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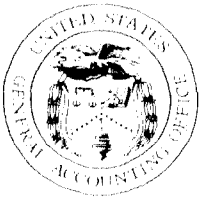
Report to Congressional Requesters

September 1991

NUCLEAR WASTE

Operation of Monitored Retrievable Storage Facility Is Unlikely by 1998



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Resources, Community, and
Economic Development Division

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September 24, 1991

The Honorable Ernest F. Hollings
Chairman, Committee on Commerce, Science,
and Transportation
United States Senate

The Honorable Richard H. Bryan
United States Senate

In response to your request, this report discusses the alternatives of continuing to store spent nuclear fuel at utility reactor sites or transferring the wastes to a federal facility for monitored retrievable storage.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies to appropriate congressional committees, the Secretary of Energy, and other interested parties. We will also make copies available to others upon request.

This work was performed under the direction of Victor S. Rezendes, Director, Energy Issues. If you have any questions regarding this report, please contact him on (202) 275-1441. Other major contributors to this report are listed in appendix I.

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

Radioactive waste is mounting at U.S. nuclear power plants at a rate of more than 2,000 metric tons a year. Pursuant to statute and anticipating that a geologic repository would be available in 1998, the Department of Energy (DOE) entered into disposal contracts with nuclear utilities. Now, however, DOE does not expect the repository to be ready before 2010. For this reason, DOE wants to develop a facility for monitored retrievable storage (MRS) by 1998.

Concerned about how best to store the waste until a repository is available, congressional requesters asked GAO to review the alternatives of continued storage at utilities' reactor sites or transferring waste to an MRS facility. GAO assessed the (1) likelihood of an MRS facility operating by 1998, (2) legal implications if DOE is not able to take delivery of wastes in 1998, (3) propriety of using the Nuclear Waste Fund—from which DOE's waste program costs are paid—to pay utilities for on-site storage capacity added after 1998, (4) ability of utilities to store their waste on-site until a repository is operating, and (5) relative costs and safety of the two storage alternatives.

Background

The Nuclear Waste Policy Act of 1982 required DOE to develop a repository to dispose of nuclear waste and to study and propose an MRS facility. It required utilities to maintain and pay for their on-site storage and to pay fees into the Nuclear Waste Fund for future federal storage in an MRS facility and disposal in the repository. In addition, DOE's contract with utilities was to state first, that after repository operations begin, DOE will take title to utilities' waste, and second, beginning not later than January 31, 1998, DOE will dispose of wastes, as provided by the act. Finally, utilities unable to store all their waste on-site could request interim federal storage on a cost-reimbursable basis. DOE's authority to enter into contracts under the latter provision expired on January 1, 1990.

Concerned that an MRS facility might become a substitute for a permanent repository, the Congress, in the Nuclear Waste Policy Amendments Act of 1987, linked development of an MRS facility to progress in permanent repository development. For example, DOE may not build an MRS facility until a license has been issued for construction of the repository. The amendments also created the independent position of Nuclear Waste Negotiator to work out the terms and conditions under which a state or Indian tribe would agree to host the repository or an MRS facility. An agreement between the negotiator and a state or Indian tribe must be enacted into federal law.

Results in Brief

DOE requested $100 million over the next 3 years to develop an MRS facility by 1998. DOE can begin accepting delivery of utilities' waste by 1998 only by having an MRS facility then. To accomplish this, however, the Nuclear Waste Negotiator must complete a siting agreement and obtain congressional approval of the agreement, including the removal of statutory links to repository development, by the end of 1992. The negotiator does not believe this is possible.

Whether DOE is legally obligated to store or dispose of waste in 1998 is unclear. Industry officials have said that utilities might sue DOE for breach of contract and seek payment from the Nuclear Waste Fund for on-site storage added after 1998 if DOE cannot take delivery of their waste then. DOE believes that such payments are not permitted by the nuclear waste act and has not stated if it would support legislation to permit such payments or what other actions it would take without an MRS facility in 1998.

Although an MRS facility is critical to DOE's ability to store waste in 1998, solely from the perspectives of utility storage capacity, cost, and safety, its absence is not considered to be a cause for concern. First, evidence indicates that virtually all utilities can store their waste on-site well beyond the scheduled repository opening date of 2010. For this reason, no utilities requested federal interim storage before the contract authority provided in the statute expired in 1990. Second, studies have concluded that there are small differences between the costs and safety of storing waste at an MRS facility or at nuclear plants.

Principal Findings

MRS Facility Unlikely by 1998

DOE plans to develop an MRS facility by 1998. To accomplish this, the Department requested $32 million in fiscal year 1992. For a number of reasons, however, an MRS facility is unlikely to be operating by 1998. First, DOE's plans depend on the negotiator's completing, and the Congress' approving, a siting agreement by the end of 1992 that would permit early development of an MRS facility. However, because the negotiator expects the process to take considerable time, he does not believe that these activities can be completed by then. The negotiator also believes that any prospective host for the facility would require some type of assurance that the MRS facility would not become a permanent substitute for the repository. Second, affected states strongly opposed

DOE's siting activities for an MRS facility and repositories. Tennessee successfully fought DOE's initial attempts to site an MRS facility in that state. In addition, states having potential sites for the first or second repository opposed DOE's siting activities. Nevada vigorously opposes the potential use of Yucca Mountain as a repository site. Finally, the Congress would have to rescind, as DOE has requested, the links between the MRS facility and repository schedules to prevent the facility from adversely affecting the incentive to complete a repository.

DOE's Legal Responsibilities Unclear

Some utilities maintain that, if DOE cannot take delivery of waste by 1998, they will sue DOE. How the courts would interpret DOE's statutory and contractual responsibilities is uncertain. Nevertheless, DOE has no contingency plans for the possibility that it cannot begin accepting waste by 1998. DOE has not determined (1) what, if any, siting activities it will undertake if the negotiator cannot find a site for the MRS facility, (2) whether an "unavoidable delays" provision of DOE's disposal contracts would take effect, and (3) how utilities are likely to react and how DOE should respond. DOE is revising its nuclear waste program mission plan to reflect the current program strategy. GAO believes that this revision is an appropriate and timely vehicle for addressing these issues.

Fund Cannot Be Used to Reimburse Storage Costs

Some utilities argue for compensation from the Nuclear Waste Fund for storage capacity added after 1998 if DOE does not begin storing their waste then. DOE maintains that the act prohibits using the fund for this purpose. GAO agrees. Furthermore, such payments would benefit utilities with the least storage capacity but not those with sufficient capacity.

Utilities Can Store All Waste On-Site

Evidence indicates that virtually all utilities can store their wastes at nuclear plant sites through the licensed 40-year operating lives of the plants and beyond. Therefore, utilities do not need an MRS facility to prevent premature plant shutdowns because of inadequate storage capacity. In the unlikely event that a utility cannot store all of its waste, DOE could provide utility-funded storage at an existing federal facility if the Congress renewed the contract authority in the 1982 act's federal interim storage provision.

Storage Options' Cost and Safety Differences Considered Small

Several studies have concluded that cost differences between waste systems with and without an MRS facility are small, primarily because utilities' costs for on-site storage without an MRS facility would be offset by

the cost of adding the facility to the system. Similarly, studies indicate that risks of storing and transporting waste are very low for both options and the differences between them are insignificant.

Recommendations to the Congress

DOE does not need funds to develop a specific site for an MRS facility until a state or Indian tribe agrees to host a facility at a specific site and the Congress enacts the agreement into law. The negotiator does not expect this to occur by the end of 1992. Therefore, GAO recommends that the Congress withhold any future funds requested by DOE for site-related activities at least until DOE has demonstrated that a state or tribe has agreed, in principle, to host a facility at a specific site. Also, in the unlikely event that one or more utilities cannot store all of their nuclear wastes on-site, GAO recommends that the Congress reinstate contractual authority under the federal interim storage provision of the 1982 act.

Matters for Congressional Consideration

GAO believes that it is highly unlikely that DOE can develop an MRS facility by 1998. Therefore, the Congress may wish to explore, through oversight hearings, whether additional legislation is desirable to address the likelihood that DOE will be unable to begin storing utilities' nuclear waste by 1998. In any such inquiry, the Congress may also wish to consider the issues of (1) equity in reimbursing utilities for their additional storage costs, (2) utilities' capabilities to expand on-site waste storage capacity, and (3) the cost and safety differences between waste storage at these plants and at an MRS facility.

