a similar length of tunnel in Calico Hills. The cost of this alternative is roughly estimated at about $800 million, excluding the cost of tests conducted in the ramps and tunnels. A previous DOE estimate of the cost of constructing the original exploratory shaft facility, including underground testing, was about $400 million. DOE decided on the new facility design in September 1991. Portions of the earlier design, such as plans for access roads and surface facilities, will be used in the new design.

In carrying out the above studies, DOE held numerous meetings with NRC and the Board. Also, DOE submitted the Calico Hills task force study to NRC for its consideration and planned to do the same with the task force study on exploratory studies facility alternatives as a part of its effort to obtain NRC's acceptance of DOE's design control process.

Conclusions

After many delays, DOE has begun limited work on the surface-based portion of its December 1988 site characterization plan and expects to begin work on the portion of the plan dealing with underground tests in the exploratory studies facility in late 1993. Although DOE was delayed somewhat by not having environmental permits from Nevada until June 1991, it was not ready to fully implement its site characterization plan in 1989 as intended because it did not have an NRC-accepted quality assurance program, had not developed modified dry-drilling technology necessary for drilling critical boreholes into the unsaturated zone beneath Yucca Mountain, and had decided to redesign its exploratory studies facility. NRC has now fully accepted DOE's quality assurance program and enough study plans so that DOE is free to proceed in earnest with its surface-based site characterization activities, including dry drilling, beginning in April 1992. Although the need for an acceptable quality assurance program and dry-drilling technology was recognized early, DOE did not emphasize these activities but instead gave higher priority to developing its environmental assessment report and site characterization plan. Also, data obtained from boreholes drilled at the site through early 1986, which were not obtained under an acceptable quality assurance program, may not be directly usable in licensing unless DOE can "qualify"

the data to NRC's satisfaction, using a procedure issued by the regulatory agency for this purpose. Obtaining new data could take up to 5 years and add substantially to program costs.

The configuration of the alternative exploratory studies facility selected by DOE differs substantially from that contemplated under the earlier design. Therefore, the original facility design, on which DOE spent more than $36 million (primarily to design the facility's surface structures), may not be usable for the new facility configuration. Also, the alternative selected will require considerably more tunneling and a revised construction method. The new facility will cost at least twice as much as the facility that was originally contemplated. Furthermore, although DOE was able to initiate some surface-based tests to begin implementing its site characterization plan, it has had to delay starting the construction of the exploratory facility from November 1989 to November 1993. In large part this delay was necessary for DOE to address the concerns raised by NRC, the state of Nevada, the Nuclear Waste Technical Review Board, and others about the facility originally planned.

Agency Comments and Our Evaluation

In commenting on a draft of our report, DOE stated that its ability to perform surface-disturbing work at Yucca Mountain was not dependent upon NRC's acceptance of OCRWM's quality assurance program. According to DOE, site characterization work on the calcite-silica studies (Trench 14) and trenching in Midway Valley could have begun as early as February 9, 1990—when the U.S. Fish and Wildlife Service issued its biological opinion related to the endangered desert tortoise—if DOE had received the necessary permits from Nevada by then. DOE's position was based on NRC's concurrence, expressed in a letter in 1989, that Sandia and USGS had adequate controls in place to continue work on the project and NRC's acceptance of the study plans prepared by these two project contractors for this work. NRC, however, commented that it did not accept the quality assurance programs of six DOE contractors (including Sandia and USGS), either with or without exceptions, until October 1990. We revised our report to reflect the comments of both agencies.

DOE suggested that we indicate that its original approaches to site characterization were satisfactory but that, through the review and oversight process, even better approaches were identified and adopted. DOE's comment, for the most part, addresses our discussion of the exploratory studies facility, including the history of the facility's design and more recent external comments on that design. We did not change our

report in response to these DOE comments because we believe our draft report accurately reflected the evolution of the facility's design, the external comments that DOE received on the design, and the fact that some of the design work for surface facilities in the original design of the exploratory studies facility will not be used in the new facility design.

DOE Has Not Yet Developed a Method for Early Identification of Disqualifying Conditions

DOE has made little progress in implementing the policy announced by the Secretary of Energy in November 1989 to focus near-term investigations on surface-based tests to identify potential unsuitable site conditions. To implement this policy, DOE began an effort in late 1989 to rank site investigation tests and to develop a method for use in judging site suitability. This effort focused primarily on potential adverse site conditions identified in NRC's regulations as criteria for ranking tests for determining site suitability. In October 1990, however, DOE decided to use its own siting guidelines to judge site suitability, and a task force made up of DOE contractors began developing a method to do this. DOE's siting guidelines, as required by NWPA, specify qualifying and disqualifying conditions that a site must meet to be judged suitable for hosting a waste repository. A contractor's report evaluating the site using the method developed was issued in February 1992, and, after considering public comments, DOE will decide whether to adopt the method and findings.

DOE's effort to rank tests continued to focus on NRC's regulations, and in March 1991 a task force report ranking broad issues was issued. DOE has decided not to continue with the second phase of this effort—to rank individual tests—but rather will develop a new ranking method for this purpose. In our view, DOE's initial ranking method would not produce a testing sequence that would be compatible with the site evaluation method being developed. The initial ranking method focused on NRC's regulations and, therefore, would not necessarily result in DOE's assigning the highest priority to tests needed to determine the existence or absence of the qualifying and disqualifying conditions specified in DOE's siting guidelines.

Although the public questioned how the early identification of potential disqualifying conditions would be achieved under DOE's site characterization plan, DOE did not obtain public comment on the proposed approaches for establishing testing priorities and evaluating site suitability. The DOE task forces developing the test-ranking and site evaluation methods have since held public briefings on their progress. Also, DOE will consider the public comments on the site evaluation method that the task force has developed and used to evaluate site suitability before adopting the task force report. This consideration, however, will take place more than 2 years after DOE began developing a method for the early evaluation of site suitability.

DOE Is Planning How to Proceed With Site Characterization

DOE had not planned to assess the suitability of Yucca Mountain until site characterization had nearly been completed. In commenting on DOE's December 1988 plan for site characterization, NRC, Nevada, and others said that early identification of potential disqualifying conditions and periodic assessments of site suitability were needed. In November 1989 the Secretary of Energy stated that the initial stage of site characterization would focus on surface-based testing as part of a new emphasis on the early evaluation of site suitability. To this end, DOE began to develop a method for making early, periodic evaluations of site suitability and to assign priorities to surface-based tests. The evaluation initiative includes an initial report, issued in early 1992, which sets forth the task force's evaluation methodology and site suitability determination. This determination, which is based on existing data, shows how the site measures up to each of the agency's siting guidelines. DOE expects to decide whether to adopt the task force's site evaluation methodology and site suitability determination sometime in the third quarter of 1992. The initiative to prioritize tests was expanded to include all underground tests but was at first suspended and later abandoned after a report was issued in March 1991 on the first phase of the effort.

Secretary Says DOE Will Address Concerns of Others

Several reviewers of DOE's site characterization plans stated that although the plans identified the studies that were needed to evaluate the site, the plan did not adequately define the sequence of studies or indicate how DOE would periodically determine from available information whether the site was suitable or not. For example, NRC stated that although many individual segments of the characterization program were of high quality, the means by which they were to be incorporated into a coordinated and integrated program was unclear. To help alleviate this concern, NRC said, total system performance assessments—assessments of how well the site, repository design, and waste package would isolate wastes—needed to be conducted early and periodically to integrate data-gathering activities. DOE's plan did not call for such an assessment until site characterization had nearly been completed.

NRC also said that performance assessments were needed to provide an early and ongoing evaluation of whether (1) any potentially adverse conditions, as defined in NRC's regulations, significantly affected the site's ability to meet the performance objectives contained in the regulations and (2) the data being gathered would be adequate to make this determination. In the same vein, Nevada, the Nuclear Waste Technical Review Board, the Edison Electric Institute, and others have taken the

position that DOE should organize and sequence its site characterization program around the early identification of any conditions that would disqualify the site for use as a repository. Nevada, for example, commented that DOE should not construct the exploratory studies facility until it has completed a surface-based testing program to establish the presence or absence of conditions that, according to DOE's siting guidelines, would disqualify a site for use as a repository.

In his November 1989 report, the Secretary of Energy stated that DOE's new emphasis on early evaluations of site suitability would initially focus on site features that could be investigated through surface-based testing. According to the Secretary, performing some of the planned surface-based testing in advance of constructing the exploratory studies facility would help ensure that the site investigation would be scientifically based, technically sound, and cost-effective. The Secretary's report said that the early surface-based testing program would begin in January 1991 and construction of the exploratory facility would be delayed until November 1992. Thus, DOE allowed itself about 2 years for surface-based testing and analysis of the test results before beginning construction of the exploratory studies facility.