Recommendation to the Secretary of Energy

GAO recommends that the Secretary of Energy develop plans for the possibility that the nuclear waste negotiator may not find a site for an MRS facility and that DOE cannot accept utilities' wastes in 1998. These plans should be discussed in DOE's revised nuclear waste program mission plan. The plans should address DOE's strategies for future MRS facility siting activities, working with utilities to interpret and apply existing waste disposal contracts or modifying them appropriately, and/or working with the Congress on legislative action.

Agency Comments

As agreed with the requesters, GAO did not obtain written agency comments on this report. However, GAO discussed the facts in the report with DOE officials, who generally agreed with their accuracy. Their comments have been incorporated where appropriate.

Contents

Abbreviations

DOE	Department of Energy
GAO	General Accounting Office
MRS	monitored retrievable storage
NRC	Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act of 1982

Introduction

Producing electricity from nuclear reactors creates highly radioactive waste by-products, called spent (used) nuclear fuel, and other high-level wastes which must be safely managed for the thousands of years it takes for the radioactivity to diminish to low levels. About 110 nuclear power plants are currently generating radioactive waste and, together, are storing a total of around 20,000 metric tons of spent fuel, primarily in water-filled pools at each reactor site.

Legislation in the last decade has strengthened the federal role in providing for indefinite safe management of these wastes. The Nuclear Waste Policy Act of 1982 (NWPA) (P.L. 97-425) established a comprehensive national program within the Department of Energy (DOE) primarily to achieve safe permanent disposal of highly radioactive nuclear waste generated by commercial utilities. The act required DOE to develop, site, construct, and operate one permanent repository and select a site for a second repository. Also, DOE was to develop and submit to the Congress a proposal to site and construct one or more monitored retrievable storage (MRS) facilities for the long-term storage of spent fuel.

The act also required DOE to enter into contracts with utilities for disposal of spent fuel. NWPA required that DOE's contracts with utilities for disposal services state that (1) after the repository begins operations, DOE will take title to utilities' spent fuel as soon as possible upon request and (2) beginning not later than January 31, 1998, DOE will dispose of the spent fuel as provided in the act. The costs of disposal and/or storage were to be recovered from the generators and owners of nuclear waste through fees paid into the Nuclear Waste Fund established in the U.S. Treasury. The act also authorized DOE to undertake a demonstration program to explore and perfect alternatives for safely increasing utilities' storage capacity. Finally, the act required DOE to assist utilities in storing their spent fuel by providing limited federal interim storage, if needed.

The Nuclear Waste Policy Amendments Act of 1987 made substantial changes to the nuclear waste program. The amendments directed DOE to investigate a site for a repository only at Yucca Mountain, Nevada, and postponed further work on a second repository for at least 20 years. They also authorized DOE to, among other things, build an MRS facility, but they placed a number of restrictions on DOE's siting activities and the facility's construction schedule and storage capacity. The amendments also established a Monitored Retrievable Storage Review Commission to assess the need for such a facility.

Monitored Retrievable Storage

In NWPA, the Congress found that long-term storage of highly radioactive waste in MRS facilities is an option for safe and reliable waste management. NWPA required DOE to study the need for and feasibility of an MRS facility and submit a proposal to the Congress for constructing and operating a facility capable of providing long-term storage, continuous monitoring, management, and maintenance of the waste, and ready retrievability for further processing or disposal.

DOE's Proposal for and Congressional Authorization of an MRS Facility

On March 31, 1987, DOE submitted its proposal to build and operate an MRS facility at the former Clinch River Breeder Reactor Project site, near Oak Ridge, Tennessee. Two alternative sites for the facility, also in Tennessee, were discussed in the proposal. Although the facility could be used for long-term storage, its principal purpose, according to DOE, would be to receive spent fuel from nuclear power plants in the eastern United States, prepare the waste for disposal, and, if necessary, store them prior to their shipment to a repository in the western United States for disposal. The MRS facility would store the spent fuel using dry storage technology.

Because of intense opposition from Tennessee officials, the 1987 amendments annulled DOE's proposal. In addition, although the amendments authorized DOE to construct and operate an MRS facility, the Congress imposed the following restrictions:

- DOE was prohibited from surveying and evaluating potential sites until after the MRS Review Commission, established by the amendments, submitted its report.
- DOE was prohibited from selecting an MRS facility site until the Secretary of Energy had recommended to the President the approval of a site for development of a repository.
- Any license for an MRS facility issued by the Nuclear Regulatory Commission (NRC) had to provide that the construction of the facility not begin until NRC issued a license for the construction of a repository.
- The amount of spent fuel that could be stored in an MRS facility was limited to 10,000 metric tons until a repository would begin accepting waste, and to 15,000 metric tons at any time.

The MRS Review Commission

In its November 1989 report to the Congress, the MRS Review Commission concluded overall that the MRS facility authorized by the 1987 amendments could not be justified because the facility's capacity and

schedule of operation were linked to the repository's schedule. The Commission found that this linkage in the amendments made it impossible for an MRS facility to be operational more than 3 years before the repository would be available, and, consequently, the value of the MRS facility was greatly diminished. According to the Commission, with this linkage, most of the need for the MRS facility would disappear because utilities would have to make other storage arrangements. However, the Commission concluded, if (1) the linkage were removed, (2) the MRS facility were constructed at an early date, and (3) the repository were delayed considerably beyond 2003 (the date by which DOE then expected to have a repository operating), then the advantages of an MRS facility might justify its construction. The Commission also found that a waste management system—the system of all activities directed towards removing waste from reactor sites and ultimately disposing of them in a repository—with an MRS facility would be somewhat more costly than one without such a facility, although the relative cost of an MRS facility decreases the longer the repository is delayed.

Nevertheless, the Commission also concluded that some interim storage facilities—substantially more limited in capacity and built under different conditions than the authorized MRS facility—are in the national interest to provide for emergencies and other contingencies. Therefore, the Commission recommended that the Congress

- authorize the construction of a federal emergency storage facility, with a capacity limit of 2,000 metric tons, to assist in the event of an accident at a nuclear power plant;
- authorize the construction of an interim storage facility, with a capacity limit of 5,000 metric tons; and
- reconsider the subject of interim storage by the year 2000.

The emergency facility would be financed from the Nuclear Waste Fund because the facility would be used primarily for emergency purposes, serving as "insurance" for the entire industry. The interim facility would be funded by individual users rather than by all utilities that pay fees into the Nuclear Waste Fund. To date, the Congress has taken no action on the Commission's recommendations.

Position of Nuclear Waste Negotiator

The 1987 amendments also established the position of the nuclear waste negotiator for a 5-year period ending in January 1993. The negotiator, who is independent of DOE, is empowered to (1) find a state or Indian tribe willing to host a repository or an MRS facility and (2) negotiate with

the governor or tribal leader the terms and conditions under which the prospective host would accept either facility at a technically qualified site. According to the amendments, any agreement negotiated with a governor or tribal leader may include whatever terms and conditions—including financial and institutional arrangements—that the parties determine to be "reasonable and appropriate." The negotiator has stated that the amendments authorize him to include in a proposed agreement a wide range of benefits and resources to assist the host, which could include federal contributions to public programs, projects, and problem solving in the jurisdiction. According to the negotiator, among the benefits that can be included are "any other type of assurance, equity, or assistance desired by the state or Indian tribe." The negotiator has also stated that any type of benefit or equity arrangement may be specified for negotiation by the potential host and the benefits need not be directly related to the facility. However, all proposals for benefits and the total fiscal effects of an agreement are subject to congressional review, and the agreement would be effective only if enacted into law.