DOE's First Initiative to Prioritize Tests and Identify Disqualifying Conditions Redirected

DOE's first initiative to carry out the Secretary's plan to perform an early search for unsuitable conditions began in late 1989. At that time, DOE established the Surface-Based Testing Prioritization Task Force to (1) develop a method to use in making early, periodic evaluations of the Yucca Mountain site for a repository and (2) prioritize surface-based tests to ensure that disqualifying conditions, if present, would be identified and studied early. The guidelines that DOE established for carrying out this assignment instructed the task force to use the performance-based standards contained in NRC's regulations as criteria. The assignment guidelines did not mention DOE's repository-siting guidelines.

Although the NRC regulations and DOE siting guidelines are compatible, the DOE siting guidelines, as required by NWPA, specify site qualifying and disqualifying conditions that are to be used in determining site suitability, whereas the NRC regulations do not specify such conditions. Under DOE's siting guidelines, a site shall be disqualified at any time during site screening, selection, and characterization if the evidence supports a finding that any 1 of 18 disqualifying conditions (conditions that, if present, would automatically disqualify a site) exist or any 1 of 24

qualifying conditions (conditions that must be present at a site) do not exist at the site.

According to a DOE official supervising the task force, DOE was then of the opinion that because the 1987 amendments to NWPA limited site characterization to Yucca Mountain, the repository siting guidelines were moot and, therefore, DOE should concentrate site characterization on NRC's repository-licensing regulations. This view, however, was not shared by all DOE officials. For example, in January 1990 the former Associate Director for Systems Integration and Regulations, OCRWM, transmitted a staff report to various DOE officials recommending that the siting guidelines be used in determining the suitability of Yucca Mountain. The former Associate Director said that the report's recommendation was based on discussions that took place at several meetings during the preceding year concerning the continued applicability of the siting guidelines in light of the December 1987 amendments to NWPA. Although the issue continued to be debated until October 1990, when the OCRWM Director publicly announced that the guidelines would apply, OCRWM did not request a legal opinion from DOE's General Counsel.[1]

Some confusion about the applicability of the guidelines continued. For example, in one case an OCRWM official told us that, according to a DOE attorney, the agency did not need to adhere strictly to the guidelines if, in deviating from the guidelines, the agency's decision was not "arbitrary or capricious." In another case an OCRWM official, in a July 1991 meeting of the Nuclear Waste Technical Review Board, said that DOE's Office of the General Counsel was reviewing the applicability of the guidelines. The DOE attorney responsible for the nuclear waste program, however, told us that the agency had to abide strictly by the guidelines and that his office was not reviewing the applicability of the guidelines.

In October 1990 DOE revised the assignment objectives of the task force. First, the objective of ranking surface-based tests was expanded to include all planned tests, including those to be performed in the exploratory studies facility. Second, the work was split into two phases. During the first phase, the task force would rank broad site suitability issues, rather than individual tests, because many tests might be necessary to address one issue. In part, the issues to be ranked were derived from the potentially adverse conditions specified in NRC's regulations. In addition, DOE decided to consider certain disqualifying conditions contained in its

[1]For a further discussion of this matter, see Nuclear Waste: Quarterly Report as of March 31, 1990 (GAO/RCED-91-55, Feb. 15, 1991).

siting guidelines. During the second phase, the task force would rank the individual tests that would be done to address the broader issues. Finally, the task force was renamed the Test Prioritization Task Force, and the task of developing a methodology to use in evaluating the site's suitability was assigned to a new task force called the Early Site Suitability Evaluation Task Force.

The Test Prioritization Task Force issued a report on the first phase of its assignment in March 1991. According to this report, the task force's analysis was to determine which issues had the greatest potential for rendering the site unsuitable for a repository with respect to possible radionuclide releases to the environment over the 10,000-year period following closure of the repository. On this basis, the analysis was not to include preclosure, or repository operations, issues. In addition, the task force was to determine which tests were most likely to accurately detect any postclosure issues that might be present at the site. In making its analysis, the task force screened and consolidated more than 100 potential concerns, or issues, into 32 potential concerns.

The task force then ranked the 32 potential concerns in order of importance. "Importance" was determined through expert estimation of the probability of a potential concern's presence at the site and, if present, of its expected impact on waste isolation. Three of the 32 potential concerns were ranked as high priority, 11 as medium priority, and the remaining 18 as low priority. In its report, the task force said that the potential concerns ranked in the low priority group were unlikely to affect waste isolation and, therefore, the task force did not determine which tests would accurately detect these potential concerns.

According to DOE officials, the second phase of the Test Prioritization Task Force's effort—the ranking of individual tests—was at first suspended and later abandoned. Thus, at this time, DOE has ranked 32 concerns, each of which pertains to one or more sections of NRC's regulations and/or DOE's siting guidelines. DOE officials told us in March 1992 that a new effort was recently initiated to rank tests and that a ranking methodology should be developed by September 1992. In response to our asking how DOE is deciding what work should be done in the meantime, the officials said that there is a general consensus that the work currently being done is of the highest priority. Moreover, they said that because of current budget limitations, not much on-site work is taking place now nor is much planned for the next year and a half.

Early Evaluation of Site Suitability to Be Done on a Formal Basis

The task force established in January 1991, called the Early Site Suitability Evaluation Task Force and made up entirely of DOE contractor and USGS personnel, was to develop a methodology for making early and periodic evaluations of site suitability. This initiative addresses a concern that we and others have long raised. For example, in November 1987 we pointed out that DOE's plans for characterizing sites at that time did not specify key decision points at which DOE would formally consider the need for early identification, examination, and resolution of potential disqualifying conditions.[2] The objectives of the task force's assignment are to

- develop an approach within the framework of DOE's siting guidelines for evaluating site suitability during site characterization and
- provide a guideline-by-guideline evaluation of the suitability of Yucca Mountain, on the basis of available data, focusing on disqualifying and qualifying conditions.

The task force categorized the 24 technical guidelines contained in DOE's siting guidelines into four groups: postclosure performance of the repository; preclosure radiological safety; ease and cost of siting, construction operation, and closure; and environmental, socioeconomic, and transportation impacts. Each of the 24 technical guidelines specifies a qualifying condition, and 18 of these guidelines also specify a disqualifying condition. For each qualifying and disqualifying condition, the task force determined whether sufficient information is available to determine whether the site can or cannot meet the specified condition or whether more information is needed. The guidelines also specify "favorable" and "potentially adverse" conditions that are based on NRC's repository regulations. According to DOE's siting guidelines, however, the latter two types of conditions were intended to be used primarily during the screening phase of searching for candidate sites rather than in determining the suitability of a site.

The proposed methodology for the early site-suitability evaluation was developed in the spring of 1991, and a task force report on evaluation results was completed in January 1992. This report, for the first time since the environmental assessment report was issued in 1986, pulls together and formally assesses the site evaluation data developed to date. A 14-member peer review panel, which the task force briefed in August 1991, reviewed and commented on the results of the evaluation contained in a draft of the task force report. DOE released the report, along with the peer

[2]Nuclear Waste: Quarterly Report on DOE's Nuclear Waste Program as of September 30, 1987 (GAO/RCED-88-56FS, Nov. 1987).

review panel's comments, for public review and comment on February 21, 1992, and requested responses by June 15, 1992. After considering the comments obtained, DOE will officially determine whether the evaluation methodology should be adopted and whether the site should, on the basis of comparisons between available data and DOE's siting guidelines, be considered unsuitable for a repository. DOE's determination is expected to be made in the third quarter of 1992.

Although the task force's objective was to develop a site evaluation approach within the framework of DOE's siting guidelines, which have the full effect and force of law, the approach being developed has not been reviewed by DOE's Office of the General Counsel for legal sufficiency. As the task force leader indicated in the July 1991 meeting of the Nuclear Waste Technical Review Board, the task force has sometimes had to interpret the guidelines to implement them. For example, when asked how the task force had defined the word "likely" in deciding whether a condition was or was not likely to be present at the site, the leader said that the term had been defined in terms of probability (that is, for example, there was a 1 in 10 chance that a condition was or was not present).

Because DOE has not obtained a legal opinion concerning the legal sufficiency of the task force's approach and of its interpretations, DOE has little assurance that it is adequately prepared to withstand a possible court challenge. If DOE's implementation of the guidelines is successfully challenged by Nevada or some other entity sometime after DOE issues its official report in 1992, DOE will have lost a substantial amount of time and money. To provide support for the task force's determinations and interpretations, DOE could, before officially adopting the task force's methodology, submit it to DOE's Office of the General Counsel for review and revise it as necessary to meet applicable requirements.

Site Suitability and Prioritization Initiatives Appear Inconsistent

The methodology for ranking site suitability issues developed by the Test Prioritization Task Force does not appear consistent with DOE's current effort to develop a methodology for evaluating site suitability in accordance with DOE's siting guidelines. For example, because DOE used a 10,000-year containment standard as its basic criterion for ranking issues, DOE (1) gave relatively low priority to the potential concerns that include the postclosure disqualifying conditions in its siting guidelines; (2) did not address the qualifying conditions that, according to the siting guidelines, a site must meet to be found suitable for a repository; and (3) did not

include in its initiative the preclosure qualifying and disqualifying conditions specified in the guidelines.[3] Consequently, the application of the prioritization methodology would not necessarily lead to the performance, early in site characterization, of tests required by the siting guidelines to determine site suitability.

DOE Assigned Lowest Priority to Disqualifying Conditions

In a December 1990 presentation to NRC, the OCRWM Director reiterated the Secretary's earlier position that DOE's initial investigations of Yucca Mountain would concentrate on the site features and conditions that could be investigated through surface-based testing and that might provide early evidence of disqualifying conditions. Evaluations, the Director said, would focus on the characteristics, features, and conditions of the natural barriers and on definitive identification of potential disqualifying conditions at the site as early as possible. The Director cited DOE's hope that independent, external review of the methods and criteria to be used, the priorities for the tests to be carried out, and the analyses and evaluations to be performed would create the public confidence that was essential to DOE's credibility.

Shortly after establishing the first task force to prioritize tests and develop a site suitability evaluation method, however, DOE, as discussed earlier, instructed the task force to use the performance-based standards contained in NRC's regulations as criteria for ranking tasks. NRC's regulations do not contain qualifying and disqualifying conditions. Because NRC's regulations are largely based on the requirement that radioactive materials above specified limits may not be released from a repository to the accessible environment for 10,000 years, the task force adopted this standard as its measure for determining the relative importance of site characterization tests. When its objectives were revised in October 1990, the Test Prioritization Task Force did not assign high priority to potential concerns that included the preclosure and postclosure disqualifying and qualifying conditions in DOE's siting guidelines that the new task force for evaluating site suitability was to use in developing its methodology. Instead, the prioritization task force continued to assess priorities on the basis of the principle underlying NRC's regulations: namely, the perceived importance of the potential concerns to waste isolation over the 10,000-year period.

[3]The 10,000-year containment standard was established by the Environmental Protection Agency and incorporated into NRC's regulations and DOE's siting guidelines.

The prioritization task force consolidated NRC's regulations and DOE's siting guidelines into the 32 potential concerns about the postclosure performance of a repository site only. However, the task force did not include any of the six postclosure disqualifying conditions contained in DOE's siting guidelines among the highest-priority concerns. One of the six disqualifying conditions, "loss of waste isolation is likely because of active dissolution of the host rock," was not included among the 32 concerns because this guideline was designed for sites consisting of salt or other minerals that could be dissolved and Yucca Mountain was not made of salt. However, as a DOE consultant pointed out at the July 1991 meeting of the Nuclear Waste Technical Review Board, even though the requirement was initially adopted for salt sites, DOE still needed to demonstrate that dissolution was not a problem at Yucca Mountain. Of the other five disqualifying conditions, one was ranked as medium priority and the remaining four were ranked as low priority. The five conditions are as follows:

- Geohydrology. The site shall be disqualified if the prewaste emplacement groundwater travel time from the disturbed zone to the accessible environment is expected to be less than 1,000 years along any pathway of likely and significant radionuclide travel. The task force considered this condition the fifth most important of the 32 potential concerns.
- Natural resources. The site shall be disqualified if ongoing or likely future efforts to recover valuable mineral resources outside the controlled area would be expected to lead to inadvertent loss of waste isolation. This condition was considered the 17th most important potential concern.
- Tectonics. The site shall be disqualified if the nature and rates of fault movement or other ground motion are expected to be such that a loss of waste isolation is likely to occur. This condition was considered the 19th most important concern.
- Natural resources. The site shall be disqualified if previous exploration, mining, or extraction activities for commercially important resources have created significant pathways between the projected underground facility and the accessible environment. This condition was considered 24th in importance.
- Erosion. The site shall be disqualified if site conditions do not allow all portions of the underground facility to be situated at least 200 meters below the directly overlying ground's surface. This condition was considered the 32nd, or least important, potential concern.

In addition, as discussed earlier, DOE will not pursue the second phase of the prioritization effort to rank individual tests. Instead, DOE plans to

develop a new approach to ranking tests, which, according to DOE officials, will be used as an "integration test evaluation tool." The officials said that they plan to develop the approach sometime later this year. Thus, more than 2 years after the Secretary's announcement on this issue, DOE still has not assigned priorities to individual surface-based tests that, if completed, might help to determine the presence or absence of disqualifying conditions at Yucca Mountain.

The low priority assigned to potential concerns that include disqualifying conditions, the exclusion of preclosure disqualifying conditions and all qualifying conditions, and the continuing delay in ranking individual site characterization tests raise questions about how DOE will use surface-based testing over the next few years in determining the presence or absence of conditions that would disqualify the site. For example, DOE's initial and periodic evaluations of site suitability will compare available data to DOE's siting guidelines to determine, for each of the siting guidelines, either (1) that the site does or does not meet the requirements of the guideline or (2) that the data are insufficient to decide whether the site meets the requirements of the guideline. However, because DOE's initial approach to ranking potential concerns and related tests resulted in DOE's assigning relatively low priority to the disqualifying conditions, the tests necessary to determine the existence of disqualifying conditions would be done later rather than earlier in site characterization under this approach.

DOE Did Not Obtain Timely Public Comments on Approaches to Ranking Tests and Evaluating the Site

According to DOE policy, effective participation of affected and interested parties is essential to the success of the nuclear waste program. DOE, however, did not afford the state of Nevada or other affected and interested parties an opportunity to review and comment on the approach taken to assign priorities to surface-based tests and make periodic evaluations of site suitability. In contrast, DOE has, through public workshops, enabled the public to participate in the development of a set of principles that DOE plans to adopt governing program planning, decision-making, and implementation.

According to a DOE official, DOE originally intended to develop and publicly release the proposed methodology for early evaluations of site-suitability. Now, however, DOE has released the methodology as a part of the site evaluation task force's report presenting the results of the task force's initial determination as to whether unsuitable conditions are present at the site. According to this official, considerable discussion has taken place

within DOE about how and when to obtain public comments on matters such as the site suitability method and findings. The DOE official said that the policy of obtaining public comments before making decisions had been adopted after the two task forces were established. Also, the official said, it was not always clear how to go about getting public comment, particularly when a decision involved complex technical issues.

Although DOE adopted the policy of obtaining early public comment after the task forces were established, the Congress, DOE, and others have long recognized the need to get affected and interested parties involved in the program. For example, the Congress, in passing NWPA, found that state and public involvement in the program was essential to promote public confidence. In February 1987 we reported that DOE needed to increase its efforts to involve states and Indian tribes to improve the program's credibility.[4] DOE concurred unreservedly with our recommendation to increase its efforts and agreed to implement the specific recommendations we made to accomplish this.

Comments we obtained from Nevada on DOE's early site suitability methodology illustrate that DOE may not have effectively communicated its intentions to affected and interested parties. In response to our asking whether Nevada was satisfied with DOE's new approach to site characterization, in May 1991 the Executive Director of the state's Agency for Nuclear Projects stated, among other things, that, on the basis of his understanding of DOE's approach, it appeared that DOE did not intend to make a straightforward determination of whether the site was disqualified. Instead, he said, it appeared that DOE intended to continue collecting data from the site and engineering trade-offs until it thought that it could produce an assessment of the total performance of a repository at the site that would be convincing to NRC.

The Executive Director was especially critical of what he said was DOE's intention to develop a site-specific "interpretation" of the siting guidelines for use in the methodology even though some of the disqualifying conditions were "exacting and clear." According to the Executive Director, Nevada continues to believe that the site should be disqualified on the basis of what is known about site conditions from existing data. He said that Nevada's primary safety and environmental concern is that the regional and site geology and hydrology are too complex to permit

[4]Nuclear Waste: Institutional Relations Under the Nuclear Waste Policy Act of 1982 (GAO/RCED-87-14, Feb. 9, 1987).

adequate demonstration of site suitability, given current scientific knowledge.

DOE officials did not agree with the state's conclusions. They said that on the basis of the minimal data available, it is too early to say that the site's geology and hydrology are too complex to demonstrate site suitability.

DOE Is Developing Strategic Principles to Guide Nuclear Waste Program

To encourage public participation in decision-making and build public trust in the nuclear waste program, DOE announced in November 1990 that it would adopt a set of strategic principles to govern program planning, decision-making, and implementation. These principles were developed and published in a draft mission plan amendment issued for public comment in September 1991.

The strategic principles are designed to allow rational, goal-oriented decisions while giving affected and interested parties opportunities to participate meaningfully in the decision-making process. These parties include the public and private segments of society that have an interest in the safe and reliable completion of the nuclear waste program.

DOE has proposed 22 strategic principles to guide the management, technical, and institutional (e.g., DOE relationships with state and local governments) aspects of the program. The following are three of the proposed principles:

- Consider public trust and confidence in program decisions. In making management, technical, and institutional decisions, recognize the importance of public concerns and the potential for building public trust and confidence.
- Assign equal importance to institutional and technical activities. Institutional challenges are as difficult as technical ones, and their importance must be recognized in program plans, activities, and resource allocations.
- Allow affected governments and interested parties to be involved in decision-making. The views of affected and interested parties are essential to decision-making and will be actively solicited.