The position of negotiator was filled in August 1990. Since that time, the negotiator and his staff have (1) set up offices in both Washington, D.C., and Boise, Idaho; (2) performed background research to develop a technical understanding of waste management facilities and the history of attempts to site them; (3) visited several nuclear facilities; (4) consulted with persons experienced in siting and operating controversial facilities; (5) attended technical conferences; (5) evaluated the social aspects of successes and failures in siting waste facilities; (6) signed a memorandum of understanding with DOE; and (7) concentrated on developing a sound process for negotiating with states and Indian tribes. According to the negotiator, he avoided prematurely contacting state and tribal governing officials because he is committed to treat all states and tribes "equally and openly" and to avoid even the perception of "back-room dealing"; therefore, he has avoided activities that might be perceived as directed towards a specific site.

In May 1991, the negotiator first contacted governors and tribal leaders by providing them general information on NWPA, its amendments, and the negotiator's office. In October 1991, the negotiator plans to issue a formal request for expressions of interest to states and Indian tribes; however, he said that prior to that time, he will be prepared to conduct preliminary discussions with any interested governing officials.

DOE's Assistance for On-Site Storage of Spent Fuel

NWPA stated that owners and operators of civilian nuclear power reactors are solely responsible for storing their spent fuel until the spent fuel is disposed of by DOE. To meet this responsibility, the utilities are to (1) maximize the effective use of existing storage facilities—primarily water-filled storage pools—at each reactor site and (2) add new on-site storage capacity in a timely manner where practical. The NWPA also required DOE to assist utilities in storing their spent fuel by encouraging and expediting these activities.

Storage Technology Demonstration Programs

NWPA required DOE to encourage and expedite on-site storage activities by establishing a cooperative program with utilities to demonstrate the use of dry storage technologies at reactor sites. The goal of these programs was to demonstrate one or more dry storage technologies that NRC could approve, by rule, for use by utilities.[1] The act also encouraged the development of technology for consolidating spent fuel to expand capacity in existing storage pools.

In 1984, DOE entered into cooperative agreements with Virginia Power Company to demonstrate the use of metal dry storage casks at the Surry Nuclear Plant site and with Carolina Power and Light Company to demonstrate the use of horizontal concrete modules for dry storage at the H. B. Robinson site in South Carolina. Spent fuel is now in storage in independent spent fuel storage installations at these two sites. On the basis of the success of these demonstration programs, a number of other utilities have applied and/or are planning to apply for approval to use dry storage technologies to expand on-site storage capacity. In addition, on the basis of information generated by these demonstration programs, NRC recently established a rule that allows utilities, without applying for site-specific approval, to use a number of approved dry storage cask designs at reactor sites after first notifying NRC of the intention to do so. Once a cask has been approved by NRC for use at a reactor site under this rule, it may also be used by other utilities without site-specific approval. NRC expects that this rule will greatly facilitate the use of dry storage technologies at reactor sites.

Also, as authorized by NWPA, DOE participated with Northeast Utilities to demonstrate the consolidation of spent fuel in the storage pool at the

[1]Dry storage involves removing spent fuel from a storage pool and placing it in a dry metal or concrete cask. The cask is then sealed, stored above ground, and continually monitored. This technology is expected to be used both by utilities for future on-site storage and at an MRS facility.

Millstone Unit 2 reactor. Subsequently, NRC approved Northeast Utilities' storage of this fuel on-site.

Federal Interim Storage

NWPA also authorized DOE to provide limited interim storage capacity at federal facilities or reactor sites to prevent disruptions in the orderly operation of any civilian nuclear power reactor due to its inability to adequately store spent fuel on-site. Utilities needing interim storage were to have entered into contracts with DOE by January 1, 1990; however, no utilities requested such storage. Interim storage, if it had been used, was to have been paid for by users through fees collected and deposited into a separate Interim Storage Fund.

DOE's Study of Dry Storage

The 1987 amendments required DOE to evaluate the use of dry storage technology for temporarily storing spent fuel at reactor sites. DOE submitted a study on dry storage to the Congress in February 1989.[2] In its study, DOE discussed

- on-site storage requirements;
- options for increasing on-site storage capacity, such as using dry storage technologies;
- cost estimates for each storage option;
- potential effects of these technologies on health, safety, and the environment; and
- the effects of transporting spent fuel under each storage option.

DOE concluded that the existing on-site storage technologies are technically feasible, safe, and environmentally acceptable options for storing spent fuel until a federal facility is available to store or dispose of the waste.

DOE also addressed whether the Nuclear Waste Fund could and should be used to fund dry storage at reactor sites. DOE concluded that NWPA does not appear to authorize using the fund to finance dry storage at reactor sites and, therefore, that it should not be used for this purpose.

Objectives, Scope, and Methodology

The Chairman, Senate Committee on Commerce, Science, and Transportation, and Senator Richard H. Bryan requested that we review the alternatives of storing spent fuel exclusively at reactors and developing

[2]Final Version Dry Cask Storage Study (DOE/RW-0220, Feb. 1989).

an MRS facility. They specifically asked us to determine (1) whether an MRS facility can be available by 1998; (2) if a facility is not available by 1998, what the legal implications would be; (3) whether utilities should be reimbursed from the Nuclear Waste Fund for on-site storage capacity that must be added after 1998 if DOE cannot begin storing spent fuel; (4) whether utilities can store all of their spent fuel at reactors until a repository is operating; and (5) what the relative costs and safety of the two storage options are.

To determine whether an MRS facility can be in place by 1998, we reviewed DOE planning documents, the legislative history of NWPA, and records of past efforts to site MRS and disposal facilities. We also interviewed DOE officials, utility representatives, and the nuclear waste negotiator for their views on DOE's ability to have an MRS facility by 1998.

To determine the legal implications of DOE's inability to take delivery of utilities' spent fuel by 1998, we reviewed NWPA's legislative history and DOE's disposal contract with utilities. We also obtained the opinion of DOE's General Counsel concerning DOE's legal responsibility under NWPA and its contract with utilities.

To determine whether utilities should be reimbursed for storage capacity added after 1998, we reviewed NWPA and its legislative history to determine whether the Nuclear Waste Fund can be used for this purpose. We obtained the opinion of DOE's General Counsel on this issue as well. To determine the equity of compensating only the utilities that require additional storage capacity, we reviewed the MRS Review Commission's report and DOE's Final Version Dry Cask Storage Study, and discussed the issue and its implications with representatives of the Edison Electric Institute and a number of individual utilities.

To determine whether utilities can provide sufficient on-site storage capacity, we reviewed (1) DOE's Final Version Dry Cask Storage Study, (2) NRC's Waste Confidence Proceeding,[3] and (3) the report of the MRS Review Commission. In conjunction, we discussed this issue with officials of NRC and the utility industry.

To compare costs for the storage options, we relied primarily on information contained in DOE's studies of dry storage and waste systems (the

[3]NRC's Waste Confidence Proceeding was intended to determine (1) how much assurance there is that radioactive waste can be safely disposed of, (2) when disposal or off-site storage facilities will be available, and (3) whether radioactive wastes can be stored safely on-site past the expiration of existing facility licenses until off-site disposal or storage is available.

latter prepared for the MRS Review Commission) and the MRS Review Commission's report and supporting studies by contractors. In addition, we obtained cost information from Virginia Power Company on its dry storage installation at the Surry plant. We used the utility's data mainly for comparison with the estimates contained in DOE's dry storage study. We did not independently verify the cost data obtained from these sources.

To compare the safety of the storage options, we considered the safety issues for both storage and transportation. We primarily reviewed studies that have extensively addressed these issues. Sources included (1) DOE's dry storage and waste system studies, (2) data—on the safety of continued storage of spent fuel at reactor sites—supporting NRC's Waste Confidence Proceeding, (3) an NRC study on transportation risks, and (4) the MRS Review Commission's report, and several supporting studies prepared by contractors. We supplemented and updated this information through discussions with officials of DOE and NRC; information obtained at related technical conferences; and discussions with industry representatives, such as officials of the Edison Electric Institute, the Association of American Railroads, Virginia Power Company, Baltimore Gas and Electric Company, and others.

We did not obtain formal agency comments on this report. However, we discussed the facts contained within with responsible agency officials and have incorporated their comments where appropriate. These officials generally agreed that the facts presented in this report are accurate. We believe that written agency comments were not necessary in this instance.

Our review was conducted between December 1989 and May 1991, and the information updated through July 1991. We did not independently verify the accuracy or the methodology of the studies reviewed in preparing this report. Except as noted above, our review was conducted in accordance with generally accepted government auditing standards.

An MRS Facility Is Unlikely to Be Operating by 1998

DOE plans to develop an MRS facility to begin accepting utilities' spent fuel by January 31, 1998. DOE is pursuing this effort, in part, because a repository that the Congress expected to be completed by 1998 will not be available until 2010 at the earliest. However, DOE bases its planned schedule for an MRS facility on several events that are not likely to occur. First, the nuclear waste negotiator must find a volunteer site, conclude an agreement, and obtain congressional approval for it. The agreement may either not contain linkage to a repository, or the linkage it contains may be different from the existing statute. In either case, congressional approval of the agreement might also pave the way for legislative modification or repeal of the statutory linkage. To have an MRS facility available by 1998, all of these activities, according to DOE, must be completed by late 1992. However, because the negotiator expects the negotiating and approval process to take considerable time, he does not believe that this can be accomplished by that deadline.

In addition, the negotiator does not believe that any state or Indian tribe will agree to host an MRS facility without some type of links to the repository to provide assurances that the facility will not become permanent. Furthermore, if the Congress were to approve an agreement removing or modifying the linkage and, therefore, permit an MRS facility to be operating by 1998, it would be reversing its position on the need for the linkage to prevent the MRS facility from becoming a substitute for the repository. Finally, public opposition in the past has prevented the siting of an MRS facility and has hindered the siting and development of other waste facilities; this factor is likely to play a significant role in current efforts to site an MRS facility.

Although DOE is unlikely to have an MRS facility available, utilities plan to litigate if DOE does not begin removing their spent fuel in 1998. They have said that they will seek reimbursement for the costs of additional on-site storage beginning in that year. The Congress knew, when it linked the MRS facility to the repository, that the type of linkage being imposed would almost certainly prevent DOE from accepting spent fuel by 1998. For that reason and others, it is questionable whether DOE is legally bound by that date. Although there are a number of ways a court might interpret DOE's legal responsibilities under NWPA and its disposal contracts, it is impossible to predict the outcome of potential litigation with any precision.

In any event, the Nuclear Waste Fund legally cannot be used to reimburse utilities for constructing additional storage facilities. Even if such reimbursement were legal, any compensation to utilities for expanding

storage capacity would be inequitable because all utilities pay fees into the fund at the same rate and the benefits would be distributed unequally among them. In the meantime, DOE is requesting about $100 million over the next 3 fiscal years to have the MRS facility operating by 1998, and it is not planning for the possibility that it may not have a facility by then.

DOE Plans to Have an MRS Facility by 1998

In its 1989 reassessment of the nuclear waste program, DOE reaffirmed its support for an MRS facility as an integral part of the waste management system. Because DOE does not expect to have a repository available until at least 2010, an MRS facility operating by 1998 could permit DOE to begin storing utilities' spent fuel at that time. According to DOE, in addition to being critical to its ability to accept spent fuel, an MRS facility would allow DOE to better meet other strategic objectives, such as having permanent disposal be timely, demonstrating DOE's commitment and ability to implement the waste management system, developing confidence in waste program schedules, and making the waste system more flexible. The director of DOE's Office of Civilian Radioactive Waste Management recently commented to us that

> . . .the MRS [facility] provides the efficiency, reliability, and flexibility the spent fuel management system needs. The key factor is the fact that containers used for spent fuel receipt and transport cannot be used for disposal, and a variety of technologies is needed for receipt and transport. A place and means to prepare spent fuel for disposal are therefore needed. Time is needed to select, test, and apply the technology needed for disposal containers. The MRS [facility] meets these needs. The MRS [facility] also provides surge storage capacity for the system; provides the means to fulfill the NWPA mission to begin spent fuel receipt in 1998; and implements national policy aimed at avoiding deferral of waste management to future generations.

DOE believes that revising the statutory linkage and storage capacity limit imposed by the 1987 amendments would allow the advantages of an MRS facility to be realized more fully. According to DOE, without the statutory linkage, the facility could start operations as early as 1998 and, therefore, would enhance confidence in the nuclear waste program. With the linkage between the MRS facility's and repository's schedules, an MRS facility could not be available, according to DOE, until about 2007. To accomplish its objective of having an MRS facility by 1998, DOE is undertaking a number of activities. First, DOE is seeking to remove the linkage through proposed legislation that would implement the National Energy Strategy. If the Congress passes this legislation, DOE possibly could have an MRS facility operating by 1998, if (1) a site is identified by

the end of 1992, (2) DOE's schedule for licensing and building the facility is accurate, and (3) DOE encounters no problems that might delay construction and operation of the facility by 1998.

In addition to proposing legislation, DOE is relying on the nuclear waste negotiator to identify a state or Indian tribe willing to host the MRS facility. DOE plans to provide the negotiator with information, studies, and other support as requested. In addition, in June 1991, DOE formally invited states, tribes, and local governments that might be interested in hosting an MRS facility to apply for financial grants to assess the feasibility of siting the facility within their jurisdictions. These grants are designed to assist a prospective host working with the negotiator in making an informed decision on hosting the facility. DOE has allotted about $1.1 million for these grants in fiscal year 1991.

Rather than undertake its own siting activities, DOE prefers that an MRS facility site be selected through the efforts of the nuclear waste negotiator, especially if these negotiations result in the state or Indian tribe agreeing to host the facility without any linkages to a repository. According to the Director of DOE's Office of Civilian Radioactive Waste Management,

> . . . [S]ince DOE's experiences in siting waste management facilities have been contentious and time-consuming, a policy decision was made to afford the Negotiator the maximum opportunity and time to consummate an agreement, consistent with the MRS [facility] opening date of 1998, before taking any DOE siting activities.

How rapidly an MRS facility could begin operating and how much spent fuel it could store would depend on the agreement arranged by the negotiator and then approved by the Congress. DOE believes, however, that, in principle, a negotiated agreement is a potentially effective way to timely develop the facility, thus allowing its advantages to be more fully realized.

If the Congress does not agree in advance to remove the linkage, DOE must rely solely on the negotiator to make it possible for an MRS facility to be operating by 1998. To meet this date, DOE assumes that the negotiator will (1) identify a voluntary host, (2) negotiate an agreement that would not contain any linkage to the repository's schedule, and (3) obtain the Congress' approval of the negotiated agreement and removal of the statutory linkage by the end of 1992.

DOE's fiscal year 1992 budget request would increase funding for the MRS program to have the facility operating by 1998. DOE requested $32 million to $34 million over each of the next 3 fiscal years (1992 through 1994) for the MRS program. The fiscal year 1992 budget request is based on identifying an MRS facility site during that year. According to DOE, the 266 percent increase over the approximately $9 million appropriated for the program in fiscal year 1991 is due to accelerating the pace of the program to support the negotiated siting process and a schedule allowing DOE to begin accepting waste in 1998. Fiscal year 1992 activities would include (1) initiating and completing preliminary facility designs, (2) completing an environmental assessment of a site, (3) begin preparing a license application for NRC, including preparing and submitting topical reports, (4) planning an environmental impact statement, (5) beginning demonstrations of an MRS facility prototype, (6) acquiring the site, and (7) preparing permit applications.

MRS Facility by 1998 Is Doubtful

For a number of reasons, it is unlikely that DOE will meet its objective to have an MRS facility operating by 1998. First, DOE is being optimistic in assuming that the Congress will reverse the position it took in the 1987 amendments by removing or modifying the linkage between the MRS facility's and repository's schedules. Second, past experience by DOE in trying to site nuclear waste facilities indicates it is unlikely that a state or Indian tribe would be willing to host the MRS facility. Third, even if a state or tribe should come forward, the nuclear waste negotiator does not expect to have an agreement in time to meet DOE's objective because of the expected length of time needed for the negotiation and approval process. Finally, the negotiator believes that a state or tribe, out of concern that the waste might remain at the site permanently, would be unlikely to agree to host an MRS facility without some form of assurance or linkage to the repository's schedule.

Concern Exists That MRS Facility Could Become Permanent Storage Site

A major concern throughout the legislative history of NWPA was the possibility that an MRS facility would become a permanent storage site—a "de facto" repository—by removing the impetus for permanently disposing of nuclear waste in a repository. A prospective host for the facility would likely share this concern because spent fuel, once placed in an MRS facility for storage, could remain in the host's jurisdiction indefinitely if a repository is not completed.