According to DOE, workshop participants generally agreed that DOE should emphasize affected-government and interested-party participation in framing policy options early in decision-making, not just in reviewing completed drafts. Among the workshop objectives discussed as a means of

building public confidence was "dispel[ing] DOE's image of decide-announce-defend, lack of openness, and lack of external involvement." However, on the basis of past experience, workshop participants were concerned that DOE would not adequately implement the strategic principles adopted. For example, one participant indicated that DOE had not fulfilled a 1984 commitment arising from similar meetings with states and Indian tribes to involve affected governments early enough to make meaningful contributions to decisions.

Budget Changes May Affect DOE's Near-Term Site Characterization Program

Since November 1989 DOE's policy has been to focus initial site characterization activities on surface-based tests and defer construction of the exploratory studies facility until November 1992. At the July 1991 meeting of the Nuclear Waste Technical Review Board, however, the OCRWM Director said that some changes in the characterization program might be needed to meet DOE's objective of beginning to accept waste in 1998. The Director said that DOE's emphasis on this objective might require the reallocation of funds from site investigations to the transportation and the monitored retrievable storage facility programs.

After the July 1991 meeting, the Congress appropriated about $275 million for the nuclear waste program for fiscal year 1992, or about $30 million less than the Administration had requested. This lower amount and the possible changes in program priorities that the OCRWM Director spoke of in July could have a significant effect on the site characterization program. In late August 1991, however, DOE officials told us that DOE had reconsidered the planned emphasis on transportation and the monitored retrievable storage facility and that top program-budget priority would be given to early surface-based testing to achieve tangible program progress. The DOE officials also said that, in view of the lower-than-requested appropriation for fiscal year 1992, the assignment of top budget priority to early surface-based tests would make it necessary to defer construction of the exploratory studies facility until November 1993.

Conclusions

DOE has yet to implement the Secretary of Energy's November 1989 initiative to prioritize surface-based tests to permit the early identification of conditions at Yucca Mountain that would make the site unsuitable for a repository. DOE has abandoned the method for assigning priorities that it was developing, and it is not clear at this time how priorities will be assigned to the specific tests that must be performed to carry out the Secretary's initiative. Furthermore, the method would, if completed as

envisioned, defer the tests necessary to determine the presence or absence of disqualifying conditions at the site.

Although DOE has briefed interested parties on its efforts to prioritize site characterization work and develop a method for early evaluations of site suitability, it did not seek comment from Nevada or other affected and interested parties on the appropriate scope and methodology for these initiatives. If it had done so, questions—such as the role that the disqualifying and qualifying conditions contained in DOE's regulations should play in assigning test priorities—could have been raised, discussed, and resolved before the detailed work of assigning priorities began in 1989.

Besides DOE's efforts to develop methods for ranking tests and evaluating site suitability, factors such as Nevada's issuance of environmental permits, the budget for the nuclear waste program, and the allocation of available funds among competing program priorities will influence how DOE proceeds with site characterization. In view of (1) the uncertainties about how DOE plans to prioritize site characterization tests, (2) the issuance of the initial report on the early evaluation of the site, and (3) questions about program spending priorities, DOE could build public confidence in its program by clearly stating, and obtaining and considering public comments on, how it intends to investigate the site over the next few years.

Also, to help avoid future program delays, DOE needs to ensure that its siting guidelines, which have the full effect and force of law, are implemented in a way that may assist DOE in avoiding, or possibly withstanding, a legal challenge. To promote this end, DOE could have its Office of the General Counsel review the legal sufficiency of, and concur in, the proposed method for determining site suitability before DOE officially adopts it.

Recommendations to the Secretary of Energy

To help DOE build public trust in its civilian nuclear waste management program through the dissemination of information, the Secretary of Energy should, in addition to obtaining comments from the public, NRC, and others on DOE's methodology for evaluating Yucca Mountain, obtain comments on DOE's proposed approach for site characterization, including its plans for (1) prioritizing site characterization tests, (2) funding such tests, and (3) scheduling surface-based and underground tests. Also, to help avoid, or possibly withstand, a legal challenge, the Secretary of

Energy should, before officially adopting the site evaluation method, obtain an opinion from DOE's Office of the General Counsel that the methodology legally conforms to DOE's siting guidelines.

Agency Comments and Our Evaluation

DOE said that although it concurred with the intent of our recommendation aimed at building public trust in the nuclear waste program, it believes that OCRWM has already established and implemented a policy for obtaining comments on its approach to site characterization. Under this policy, DOE said that it had responded in writing to 4,615 comments on the draft and final site characterization plans and held public hearings on the plans. In addition, DOE said that it transmits study plans to NRC and Nevada, responds to the Nuclear Waste Technical Review Board's comments on the site characterization plan, and frequently meets with these and other parties on its plans and progress.

DOE also said that it recognizes with us the importance of interacting with affected governments, interested parties, and the public before making decisions and is committed to availing itself of such potentially beneficial opportunities. In addition to releasing the site evaluation report for public comment, in May 1992 the OCRWM Director will hold a public forum on policy issues related to the report of the site evaluation task force. This forum will secure for DOE the benefit of discussing and responding to these major issues before making any policy decisions.

In addition, DOE said that implementing a test prioritization scheme is both technically and managerially complex. Testing priorities, DOE said, are tied to funding and scheduling issues, which are ultimately DOE's responsibility; therefore, DOE said, it must set the priorities. DOE said that it is, however, committed to involving the public in policy decisions regarding the approaches to test prioritization. DOE said that it has already discussed many of these issues with the Nuclear Waste Technical Review Board and expects that the issues will be raised during the OCRWM Director's forum.

We agree that DOE obtained and considered many comments on its site characterization plan. Its actions were consistent with the act's requirement that DOE, before sinking exploratory shafts, submit a site characterization plan for review and comment to NRC, the state, and any affected Indian tribe on whose reservation the candidate site is located. Moreover, our recommendation was not directed at the more than 6,000-page site characterization plan that DOE issued in December 1988 but rather at DOE's efforts to implement the Secretary of Energy's November

1989 pronouncement that DOE's near-term scientific investigations of Yucca Mountain would focus on surface-based testing aimed at the early identification of any conditions indicating that the site is not suitable for a repository.

Although DOE is to be commended for its decision to obtain public comments on the Early Site Suitability Evaluation Task Force's report before deciding whether officially to adopt the proposed evaluation methodology, these comments are being obtained more than 2 years after the Secretary's November 1989 pronouncement. The fact that contractors developed the site evaluation method rather than DOE does not, in our view, absolve DOE from criticism that public comment was not obtained before the site evaluation approach was selected. While DOE has not yet formally adopted the methodology and/or the conclusions of the task force, it appears to us that DOE would find it extremely difficult to repudiate the task force's work at this late date.

We also agree with DOE's statement that test prioritization can be complex and that DOE is responsible for the final decisions regarding such matters. Nevertheless, as DOE itself points out, these matters would not preclude DOE from involving affected and interested parties in determining the approach to be taken—including whether testing priorities should focus on the qualifying and disqualifying conditions set forth in DOE's guidelines.

DOE challenged the accuracy of our statement that the early site suitability evaluation task and the test prioritization task were inconsistent and would produce incompatible results. DOE said that the two tasks did not use different criteria and were fully compatible because both relied explicitly or implicitly on the qualifying and disqualifying conditions in DOE's guidelines. DOE further said that the DOE and NRC regulations were not "widely dissimilar." Lastly, DOE said that the task force on prioritization focused on the postclosure guidelines that are considered to be most important to an evaluation of site suitability and that the site suitability task force considered the complete set of preclosure and postclosure qualifying and disqualifying conditions, as required for a formal evaluation of site suitability.

As DOE implies, it must, to comply with the act, make a formal site suitability determination on the basis of the specific qualifying and disqualifying conditions that the act required DOE to develop. Although we agree that the DOE and NRC guidelines are compatible—as we specifically state in our report—DOE must prioritize its work to ensure that the tests

needed for the early identification of any conditions that could disqualify the site are based on the more specific qualifying and disqualifying conditions that DOE developed in accordance with the act's requirements. In a March 1992 meeting on our draft report, DOE officials told us that DOE had recently decided to develop a new test-ranking method. Accordingly, the question of whether the ranking method that DOE was developing would defer the tests necessary to determine the presence or absence of disqualifying conditions at the site is moot.

In discussing the delay in seeking a legal opinion from its General Counsel on the applicability of its siting guidelines, DOE said that a decision not to apply the guidelines would have constituted a break with precedent and would have required a legal review, whereas the application of the guidelines did not. Although we do not quarrel with this statement, we note that DOE's first effort to develop a site evaluation method focused on NRC's regulations and not on DOE's. Also, DOE officials extensively debated the applicability of the guidelines until October 1990, when the OCRWM Director announced his decision to use DOE's guidelines in determining site suitability. Even at that time, however, DOE decided to continue to emphasize NRC's regulations in prioritizing tests.