In the 1987 amendments to NWPA, the Congress addressed the need to assure that spent fuel stored at an MRS facility would be removed to a

repository in a timely manner. To provide this assurance, the Congress found it necessary to ensure continued progress towards having a repository once an MRS facility begins operations. Therefore, the Congress linked the development of an MRS facility to the repository's schedule so that the facility could not be constructed and operate without specific progress towards having a repository. Consequently, because DOE does not expect to receive NRC's authorization to construct a repository at Yucca Mountain until 2004, DOE estimates that it could not, with the linkage in place, have an MRS facility operating before about 2007.

DOE's MRS policy is based on the assumption that a potential host state or Indian tribe will agree to, and the Congress will approve, an agreement that would allow an MRS facility to begin operating in 1998. DOE is relying primarily on the nuclear waste negotiator to accomplish these tasks by the end of 1992. DOE's conviction that an MRS facility will be available by 1998 through the negotiator's efforts is based on the assumption that the Congress will reverse its position on the need for the linkage if a state or tribe—knowing that a repository will not be available at least until 2010—is willing to accept an MRS facility that can be operating as early as 1998.

A volunteer host for the MRS facility may negotiate into an agreement whatever assurances it needs to guarantee that the facility does not become permanent. However, what such assurances might be and whether these might also prevent an MRS facility from operating by 1998 depend on the specific concerns of a prospective host and cannot be known at this time. It is possible that such assurances might be just as restrictive as the current linkage. If the assurances are less restrictive but still satisfactory to the prospective host, they may not be sufficient to convince the Congress that the MRS facility would not become a "de facto" repository.

In parallel with the nuclear waste negotiator, DOE could begin its own MRS site selection process in an attempt to have a site by late 1992 so that an MRS facility could be available by 1998. In such a case, it is logical to assume that any site selected by DOE would not be within the jurisdiction of a state or Indian tribe that would willingly accept the facility. (If a state or tribe were a willing host, it should be working with the negotiator and, therefore, DOE's involvement in the site selection process would be unnecessary.) Under these circumstances, therefore, DOE would have to try to force an MRS facility on an unwilling recipient. It is questionable whether the Congress would support DOE over a proposed site's objections. As discussed below, the Congress did not support DOE's

initial proposal to site the MRS facility in the state of Tennessee over the objections of that state, and, in the 1987 amendments, voided DOE's selection of the preferred and alternative Tennessee sites.

Even if DOE were to gain congressional support to locate an MRS facility at the site it chose, the linkage to the repository's schedule would still have to be modified or removed to have the facility in 1998. DOE has included a provision in proposed legislation to implement the National Energy Strategy that would, if enacted, repeal the linkage. Whether the Congress will enact this legislation with the MRS provision intact is also questionable.

States Reluctant to Host MRS Facility

The key barrier to siting an MRS facility is the reluctance of states and tribes to accept it in their jurisdictions. Experience in trying to site nuclear waste facilities suggests that no state or tribe will volunteer to host an MRS facility. DOE's experience with Tennessee provides an example. In April 1985, DOE identified three sites in Tennessee for an MRS facility. Although the local community at the primary site near Oak Ridge supported the proposed facility, state officials strongly opposed siting the facility in the state. Subsequently, in the 1987 amendments act, the Congress nullified the selection of that site and the two alternative sites DOE had selected.[1] In addition, DOE encountered vigorous opposition from all states initially identified as having potential repository sites.

Because of the uncertainties in the repository's schedule, states and tribes may be even more reluctant now to host an MRS facility out of concern that the facility might become a long-term or permanent storage facility. Since DOE selected the three original sites in Tennessee, its scheduled date for opening a repository has slipped 12 years. A number of factors could cause this date to slip even further. For example, Nevada has vehemently opposed DOE's efforts to develop a repository at Yucca Mountain by refusing, until June 1991, to act on three DOE applications for environmental permits, and by denying DOE access to the site to investigate its suitability for a repository. In June 1991, Nevada issued one of the three permits and issued a second permit in July 1991. According to DOE officials, although a third permit—for water appropriation—has not yet been granted, DOE has been able to circumvent this

[1]The nullification of the sites in Tennessee does not preclude these sites from being considered by DOE or the negotiator in the new selection process; however, these sites, which have already been studied and found suitable for an MRS facility, are to be considered by DOE on the same merits as any other sites.

problem by purchasing water in California and shipping it to Yucca Mountain. Therefore, DOE can now proceed with surface-based testing at the Nevada site. Whether and when other permits that DOE needs will be issued by Nevada and what the ultimate effects might be of any further delays in the permitting process on the repository's schedule are unknown.

Furthermore, if DOE gains unrestricted access to Yucca Mountain to investigate the site, it could find the site unsuitable for a repository. In this event, DOE would have to develop recommendations to the Congress for its consideration on how to proceed with the nuclear waste program.

Negotiated Agreement Within DOE's Schedule Unlikely

To overcome states' and Indian tribes' opposition to hosting an MRS facility, DOE is relying on the nuclear waste negotiator to identify a willing state or tribe and negotiate an agreement. According to DOE, an agreement without the current linkage to the repository's schedule must be negotiated and approved by the Congress by late 1992 to have an MRS facility operating by 1998. A number of factors, however, make successfully siting and operating an MRS facility by 1998 through this approach doubtful.

The position of nuclear waste negotiator expires in January 1993. The negotiator was not selected and confirmed until August 1990—more than 2-1/2 years into his 5-year term. The negotiator made initial contacts with states and tribes—through introductory letters to all governors and tribal leaders providing general information on his role and the negotiation process—in early May 1991. Furthermore, the negotiator plans to make a formal request for expressions of interest by states and tribes "willing to seek a preliminary dialogue" before October 1991. By that time, 15 months will remain to identify interested states or tribes and negotiate an agreement. The negotiator told us that even with a very aggressive effort, it is unlikely that he can negotiate and gain approval of an agreement by late 1992. In addition, the negotiator said that while he is aware of DOE's objective of having an MRS facility by 1998, his negotiation effort is not driven by that goal. He stated that his goal is to negotiate a siting agreement however long it takes, not to try to meet DOE's objective. For these reasons, the negotiator said, he does not think it is possible to negotiate and gain approval of a siting agreement consistent with DOE's current objective of having an MRS facility by 1998.

According to the negotiator, any negotiated agreement is likely to contain some type of linkage to DOE's repository program. A prospective host state or tribe would probably insist on assurances that spent fuel stored at the MRS facility would eventually be removed. He added that the nature of such assurances and the effect they might have on the MRS facility's construction and operating schedule cannot now be foreseen.

Not Having MRS Facility in 1998 Would Have Legal Implications

If an MRS facility is not operating by January 31, 1998, DOE will be unable to meet what the utilities consider to be a commitment to store or dispose of spent fuel from utilities by that date. NWPA, as amended, the relevant legislative history, and DOE's disposal contract with utilities are not clear on what the potential implications of this occurrence would be. However, if DOE cannot store and/or dispose of utilities' spent fuel by 1998, they may sue DOE.

NWPA's and Contract's Requirements

In NWPA, the Congress found that the owners and generators of spent nuclear fuel have the primary responsibility to provide storage until the waste is disposed of by DOE (sec. 111(a)(5)). Utilities are responsible for paying all the costs associated with at-reactor storage and for paying fees established to recover the full cost of DOE providing storage in an MRS facility and permanent disposal in a repository. Regarding the conditions under which DOE will accept this spent fuel, the act (sec. 302(a)(5)) requires DOE's contracts with utilities to provide that

- after a repository begins operations, DOE will take title to (legal ownership of) spent nuclear fuel as expeditiously as practicable upon the generator's or owner's request, and
- in return for the payment of established fees, DOE, beginning not later than January 31, 1998, will dispose of the spent fuel as provided in the act.

As originally included in NWPA, these two requirements were compatible because it was generally anticipated that a repository would be operating by or before 1998. However, because a repository will not be operating before 2010 at the earliest, the two requirements now seem to conflict with each other.

DOE's disposal contract, however, combines NWPA's requirements to "take title to" and to "dispose of" spent fuel under the term "services." The contract states that the disposal "services" DOE will provide shall begin "after commencement of facility operations, not later than January 31,

1998." The contract defines a "facility" as either a repository or an MRS facility. The contract does not state which of the two phrases—"after commencement of facility operations" or "not later than January 31, 1998"—takes precedence if a facility is not operating by 1998. DOE believes that the contract obligates it to take possession of spent fuel by the end of January 1998 only if either a repository or an MRS facility is operating at that time.

Possible Court Interpretations of DOE's Legal Responsibilities

Because DOE is likely to be challenged in court if it is unable to accept spent fuel by 1998, we reviewed NWPA and its legislative history and identified four possible interpretations that a court might construct in determining DOE's responsibilities under the act and the disposal contracts. However, at this time, it is not possible to predict with confidence the basis of the suits, the defenses that may be offered, and the eventual outcome.

The first plausible interpretation a court might find is that an operating repository is a necessary condition for DOE to meet both requirements stated in NWPA. This interpretation is based on a number of factors: (1) accepting title to the waste is a prerequisite to "disposal," and NWPA states that DOE is obligated to take title to the spent fuel only after a repository begins operations; (2) NWPA's definition of disposal—"emplacement in a repository"—implies that a repository would be available; and (3) the legislative history suggests that behind NWPA's requirements was the assumption that a repository would be operating by 1998. Under this interpretation, DOE would not be obligated to accept title to or dispose of nuclear waste until a repository is operating. (In the contract with utilities, DOE has expanded this requirement so that its obligation begins when either a repository or an MRS facility begins operating.)

Second, because NWPA's requirements to accept title to and dispose of the waste would conflict if a repository is not operating in 1998, a court might interpret the two requirements to be separate and distinct. Under this approach, DOE would not be obligated to accept title to nuclear waste until a repository is operating. However, DOE would be responsible for disposing of the waste beginning in 1998. This approach does not address the interdependence between the two requirements, nor recognize that taking title is a prerequisite to disposal.

Third, a court could interpret the requirement to dispose of waste as a modification of the obligation to accept title to them. Under this interpretation, the requirement to "dispose of" the waste "beginning not later than January 31, 1998," also requires DOE to accept title to them by that date. DOE's obligation to take title to the waste would no longer depend on the "commencement of repository operations"; instead, the date by which DOE is to dispose of waste is the key focus. However, if neither a repository nor an MRS facility is available, DOE would have to take title to the spent fuel but leave it at reactor sites. In DOE's opinion, however, NWPA does not permit the agency to use the Nuclear Waste Fund to pay for on-site storage.

Finally, a court could interpret the requirement "to dispose of" waste as not restricted solely to the statutory term "disposal." To interpret the two statutory requirements consistently, a court might find that NWPA's direction "to dispose of" the waste by a certain date, in exchange for the payment of fees under the contract, refers to DOE's overall responsibility to enter into contracts by that date that would obligate DOE to provide "disposal" services.

We believe that the Congress' decision to establish, in the 1987 amendments, a link between the MRS facility's and repository's schedules is consistent with the first interpretation—that DOE is not required to accept title to or dispose of waste until a repository is available. The Congress' action suggests that it found DOE's ability to begin storing spent fuel by 1998 less important than ensuring continued progress on a repository.

In DOE's first amendment to its mission plan—the principal strategy document for the program—which it submitted to the Congress in June 1987, DOE stated that it did not expect to receive an NRC construction permit for the repository until early 1998. Based on that projection, DOE further estimated that the repository would not begin operating until 2003. The delay in repository operations left an MRS facility as the sole means by which DOE could accept spent fuel in 1998—the date Congress originally included in the NWPA on the expectation that the repository would be ready. Consistent with these developments, DOE proposed the Tennessee site and requested authorization to build the MRS facility. There was no linkage to the repository in DOE's MRS proposal.

In responding to 1987 prehearing questions from the Senate Environment and Public Works Subcommittee on Nuclear Regulation, DOE also stated that the MRS facility was critical to meeting a 1998 date. That

Subcommittee was in the process of considering legislation that would become the 1987 amendments. Intending to spur continued progress toward completion of the repository, the final language of the 1987 amendments contained linkage between the MRS and the repository at two points. Site selection for the MRS facility was held in abeyance until the President recommended a site for the repository and construction of the facility was made contingent on NRC's issuance of a construction permit for the repository. Given DOE's best estimate at the time that a repository construction permit would not be issued until early 1998, the newly enacted linkage meant that meeting a 1998 date for opening the MRS facility became very questionable.

These events suggest that at a minimum, the Congress meant to subordinate the importance of the statutory 1998 date. If this interpretation of the legislative history is correct, it supports the first interpretation of the statute; that DOE has no obligation to take title to or dispose of waste in 1998, if no facility is available then. Of course, there are other readings that might be given to this legislative history, and the ultimate resolution of these matters will only come from legislative action to clarify the statute or a final judicial determination of the matter.

If utilities sue DOE because it is unable to store or dispose of their nuclear waste in 1998, the agency could respond that it is not obligated to begin accepting or disposing of waste in 1998 unless there is some facility operating. Alternatively, it could argue impossibility of performance under the act and the contract. Another possibility is that DOE might elect to invoke the "unavoidable delays" provision of the standard contract. The contract states that neither DOE nor the utilities are liable for damages caused by the failure to perform their obligations if the failure is due to causes "beyond the control and without the fault or negligence of the party failing to perform."

In its response to questions prior to the April 23, 1987, hearings, DOE stated that if delays in any DOE facility prevent it from providing disposal services by January 31, 1998, the contract's provisions relating to delays will become operative. According to DOE, if avoidable delays—those within the "reasonable control" of DOE or the utilities—occur, the contract allows for an equitable adjustment of charges and schedules to reflect additional costs incurred. DOE stated that unavoidable delays would result in no financial liability and require only a readjustment of schedules to accommodate the delays. More recently, however, DOE stated that it has made no policy decisions on its course of action if no

DOE facility is available by 1998 and has not explored how and under what conditions the contract's "unavoidable delay" provision might be implemented.

Utilities Might Seek Compensation for On-Site Storage Added After 1998

NWPA states that the owners and generators of spent fuel have the sole responsibility to provide for, and pay the costs of, storage at reactor sites. Nevertheless, utilities and their representative organizations have stated that if DOE cannot meet what they see as DOE's firm, binding commitment to begin accepting spent fuel by 1998, they will likely demand some kind of financial reimbursement for the additional on-site storage costs they would incur after that date. This compensation has been suggested in a number of forms: direct payment to utilities from the Nuclear Waste Fund, a credit against fees paid to the fund, and payment to utilities from DOE's general appropriations. Yet direct compensation would give a greater benefit to those utilities requiring the most additional storage. This raises questions of equity.

Legal Restrictions on Use of Fund

On the basis of our review of the NWPA, as amended, we agree with DOE's position that the Nuclear Waste Fund cannot be used to finance on-site storage of wastes. This also suggests that DOE cannot reimburse utilities through credits against payments into the fund. Both forms of compensation would require legislation to implement. Legislation has been proposed that would allow all utilities to deduct a portion of their fee payments after January 31, 1998—to offset the expenses of storing spent fuel generated after that date—until DOE accepted the spent fuel at some facility.[2]

Differential Distribution of Benefits

Assuming that compensation for additional storage capacity was limited to utilities that constructed additional storage, reimbursement by either direct payments from the Nuclear Waste Fund or credits against future payments into the fund would essentially distribute benefits unequally among utilities. Because utilities' storage capacity situations differ from one another, the benefits of reimbursement for additional storage capacity needed until DOE can begin accepting the waste would be different. Some utilities—particularly those with newer reactors—have already invested in sufficient on-site storage capacity to accommodate

[2]The present fee is 1 mil—one-tenth of one cent—per kilowatt-hour of electricity generated by nuclear power. The proposed credit would be a deduction from fees of 0.56 mil per kilowatt hour.

all of the spent fuel generated over the life of their plants and, therefore, will not need to add any storage capacity in the foreseeable future. Other utilities, however, will require significant amounts of additional storage capacity if DOE does not begin to store or dispose of spent fuel in 1998. Between these two extremes are other utilities that will need to add varying amounts of storage capacity. Because all of these utilities pay fees into the Nuclear Waste Fund at the same rate, using the fund to reimburse utilities needing additional on-site storage capacity after January 1998 would result in all utilities' subsidizing the costs of the additional storage needed in varying amounts at only some reactor sites. Thus, utilities that have already provided sufficient on-site storage capacity would essentially pay for, but not benefit from, the reimbursements from the fund. In effect, these utilities would pay for storage capacity needed by other utilities.