According to DOE, the report of the Early Site Suitability Evaluation Task Force is a contractor report, which DOE has not adopted or approved. DOE also said that the report was not subject to formal legal review and that the Department had not yet decided how the report might be used. DOE said, however, that its attorneys had participated in early discussions of the methodology to ensure that the siting guidelines were being appropriately applied.

Although informal assistance from attorneys is useful, a formal review provides the benefit of the General Counsel's entire review and control process, and written opinions help to minimize the misunderstandings that can often arise from informal discussions. For example, DOE might have saved much time and effort by having its General Counsel's office review DOE's plan to use NRC's regulations in developing the procedures directed at implementing the Secretary's November 1989 policy of obtaining early identification of potential disqualifying conditions. Similarly, a legal review of the methodology developed to evaluate site suitability could identify any legal problems or issues that, if not corrected, could jeopardize more than 2 years' effort. The fact that the work was done by DOE contractors rather than by DOE itself would not lessen the adverse consequences of such an event.

Not Having State Permits Has Prevented DOE From Performing Some On-Site Activities

Problems in obtaining the environmental permits that DOE needs to conduct work at the Yucca Mountain site have prevented DOE in the last 4 years from performing some site activities, such as road construction, that may be necessary for site characterization. However, problems in obtaining the permits did not significantly delay comprehensive implementation of DOE's site characterization plan because, as discussed in chapter 2, DOE (1) did not gain NRC's limited acceptance of the quality assurance programs of key participants until October 1990 and full acceptance of all participants until January 1992, (2) had not developed necessary dry-drilling technology, and (3) had to redesign its exploratory studies facility. DOE applied for three permits needed to resume investigations at the Yucca Mountain site in 1988, but Nevada delayed acting on the applications because of pending litigation. The litigation was resolved in DOE's favor, and Nevada issued the first of the three permits in June 1991.

Whether Nevada delayed program progress has become an issue because of proposed legislation that would take away Nevada's responsibility for processing the additional environmental permits that DOE needs and give this responsibility to a federal agency. In addition to the 3 permits already requested, DOE will have to apply for and obtain at least 14 other permits to complete site characterization. Continuing difficulties in obtaining these permits could, according to one estimate, delay the completion of DOE's site characterization program by as much as 8 years. To minimize further delays, DOE has had legislation proposed that would take away Nevada's permit-processing responsibility. Nevada, however, has indicated that it might challenge the constitutionality of any such legislation enacted. Such a challenge, whether successful or not, could further delay programs.

Effects of Nevada's Withholding of Environmental Permits

DOE had three applications for environmental permits pending before the state of Nevada for about 3 years. Two of the permits were issued in mid-1991 as a result of court action. Although the third permit, which DOE needs to obtain water, was not issued until March 1992, Nevada issued a temporary permit authorizing DOE to use water from an existing well in September 1991. According to NRC officials, DOE's contractors could have begun on-site investigations for which they were responsible sometime between October 1990 and January 1991. Also, without the permits, DOE was unable to perform work at the site before October 1990 that was not covered by NRC's quality assurance requirements.

DOE's Applications for Environmental Permits Pending for Over 3 Years

In March 1987 Nevada informed DOE that it could no longer conduct activities at the Yucca Mountain site using a permit issued by the state for the Nevada Test Site. Thereafter, DOE submitted applications to Nevada for (1) a surface-disturbance air quality permit on January 20, 1988, (2) a water appropriation permit on July 22, 1988, and (3) an underground injection control permit on April 5, 1989. Nevada, however, returned the three applications to DOE in December 1989, stating that they had become moot for three reasons. First, a new state law made it illegal to store high-level radioactive waste in Nevada; second, a state resolution opposed the placement of a high-level radioactive waste repository anywhere in the state; and third, a second resolution prohibited the establishment of a repository at Yucca Mountain.[1] The two resolutions were transmitted to the Congress and the President on April 19, 1989.

On January 5, 1990, Nevada petitioned the U.S. Court of Appeals for the Ninth Circuit, challenging DOE's decision to investigate Yucca Mountain for a repository. Nevada maintained, among other things, that its notification to the Congress of its disapproval of Yucca Mountain as a repository site constituted a valid and effective "notice of disapproval," as provided for by section 116(b)(2) of NWPA, as amended. Accordingly, it sought a declaration that the site was disapproved and an injunction terminating site characterization activities at Yucca Mountain. The circuit court ruled against Nevada on September 19, 1990, and on March 4, 1991, the U.S. Supreme Court refused to hear Nevada's appeal.

In a related action, DOE sued Nevada on January 25, 1990, in the U.S. District Court for the District of Nevada. DOE asked the court to declare that (1) Nevada's notice of disapproval was invalid, (2) NWPA took precedence over Nevada's resolutions, (3) Yucca Mountain was not disapproved as a repository site, and (4) DOE's applications were not moot and that Nevada must act on the applications within 30 days. DOE also asked the district court to prohibit Nevada from unlawfully interfering with DOE's site characterization activities. This case was stayed, pending resolution of Nevada's court of appeals petition and subsequent appeal to the Supreme Court. However, after the Supreme Court refused to hear Nevada's appeal, the district court ruled, on March 20, 1991, that (1) DOE and Nevada should develop and submit to the court a stipulation (agreement) by April 22, 1991, providing that the permit applications be expeditiously processed in accordance with state law and that the applications not be denied for any reason that had been disposed of by the

[1]Nevada Assembly Bill 222, enacted into law on July 6, 1989, and Assembly Joint Resolutions 4 and 6, enacted by the Nevada Legislature on April 6, 1989, and approved by the governor on April 17, 1989.

U.S. Court of Appeals; (2) final actions on the applications for the air quality permit and the underground injection control permit would take place by June 3, 1991; and (3) a hearing would be held on the processing of the application for the water appropriation permit on July 17, 1991.

Because DOE and Nevada could not agree on the processing of the air quality and injection control permits—DOE wanted the agreement to set specific dates for final action and Nevada refused—the district court ordered on May 13, 1991, that Nevada fully process the two permits by July 17, 1991. Nevada issued the air quality permit on June 12, 1991; the underground water injection permit on July 17, 1991; and the water appropriation permit on March 2, 1992. In March 1992 DOE officials told us that DOE had not begun work covered by the underground water injection permit because DOE had to request a modification to the permit. The officials expected Nevada to approve the modification in April 1992.

Effects of Delay in Action on DOE's Permit Applications

As discussed in chapter 2, DOE was not ready to begin even the limited surface-based portion of its site characterization plan until NRC accepted the quality assurance programs of DOE and its major contractors. This acceptance was obtained over the period from October 1990 to January 1991. Following receipt of the air quality permit, DOE, on July 8, 1991, began limited new work at Yucca Mountain. DOE was able to begin this work, however, only because it brought water to the site from California. On September 11, 1991, Nevada issued DOE a temporary permit to use water from a well located 46 road miles from DOE's water storage tanks.

In commenting on our draft report, Nevada said that it had issued DOE a permit in 1983 for use at the site of this well, which is located about 6 miles west of Yucca Mountain. Nevada said that the temporary use granted DOE in September 1991 was the seventh granting of an annual DOE request for a 1-year extension to allow DOE to "perfect" its earlier granted appropriation. According to Nevada, DOE would not have needed water from California if it had been diligent and timely in its pursuit of this already appropriated water right.

Even though DOE was not ready to begin new licensing-related investigations until sometime between October 1990 and January 1991, Nevada's inaction on DOE's permit applications was not without effect on DOE's site characterization program. For example, DOE could not perform any activity at the Yucca Mountain site requiring ground-disturbing work, such as testing its new dry-drilling technology at the site or replacing

defective or outdated monitoring equipment. Moreover, according to the Manager, Yucca Mountain Project Office, DOE could have been doing other work that was not required to be done under an approved quality assurance program for licensing purposes, such as constructing roads, improving the water system, and constructing the administration building.

Need for Additional Permits Could Delay Future Characterization Efforts

In addition to the three permits that it has already applied for, DOE needs at least 14 more permits, registration certificates, and approvals (hereinafter referred to collectively as permits) to carry out its site characterization plan. Of the 14 additional permits needed, 10 are to comply with federal regulatory authority that the Environmental Protection Agency has delegated to the state of Nevada and 4 are to comply with state requirements. DOE has had legislation introduced in the Congress that is designed to prevent Nevada from withholding permits to delay the program.

EPA has delegated regulatory authority for the Clean Air Act, the Clean Water Act, and the Safe Drinking Water Act to the state of Nevada.[2] EPA has also delegated regulatory authority for the Resource Conservation and Recovery Act to Nevada; however, DOE obtained the registration certificate needed to comply with this act in June 1989. The Clean Air Act established federal policy to protect and enhance the quality of the nation's air resources; the Clean Water Act established federal policy to restore and maintain the chemical, physical, and biological integrity of the nation's waters; and the Safe Drinking Water Act established federal policy to protect public drinking water, including underground aquifers.

In addition to the three permits it has applied for, DOE estimates that (1) to comply with the requirements of the Clean Air Act, it will need seven permits to accomplish planned surface-disturbing activities, build two construction material handling plants, and construct the exploratory studies facilities; (2) to comply with the requirements of the Clean Water Act, it will need one permit to discharge waste water resulting from construction activities; and (3) to comply with the requirements of the Safe Drinking Water Act, it will need two permits—one to inject tracers in connection with studies to be done in the exploratory studies facility and one to provide a drinking water supply system.

[2]The Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 and the Water Quality Act of 1987, as amended, are collectively referred to as the Clean Water Act.

Nevada also has state environmental laws requiring the issuance of permits. In addition to its permit application to use Nevada water, DOE estimates that it will need four new permits to carry out its planned site characterization activities. DOE will need permits to construct a sanitary and sewage collection system; to construct water pollution control facilities, such as sewage lagoons and waste-water ponds; and to deal with protected animals.

The permit needed to deal with protected animals was not a problem until July 1990, when Nevada refused to renew a DOE contractor's wildlife-handling permit for use on DOE controlled lands, even though the contractor had held such a permit for the previous 16 years. Nevada returned the renewal application for the same reason that it had earlier returned DOE's three permit applications: namely, that it was moot because of the recently enacted state law and resolutions. The state and DOE negotiated a compromise, and a permit was issued in August 1990 that allowed the contractor to conduct work on DOE lands except for Yucca Mountain. According to a contractor official, however, Nevada, in preparing the issued permit, inadvertently allowed the handling of animals on one section of Yucca Mountain.

DOE has had legislation introduced in the Congress that would, if enacted, effectively eliminate Nevada from the permit issuance process. The proposed legislation includes, among other things, the following provisions:

- A federal agency administering a law or regulation that imposes a requirement for a permit, license, right of way, certification, approval, or other authorization for site characterization activities conducted under NWPA shall administer such a requirement itself, without regard to whether it has been or could be delegated to a state.
- The Secretary of Energy does not need a permit from a state or local government or Indian tribe to conduct site characterization studies.
- The Secretary of Energy must consider the views of state, local, and tribal officials regarding the substantive provisions of state, local, and tribal laws affecting site characterization activities.
- An action contesting the constitutionality of this new section of NWPA must be brought within 60 days of the section's enactment, and such action may not enjoin site characterization activities.
- The new section of NWPA applies only to site characterization work begun before the Secretary of Energy applies to NRC for a repository construction license.

- The Nuclear Waste Negotiator may include or exclude from a negotiated agreement the provisions added by this amendment.

In October 1990 the Executive Director of Nevada's Nuclear Waste Project Office was quoted in a newspaper article as saying that the state could delay DOE's access to Yucca Mountain for 6 to 8 years. In responding to our questions about how his views on this matter would be affected by either the recent court decisions or the enactment of DOE's proposed legislation, the Executive Director said that although the recent court decisions had exhausted one line of remedy for the state, Nevada was continuing to review the federal program for defects and to evaluate what other remedies might be available. Furthermore, he said that both GAO and DOE had recently acknowledged that, until the past few months, DOE, and not Nevada, had been the cause of program delays. He also said that despite DOE's long-standing complaints that Nevada has delayed and frustrated the program's progress, DOE was not ready, nor is it now ready except on a limited basis, to begin implementing its planned site work.

According to the Executive Director, in the unlikely event that DOE's proposed legislation was adopted, the legislation would preempt Nevada's regulatory and statutory authority. This, in itself, he said, would invite protracted and many-faceted litigation, possibly preceded by a lawsuit raising the constitutional issue of whether the Congress could restrict the authority of the courts to grant injunctive relief during the process of adjudication. He added that it was not possible to estimate the length of the delay that might result from the passage of this proposed legislation.

In the Executive Director's opinion, returning to the delegating federal agency the regulatory authorities delegated to Nevada would not significantly reduce DOE's delays in gaining approval because (1) federal agency staffing has not been funded to discharge this unexpected duty and (2) the quality of DOE's applications for permits, which has delayed applications in the past, would still create delays at the federal level.

Conclusions

DOE has obtained the permits it needs to begin, at least on a limited basis, the characterization of Yucca Mountain. Delays in obtaining permits prevented DOE from performing any ground-disturbing work between March 1987, when Nevada advised DOE that it could not perform work at the Yucca Mountain site using the Nevada Test Site work permits, until June 1991. Whether DOE's not having the needed permits has held up DOE's progress has become an issue because legislation is pending that is

designed to eliminate Nevada's ability to delay program progress through use of the permit process. DOE maintains that Nevada's failure to act on the three permits has delayed its program, and, therefore, it wants the legislation enacted to prevent such delays in the future. Conversely, Nevada maintains that its actions have not held up the program because DOE was not ready to begin new investigations.

Given Nevada's strong opposition to the building of a nuclear waste repository in the state, it is clear that Nevada will do whatever it legally can to block or impede the development of any repository. Therefore, the proposed legislation could help reduce program delays. However, some issues appear to go beyond the program itself, including policy and constitutional issues involving federal and state relationships. For example, if enacted, the legislation could set a precedent, and hence government policy, for dealing with similar federal and state problems in the future. Also, the constitutionality of the proposed legislation may be at issue. Nevada has indicated that it would challenge the constitutionality of at least one provision of the proposed legislation: namely, the provision that would bar the courts from enjoining site characterization activities while the law's constitutionality was being challenged.

Despite numerous uncertainties associated with the program, additional delays are almost certain. The severity of any adverse impacts on the program caused by delays will depend on the length of the delays encountered. While such delays will clearly have adverse effects on certain aspects of the program, such as costs, the effects of the delays on other aspects of the program, such as the quality of the investigations needed to determine site suitability, are less predictable.

Comments From the Department of Energy

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

Department of Energy
Washington, DC 20585

MAY 5 1992

Mr. Victor S. Rezendes
Director, Energy Issues
Resources, Community and
Economic Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Rezendes:

The Department of Energy (DOE) appreciates the opportunity to review and comment on General Accounting Office (GAO) draft report RCED-92-73, entitled "Nuclear Waste: DOE's Repository Site Investigations, a Long and Difficult Task."

The draft report contains the following recommendation to the Secretary of Energy:

"To help DOE build public trust in its civilian nuclear waste management program through information dissemination, the Secretary of Energy should, at the same time that DOE obtains comments from the public, NRC, and others on its methodology for evaluating Yucca Mountain, also obtain comments on DOE's proposed approach for site characterization, including its plans for (1) prioritizing site characterization tests, (2) funding such tests, and (3) scheduling surface-based and underground tests. Also, to help avoid, or possibly withstand, a legal challenge, the Secretary of Energy should, before officially adopting the site evaluation method, obtain an opinion from DOE's Office of the General Counsel that the methodology legally conforms to DOE's regulatory guidelines."

See comment 1

DOE concurs in the intent of the first part of the recommendation with regard to the need to build public trust in the Civilian Radioactive Waste Management Program, and believes that the Office of Civilian Radioactive Waste Management (OCRWM) has already established and implemented a policy for obtaining comments on its approach to site characterization.

DOE's Site Characterization Plan (SCP), which was required by the Nuclear Waste Policy Act (NWPA), contains DOE's proposed approach for its site characterization program. In the process of developing these plans for site characterization, DOE responded in writing to 4615 comments on the consultation draft of the SCP and the final SCP from the Nuclear Regulatory Commission (NRC), the U.S. Department of the Interior, the Environmental Protection Agency, the U.S. Geological Survey, the State of Nevada, the California Energy Commission, the Lincoln County (Nevada) Board of Commissioners, the Edison Electric Institute, and the general public. In addition to having requested and received written comments on the SCP, three public hearings were held to receive additional comments on plans for site characterization and related program activities. Written responses to

these comments were provided to those who participated in the public hearings. DOE also transmits copies of individual study plans as they are completed to both NRC and the State of Nevada, and DOE responds to comments provided on these plans. Finally, DOE responds in writing to comments on its site characterization plans from the Nuclear Waste Technical Review Board (NWTRB), which are included in the NWTRB's biannual reports to the Congress and the Secretary of Energy.

The DOE continues to meet frequently with NRC staff, NRC's Advisory Committee on Nuclear Waste, and the NWTRB to discuss its plans and progress, including issues relating to the schedule and budget for planned site characterization work. DOE also holds regular public meetings in the vicinity of the Yucca Mountain site to discuss program activities and receive public comments.

The implementation of test prioritization decisions is both technically and managerially complex. It is inextricably tied to funding and scheduling issues which are ultimately DOE's responsibility and, therefore, such decisions must be made by DOE. The Department is, however, committed to predecisional involvement in policy decisions regarding the approaches to test prioritization. Many of these issues have already been discussed with the NWTRB and are expected to be raised during the Director's Forum as well.