A secondary effect of using the Nuclear Waste Fund to compensate utilities would be a potential shortfall in funds necessary for constructing and operating the nuclear waste management system. If DOE used the fund to reimburse utilities for their on-site storage costs after January 1998, it would still need to ensure that the disposal fee charged to all nuclear utilities is high enough to recover the costs of constructing and operating the repository and/or the MRS facility. This would increase disposal costs for all utilities—both those that did and did not benefit from the reimbursements—and for all the utilities' ratepayers. This fee increase may, depending on its size, offset the benefits of the reimbursement to those receiving it. Those utilities not benefitting from the reimbursement would again be penalized by having to pay higher fees for benefits accruing to others.

Finally, the proposal to reimburse utilities' additional storage costs beginning in 1998 from another of DOE's appropriation accounts would mean that all taxpayers would bear these storage costs. However, as with any reimbursements from the fund, the benefits of this form of compensation would be differentially distributed among utilities. Moreover, whether the Congress would provide such compensation in a time of tight budgetary conditions is uncertain.

The most equitable approach would be for utilities to continue to pay the costs of storing their spent fuel on-site until DOE can begin removing it for storage or disposal. Each utility would expand its storage capacity on-site as needed at its own expense. By this means, a given utility—and its ratepayers—would directly benefit from its own expenditures. No utility would have to indirectly pay for another's needed storage

capacity, as would be the case with reimbursement from the fund. In addition to being the most equitable approach, it is also consistent with NWPA, which assigns the utilities the responsibility for storing the spent fuel and paying the associated costs.

Finally, the utilities' threatened lawsuits would likely be based on DOE's contracts. If DOE is unable to take possession of spent fuel in 1998 and a court finds either that DOE is not required by contract to accept spent fuel until a facility is available or that an unavoidable delay has prevented DOE from performing, apparently the agency would have no financial liability. Consequently, under these circumstances, compensation to utilities for storage capacity needed beginning in 1998 would not be called for.

DOE Has No Contingency Plans

Despite the evidence that an MRS facility is unlikely to be operating by 1998, DOE is reluctant to acknowledge this possibility. In September 1990, we directed a number of questions to DOE's General Counsel regarding DOE's obligation to accept and dispose of spent fuel under NWPA and its contracts with utilities. In a February 7, 1991, reply, DOE's General Counsel stated, ". . . DOE anticipates that acceptance of the materials at an MRS facility can begin in 1998." Not only is DOE too optimistic in assuming that an MRS facility will be operating by 1998, but also it has no contingency plans if this does not occur.

We asked DOE's General Counsel for DOE's position on whether the contract provisions relating to unavoidable delays in meeting the terms of the contract would become operative if it is unable to accept spent fuel in 1998. In his response, DOE's General Counsel stated that ". . . It would be appropriate to consider the effect of such contract provisions only after all the facts and circumstances are known. Therefore, the Department has not considered what actions it may pursue or whether the contract provision dealing with delays may become operative if no facility is available."

Furthermore, there is no evidence that DOE has seriously considered how utilities may react if it cannot begin to accept spent fuel in 1998, nor determined how it should respond if suits are brought against it and utilities demand compensation. In addition, DOE has not determined what it will do in the event that the negotiator is unable to find a voluntary host for the MRS facility. In his May 1991 response to prehearing questions from a Senate Committee, the director of DOE's Office of Civilian

Radioactive Waste Management stated that DOE will evaluate the negotiator's progress at the end of 1991 and, at that time, will determine how to proceed. It is uncertain whether DOE will then begin to develop an alternative siting strategy or simply abandon—or ask for the Congress' approval to abandon—the MRS program.

As noted earlier, DOE is currently preparing a new mission plan amendment revising the waste program strategy in line with the November 1989 reassessment of the program. DOE expects to issue the amendment at the end of 1991. However, according to the waste office director's statement, this amendment will not include contingency plans for siting an MRS facility.

According to the director of DOE's waste program office, ". . . DOE informally and internally evaluates contingencies on a continuing basis. Alternatives have been identified and scenarios associated with each have been characterized. The key issue is, at what time and/or in response to what signal(s) or event(s) should DOE pursue those contingencies or alert Congress to the potential need for new guidance or policy concerning an MRS [facility]. Present plans are to discuss volunteer siting prospects and progress with the Negotiator in December 1991 and to select and implement one or more contingency plans by the end of 1992 if a negotiated agreement has not been enacted by Congress."

Conclusions

NWPA, as amended, links development of an MRS facility to progress on a repository. On the basis of DOE's current schedule for developing a repository, the earliest that DOE could be ready to operate an MRS facility is 2007. DOE, however, wants to develop an MRS facility as early as 1998, primarily so it can begin storing utilities' spent fuel by January 31 of that year. To achieve this objective, DOE is relying on the negotiator to negotiate, and the Congress to approve, an agreement with a state or Indian tribe that would permit DOE to develop an MRS facility by 1998. In a parallel action, DOE has proposed to the Congress legislation that if enacted, would repeal the linkage between the facility's and the repository's schedules.

In support of its objective, DOE is seeking about $100 million in fiscal years 1992 to 1994 for various activities to design, site, and license an MRS facility. DOE's program is based on the assumptions that by the end of September 1992 (1) the negotiator will have successfully concluded negotiations with a host state or tribe, (2) the host will have agreed to

early development of the facility, and (3) the Congress will have enacted the agreement into law and repealed the existing links.

On the repository's present development schedule, the statutory links would not permit an MRS facility to begin operation before 2007, at the earliest. Thus, DOE has not designed its program for developing an MRS facility around the links to progress on the repository. Instead, it has based its program on a set of over-optimistic assumptions concerning the negotiator's success in completing and gaining congressional approval of an agreement that meets DOE's needs along with repeal of the links. For example, because of proven public and political opposition to nuclear waste facilities, it is questionable whether the negotiator can identify a willing host for the MRS facility. Even if a willing host can be found, either it or the Congress might not agree to remove or modify the links between the MRS facility's and repository's schedules out of concern that the repository would never be built and, consequently, the MRS facility would become permanent. Furthermore, because the negotiator expects the negotiating and approval processes to take longer than DOE's estimates allow, it is unlikely that successful negotiations and congressional approval can be completed in time—by late 1992—for DOE to develop the facility by 1998.

Despite this evidence, DOE has not stated what its plans are in the event that an MRS facility cannot be operational by 1998. Planning for such a contingency is important because DOE's inability to begin accepting utilities' spent fuel by 1998, which seems likely, may trigger lawsuits by utilities and requests that DOE compensate utilities for any new storage capacity that they have to add at their nuclear plants after January 31, 1998.

The possible outcome of utilities' lawsuits is unclear; there are several possible ways that the courts might decide. One of the possible outcomes is that the court would find DOE is not obligated to begin accepting spent fuel until a repository is available. This interpretation would be consistent with the Congress' action in establishing the links between the MRS facility and repository schedules in the 1987 amendments to NWPA. In 1987 the Congress established the linkage, though it was aware that, on the basis of DOE's repository schedule then in effect, DOE might not be able to comply with the linkage and also develop an MRS facility by 1998.

In the event that utilities sue DOE, we cannot predict with any certainty how a court would actually interpret DOE's legal responsibilities under

either NWPA or DOE's disposal contracts with utilities. Therefore, legislation could help clarify such issues as whether DOE is obligated to begin accepting spent fuel by January 31, 1998, and whether utilities are responsible for storing their spent fuel until a repository or an MRS facility is available. Such clarification at an early date may help avoid protracted lawsuits by utilities against DOE that could be detrimental to the entire nuclear waste disposal program.