DOE shares GAO's recognition of the importance of predecisional interaction with affected governments, interested parties and the public and is committed to availing itself of such potentially beneficial opportunities. The Early Site Suitability Evaluation (ESSE) report has been made available for a 90-day public comment period, which is scheduled to close on June 15, 1992. In addition, a Director's Forum, open to the public, has been scheduled for May 7, 1992, and was announced in the Federal Register on April 2, 1992. The Forum will focus on policy issues related to the policy, strategy and plans for site evaluation and will secure for OCRWM the benefit of predecisional discussions of these major issues. The Department will respond to all comments offered before making any policy decisions.

With respect to the second part of GAO's recommendation, DOE concurs in the importance of obtaining a legal review prior to making major decisions with regulatory implications. It should be noted that the ESSE document is a contractor report and has not been adopted or approved by DOE. The opinions expressed therein are strictly those of the contractor. The document has not been subject to formal review by the DOE General Counsel prior to its issuance for public comment, and DOE has not yet made a decision concerning formal DOE endorsement of the report or how it may be used in the future by DOE management.

It is also important to clarify a number of other issues addressed in the text of the draft report.

See Comment 2.

First, with regard to DOE's readiness to proceed with new site characterization work, the Department strongly disagrees with the conclusion in the draft report that the State of Nevada's delay in issuing required environmental permits did not significantly affect the start of new site investigations because DOE (1) did not gain NRC's acceptance of the quality assurance programs of all participants until March 1991, (2) had not developed the necessary dry-drilling technology, and (3) had to redesign its Exploratory Studies Facility (ESF).

It should be noted that DOE's ability to perform surface-disturbing scientific investigations at the Yucca Mountain site was not dependent upon the qualification of the OCRWM quality assurance program. Qualification audits of Sandia National Laboratory and the U.S. Geological Survey were performed in 1989. The NRC, in reporting on these audits, agreed that adequate controls were in place for these participants to continue Yucca Mountain Project work. In 1989, NRC also accepted the study plans prepared by these participants for work on the calcite-silica studies and trenching in Midway Valley. As of February 9, 1990, when the U.S. Fish and Wildlife Service issued its Biological Opinion that site characterization activities were not likely to jeopardize the endangered desert tortoise, at least these two site characterization activities could have been initiated, had the permits been issued. The development of a dry-drilling technology was not a prerequisite for these and many other site characterization activities. Likewise, completion of DOE's ESF design was not necessary to proceed with other surface-disturbing work. Therefore, surface-disturbing site characterization activities could, as stated previously, have been initiated on February 9, 1990, but were delayed for 17 months by the delay in receiving the permits.

See Comment 3.

Another major issue of concern to the Department is the discussion in the draft report of DOE's development of a methodology for early identification of potential disqualifying conditions. Some misunderstanding appears to remain regarding the relationship between these activities which has led to inaccuracies in the conclusions reached and in the manner in which disqualifying (and qualifying) conditions in DOE's siting guidelines have been addressed by GAO. Specifically, the draft report incorrectly states that the Test Prioritization Task (TPT) and ESSE are inconsistent and concludes that they will yield incompatible results. Several important points should be noted:

o The two tasks did not use different criteria--although the methods for prioritizing tests and evaluating site conditions differed, the tasks are fully compatible as both relied (explicitly or implicitly) on the qualifying and disqualifying conditions in DOE's siting guidelines. The TPT did not focus solely on NRC regulations, but used DOE's regulations as well. The NRC and DOE regulations are not widely dissimilar--the NWPA required NRC's concurrence in DOE's siting guidelines to ensure that the related regulations of the two agencies would not conflict.

o The TPT focused on the postclosure guidelines which are considered to be the most important to an evaluation of site suitability, and the ESSE considered the complete set of preclosure and postclosure qualifying and disqualifying conditions, as required for a formal evaluation of site suitability.

o The initial focus of the TPT on potentially adverse conditions (PACs) from the siting guidelines was not inappropriate since these PACs were the basis for the PACs included in DOE's siting guidelines in which NRC concurred. Any PAC, if sufficiently severe, could lead to site disqualification and, in fact, the disqualifying conditions generally represent the bounding case of a PAC.

DOE believes that the discussion of the Department's delays in seeking legal opinions from the DOE General Counsel is misleading. Continued application of the guidelines is consistent with the NWPA, as amended, and previous evaluations of the suitability of the Yucca Mountain site. DOE's legal counsel from Headquarters and the DOE Nevada Field Office were involved in early discussions of the methodology to ensure that the siting guidelines were being appropriately applied.

See Comment 4.

Finally, DOE requests that the report indicate that DOE's original approaches to site characterization were satisfactory but that, through the mandated review and oversight process, even better approaches were identified and adopted. This is evidence that the process ensures that DOE has the benefit of available expertise and that optimal decisions are implemented.

See Comment 5.

Editorial changes have been provided to GAO under separate cover. It is hoped that the comments provided in both letters will be helpful to GAO in its preparation of the final report.

Sincerely,

James E. Reid

Elizabeth E. Smedley
Acting Chief Financial Officer

The following are GAO's comments on the Department of Energy's letter dated May 5, 1992.

GAO Comments

1. This comment is addressed in the "Agency Comments and Our Evaluation" section at the end of chapter 3.

2. We address this comment under the heading "NRC Conditionally Accepts DOE's Quality Assurance Program in Early 1991" in chapter 2.

3. This comment is addressed under the headings "DOE Is Planning How to Proceed With Site Characterization" and "Agency Comments and Our Evaluation" in chapter 3.

4. We address this comment in the "Agency Comments and Our Evaluation" section at the end of chapter 2.

5. Changes have been made, as appropriate, in response to editorial comments.

Comments From the Nuclear Regulatory Commission

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

March 10, 1992

Mr. Victor S. Rezendes
Director, Energy Issues
Resources, Community, and Economic
Development Division
U. S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Rezendes:

SUBJECT: DRAFT REPORT, "NUCLEAR WASTE: DOE'S REPOSITORY SITE INVESTIGATIONS, A LONG AND DIFFICULT TASK" (GAO/RCED-92-73)

See Comment 1.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the subject draft U.S. General Accounting Office report and has no general concerns with the overall contents of the report. Because the subject report discusses activities related to DOE's quality assurance (QA) program, it is important to note that on March 2, 1992, the NRC staff closed out its objection to DOE's Site Characterization Plan related to quality assurance programs. The NRC staff will continue to monitor DOE's QA program implementation through future audits and surveillances. Our specific comments are as follows:

See Comment 2.

Page 2, Paragraph 1: In the first sentence the number of civilian nuclear plant sites should be 70.

See Comment 3.

Page 23, Paragraph 2: The first sentence should be revised to read "...until NRC accepted DOE and its major contractors' quality assurance programs that are related to the work to be accomplished." The next two sentences should be changed to read, "NRC accepted the programs of two DOE contractors, without exceptions, and four others, with exceptions, in October 1990. The programs of OCRWM's headquarters and field offices were accepted, with exceptions, in March 1991."

See Comment 4.

Page 25, Paragraph 1: In the last sentence, the 30 percent may be correct for the initial costs of development, start-up, and implementation of a project quality assurance (QA) program, but 10 to 15 percent is more appropriate for the operation of a QA program.

See Comment 3.

Page 27, Paragraph 1: Although not totally incorrect, the second sentence should be clarified to state that NRC accepted (with some minor exceptions) the QA programs of six of the project participants in October 1990 and another in May 1991. From a QA standpoint, these participants could have started work on new activities (not related to the exceptions) after those dates.

See Comment 3.

Page 29, Paragraph 1: The last two sentences could be clarified. Although the U.S. Department of Energy (DOE) did need NRC's full acceptance of all program participants' QA programs before it could initiate work on every proposed site investigation, DOE could conduct work on many investigations that were the responsibility of those project participants whose QA programs were accepted in October 1990 and May 1991. NRC acceptance of all program participants was accomplished in January 1992.

See Comment 2.

Page 30, Paragraph 1: The number "17," in the second sentence, is incorrect. NRC's QA staff did not observe any DOE audits between January 1985 and December 1987.

See Comment 2.

Page 34, Third full sentence: The sentence should be corrected to state, "...the formation is the major barrier to the movement of certain radionuclides from the repository area...."

We appreciate the opportunity to comment on this draft report. If you have any questions about these comments, please call Mr. B. J. Youngblood, of my staff, at 301-504-3404.

Sincerely,

Original Signed By:
James M. Taylor

James M. Taylor
Executive Director
for Operations

The following are GAO's comments on the Nuclear Regulatory Commission's letter dated March 10, 1992.

GAO Comments

1. This comment was added to the report, as suggested (see ch. 2).

2. Changes have been made, as appropriate, to NRC's editorial comments.

3. This comment is addressed under the heading "NRC Conditionally Accepts DOE's Quality Assurance Program in Early 1991" in chapter 2.

4. We did not change our report in response to this statement because our report was factually correct.

Comments From the State of Nevada

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

BOB MILLER
Governor

STATE OF NEVADA

ROBERT R. LOUX
Executive Director

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March 4, 1992

Victor S. Rezendes
Director, Energy Issues
Resources, Community, and
Economic Development Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Rezendes:

On behalf of Governor Miller, attached please find comments by the State of Nevada on your draft report, Nuclear Waste: DOE's Repository Site Investigations, A Long and Difficult Task (GAO/RCED-92-73).

Should you have any questions, please do not hesitate to contact me.

Sincerely,

Robert R. Loux
Executive Director

RRL:cs
Attachment

cc: Dwayne Weigel

STATE OF NEVADA COMMENTS ON THE DRAFT REPORT
NUCLEAR WASTE: DOE'S REPOSITORY SITE INVESTIGATIONS,
A LONG AND DIFFICULT TASK (GAO/RCED-92-73).

See Comment 1.

1. Page 2, par. 1 - Radioactive wastes are stored at 72 (not 30) commercial reactor sites.

See Comment 2.

2. Page 3, par. 3 cont. on page 4 - The state legislation (AB 222) was not overturned by the court. The court ruled that the state's Notice of Disapproval pursuant to the NWPA was premature, and therefore not valid and effective at that time. There was no ruling regarding the validity of the legislation prohibiting the storage of high-level radioactive waste in Nevada.

See Comment 3.

3. Page 4, par. 3 - The DOE did not seek to develop the drilling technology at the Yucca Mountain site, but rather planned to do test drilling with the new rig on the Nevada Test Site, where DOE's permits were not applicable to the Yucca Mountain Project. DOE never applied for a permit which included this test drilling. The modified, not "new drilling technology was developed at the manufacturer's plant in Utah and later tested in Utah and Arizona.

See Comment 1.

4. Page 5, par. 1 - "Because of this decision and budget considerations, DOE postponed design of the underground facility by one year and initiation of construction of the facility until November 1993."

See Comment 4.

5. Page 6, par. 2 - see comments 2 and 3

See Comment 1.

6. Page 10, par. 1 - "In addition, DOE and the nuclear industry consider the safe, permanent disposal of nuclear waste essential to the continued viability of the nuclear power industry." This is neither a finding nor a purpose of the NWPA and is not relevant to the subject GAO evaluation.

See Comment 1.

7. Page 11, par. 2 - "and (4) recommendation of a site for a repository by the Secretary of Energy to the President and subsequent recommendation of the site by the President to the Congress."

See Comment 1.

8. Page 21 & 22, par. 4 - On page 7, the report indicates Nevada has been asked for written comment, and its comments will be reproduced in their entirety in Appendix III.

See Comment 5.

9. Page 23, par. 2 - The overall OCRWM QA program was not fully accepted until December 20, 1991.

See Comments 1 and 6.

10. Page 24, par. 1 - see Attachment 1 for DOE's latest Total Project Cost at $6.319337 billion.

See Comments 1 and 6.

11. Page 24, table 2.1 - Why are the ESF cost figures in this table not consistent with Attachment 1, ESF Data Sheet (7. Financial Schedule)?

See Comments 1 and 6.

12. Page 25, par. 2 - see Attachment 2 for current information from DOE on status of Study Plans.

See Comment 5.

13. Page 27, par. 1 - Los Alamos did not obtain full NRC acceptance until May 29, 1991 and SAIC did not obtain full acceptance until Oct. 9, 1991.

See Comment 5.

14. Page 29, par. 1 - NRC conditionally accepted the OCRWM QA program for Midway Valley/Calcite Silica work on March 11, 1991.

See Comment 5.

15. Page 29, par. 2 - Basic facts are correct but the dates of actual acceptance are wrong. This is based on the dates of the letters from the NRC to DOE accepting the programs.

See Comment 3.

16. Page 31, par. 2 - DOE has decided not to use any of the existing borehole data.

See Comment 1.

17. Page 32, par. 1 - "... because it lacked necessary environmental permits form Nevada, and lacked an acceptable Quality Assurance Program, as described elsewhere in this report. DOE did not have any of its QA programs accepted by July 1989.

See Comment 3.

18. Page 32, Par. 3 - see comment 3

See Comment 1.

19. Page 33, par. 1 - see comment 3. Also, this is DOE's second prototype drilling to be designed and constructed. The earlier rig (LM 120) was the one tested in Utah and Arizona and the subject of the permit discussion. The rig planned for use in 1992 (LM 300) was built and tested in Utah and delivered to the Yucca Mountain Project in December 1991 where it has been sitting idle since delivery.

See Comment 1.

20. Page 34, Par. 2 - Why are these cost figures not consistent with those in Attachment 1, ESF Data Sheet (7. Financial Schedule)?

See Comment 1.

21. Page 37, par. 1 - These ESF cost estimates are vastly different from those in Attachment 1, ESF Data Sheet. Why?

See Comment 1.

22. Page 37b, par. 1 - Work other than that requiring use of the LM 300 drill rig (see comment 14) could have been taking place since mid-1991 if DOE plans, schedules and budgets had permitted. According to Carl Gertz, YM Project Manager, the limiting factor on work, once started in 1991, was that FY 91 funds were exhausted by the time this small amount of work was completed and considerable FY 92 work has been deferred

because of the unexpected $30 million cut in the program's appropriation.

See Comment 5.

23. Page 58, par. 1 - See above comments for pages 23 and 27.

See Comment 2.

24. Page 61, par. 3 - This well, on BLM Public Land about 6 miles west of Yucca Mountain, was permitted to the DOE by Nevada in 1983 to provide water for use at the Yucca Mountain site. The temporary use granted by the State Engineer was the seventh granting of DOE's annual requests for a 1-year extension of time to prove "beneficial use" of the water, and thus perfect its earlier granted appropriation. It is unusual that such a lengthy extension is requested and granted. Water from this well could have been used in place of purchased water from California if DOE had been diligent and timely in its implementation and perfection of this already appropriated water right.

The following are GAO's comments on the state of Nevada's letter dated March 4, 1992.

GAO Comments

1. Changes have been made, as appropriate, in response to Nevada's editorial comments.

2. This comment is addressed under the heading "Effects of Nevada's Withholding of Environmental Permits" in chapter 4.

3. We address this comment under the heading "DOE Is Developing Technology for Drilling Critical Boreholes" in chapter 2.

4. This comment is addressed under the headings "DOE Is Developing Technology for Drilling Critical Boreholes" in chapter 2 and "Effects of Nevada's Withholding of Environmental Permits" in chapter 4.

5. We address this comment under the heading "NRC Conditionally Accepts DOE's Quality Assurance Program in Early 1991" in chapter 2.

6. Attachments 1 and 2 to Nevada's comments are not reproduced in this report. Attachment 1 was a page from DOE's budget justification for fiscal year 1993 showing the estimated cost of the exploratory studies facility. Attachment 2 was a copy of the weekly highlights report of the Manager, Yucca Mountain Project Office, to the Director, OCRWM, for the week ending February 7, 1992. Among other things, this report showed the status of DOE's development of site characterization study plans.

Major Contributors to This Report

Resources, Community, and Economic Development Division, Washington, D.C.	James E. Wells, Jr., Associate Director Dwanye E. Weigel, Assistant Director Richard A. Renzi, Assignment Manager Daniel J. Semick, Staff Evaluator
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Related GAO Products

Nuclear Waste: Quarterly Report as of March 31, 1990 (GAO/RCED-91-55, Feb. 15, 1991).

Nuclear Waste: DOE Needs to Ensure Nevada's Conformance With Grant Requirements (GAO/RCED-90-173, July 9, 1990).

Nuclear Waste: Quarterly Report as of December 31, 1989 (GAO/RCED-90-130, Apr. 30, 1990).

Nuclear Waste: Quarterly Report as of September 30, 1989 (GAO/RCED-90-103, Mar. 2, 1990).

Nuclear Waste: Changes Needed in DOE User-Fee Assessments to Avoid Funding Shortfall (GAO/RCED-90-65, June 7, 1990).

Nuclear Waste: Quarterly Report on DOE's Nuclear Waste Program as of June 30, 1989 (GAO/RCED-90-59, Dec. 12, 1989).

Nuclear Waste: Fourth Annual Report on DOE's Nuclear Waste Program (GAO/RCED-88-131, Sept. 28, 1988).

Nuclear Waste: DOE Should Base Disposal Fee Assessment on Realistic Inflation Rate (GAO/RCED-88-129, July 22, 1988).

Nuclear Waste: Information on Cost Growth in Site Characterization Cost Estimates (GAO/RCED-87-200FS, Sept. 10, 1987).

Nuclear Waste: Repository Work Should Not Proceed Until Quality Assurance Is Adequate (GAO/RCED-88-159, Sept. 29, 1988).

Nuclear Waste: A Look at Current Use of Funds and Cost Estimates for the Future (GAO/RCED-87-121, Aug. 31, 1987).

Nuclear Waste: Status of DOE's Nuclear Waste Site Characterization Activities (GAO/RCED-87-103FS, Mar. 20, 1987).

Nuclear Waste: Status of DOE's Implementation of the Nuclear Waste Policy Act (GAO/RCED-87-17, Apr. 15, 1987).

Nuclear Waste: Institutional Relations Under the Nuclear Waste Policy Act of 1982 (GAO/RCED-87-14, Feb. 9, 1987).

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