Alternatively, legislation would also be necessary to compensate utilities from the Nuclear Waste Fund or another of DOE's appropriation accounts for additional storage capacity needed after January 1998. However, providing such compensation raises significant questions about the equity of the treatment of (1) utilities and/or (2) taxpayers. The most equitable approach, consistent with NWPA, is for utilities to continue to pay the costs of storing their spent fuel on-site until DOE can begin removing it, thereby incurring the costs associated with producing revenues from sales of electricity.

Recommendation to the Congress

DOE does not need funds to begin developing a specific site for an MRS facility, such as site acquisition, until the nuclear waste negotiator has obtained a state's or Indian tribe's agreement to host a facility at a specific site and the Congress has enacted the agreement into law. The negotiator does not expect this to have occurred by the end of 1992. Therefore, we recommend that the Congress withhold any future funds requested by DOE for site-related activities at least until DOE has demonstrated that a state or tribe has agreed, in principle, to host a facility at a specific site.

Matters for Consideration by the Congress

We believe that it is highly unlikely that DOE can develop an MRS facility by 1998. This raises the specter of future lawsuits by utilities asserting that DOE has failed to meet its commitment to begin accepting their nuclear waste by then. Also, utilities may seek compensation for the costs of providing additional on-site storage capacity. Therefore, the Congress may wish to explore, through oversight hearings, whether additional legislation is desirable to address the likelihood that DOE will be unable to begin accepting for storage or disposal utilities' nuclear waste by 1998. In any such inquiry, the Congress may also wish to consider the issue of equity in reimbursing utilities for their additional storage costs.

Recommendation to the Secretary of Energy

GAO recommends that the Secretary of Energy develop plans for the possibility that the nuclear waste negotiator cannot find a site for an MRS facility and that DOE cannot accept utilities' nuclear waste in 1998. These plans should be discussed in DOE's revised mission plan for the nuclear waste program. The plans should address DOE's strategies for future MRS-facility siting activities, working with utilities to amend the waste disposal contracts, and/or working with the Congress on a legislative solution.

Utilities' Storage Capacity, Costs, and Safety Considerations Do Not Justify an MRS Facility

The likelihood that there will be no MRS facility by 1998 raises concerns regarding whether (1) utilities can store the additional waste at reactor sites and (2) costs and safety risks of on-site storage may exceed those of an MRS facility. However, available evidence indicates that these concerns are unfounded. The evidence indicates that virtually all utilities are capable of storing on-site all of the waste generated over the life of each plant, and neither cost nor safety factors favor one storage option over the other. The evidence not only eases the concerns over not having an MRS facility in 1998, but also may be useful in future debates on the need for and value of such a facility at a later date.

Although it is estimated that utilities will have generated over 60,000 metric tons of spent fuel by 2010, when a repository is expected to be operating, both the MRS Review Commission and the Edison Electric Institute expect that virtually all utilities will be able to accommodate their waste until DOE can place them in a repository. If for some unexpected reason, one or more utilities cannot store all of their spent fuel, the expired federal interim storage provision of NWPA could be reinstated. With or without an MRS facility, however, some utilities will have to expand their on-site storage capacity.

Reports by DOE, NRC, and the MRS Review Commission show that differences between the costs and safety of storing spent fuel at reactor sites versus storage at an MRS facility are very small. That these differences are small is explained largely by the fact that both options would employ the same type of storage technology—dry storage—and would require shipment of spent fuel under comparable conditions and by similar transportation modes to a repository.

The estimated total cost of a waste management system without an MRS facility is $9.2 billion and $9.7 billion (in discounted 1989 dollars) with an MRS facility. Given the uncertainty of the costs of new dry storage technology, the difference is considered to be very small. Utilities' costs for additional on-site storage if an MRS facility is not included in the waste system would basically be offset by the cost of adding the facility to the system. Although there are minor differences in the risks of the options, the studies conclude these risks and the differences between them are so small as to be insignificant. Spent fuel has been safely stored for many years in storage pools at reactor sites, and dry storage technologies are considered by NRC and others to be at least as safe. Similarly, spent fuel has been safely transported for many years without serious accidents, injuries, or health hazards.

Utilities Are Expected to Meet Life-Of-Plant Storage Requirements

By 2010—the earliest date when the repository may be operating—about 60,000 metric tons of spent fuel will have been produced by utilities. Although most of this spent fuel will be in existing storage pools, almost one-fourth will have to be stored in dry storage facilities. Without an MRS facility, utilities will have to store their waste on-site until a repository becomes available, which utilities, in general, are capable of doing.

Spent Fuel Will Exceed Storage Pools' Capacity

The MRS Review Commission estimated future domestic requirements for storing spent fuel. These estimates are based on the assumption that a repository will begin operating in 2013 rather than DOE's current estimate of 2010. In view of the problems that have plagued DOE's repository development project and the 12-year delay in the project since NWPA was enacted, the later date is not unrealistic. The Commission's estimates, shown in table 3.1, illustrate the expected growing volume of spent fuel at reactor sites and the amount of storage capacity (beyond that available in existing storage pools) that will have to be provided at reactor sites and/or at an MRS facility.

Table 3.1: Estimated Volume of Spent Fuel

Spent Fuel in Metric Tons

	Volumes of spent fuel		
Year	In pool storage at reactors	In excess of pools' capacity at reactors	In repository[a]
1995	28,680	1,286	0
2000	36,807	3,711	0
2005	42,026	8,019	0
2010	46,362	13,932	0
2015	49,914	20,007	1,149
2020	43,857	20,819	12,798
2025	36,799	19,208	27,715

[a]Under this scenario, the repository would begin operating in 2013.
Source: MRS Review Commission.

As can be seen in table 3.1, almost 1,300 metric tons of spent fuel in excess of pools' storage capacity will be produced by 1995 and over 3,700 metric tons by 2000. As a result, several utilities have already begun to add dry storage facilities at reactor sites in anticipation of filling up their existing storage pools. Therefore, based on estimates reported by the MRS Review Commission, an MRS facility by 1998 would only reduce the amount of storage capacity utilities would have to add on-site, not eliminate the need for additional on-site storage capacity.

DOE officials told us, however, that if spent fuel projections continue to decline—as they have in recent years—an MRS facility operating by 1998 could eliminate the need to add new storage at reactor sites after that date.

Utilities Are Able to Provide Adequate Capacity

A number of studies and industry representatives have concluded that virtually all utilities should be able to store their spent fuel through their plants' licensed life and beyond. The MRS Review Commission found that most, if not all, utilities can store all of the spent fuel that would be generated during each reactor's licensed 40-year operating life. According to the Commission's report, utilities will add on-site storage capacity as needed and could expand this capacity as necessary to meet life-of-plant storage requirements (or beyond, in the event that a utility receives a license to extend its nuclear plant operations). At most sites, sufficient storage capacity for a plant's lifetime can be provided by reracking spent fuel pools and using dry storage. Reracking involves replacing existing racks that hold spent fuel bundles in storage pools with new racks designed to allow closer spacing of the bundles and, therefore, increasing storage capacity in the pools. Dry storage requires a relatively small area per unit of storage at a reactor site, and because one storage cask at a time is added, it can be expanded in relatively small increments. Although dry storage requires additional space beyond that currently used at reactor sites, the Commission found that most utilities have sufficient land to accommodate the new storage. In addition, according to NRC, it has not identified any credible technical or institutional factors that would prevent the use of dry storage at almost any reactor site.

For reactor sites where there might be insufficient space for extensive use of dry storage, utilities may be able to consolidate spent fuel rods as another means of increasing storage capacity in a storage pool. The Commission noted, however, that, although rod consolidation[1] has been shown to be effective in reducing the volume of waste, the technology has yet to be demonstrated for use on a large scale. Finally, the Commission concluded that some utilities could temporarily solve their storage problems by shipping spent fuel from one utility-owned reactor to another with more storage capacity.

[1]Rod consolidation involves removing spent fuel rods from the structures holding them together and grouping them closer together in a canister, thereby reducing the space needed for storing the wastes.

Representatives of the Edison Electric Institute, the industry association representing the majority of utilities with nuclear plants, told us that virtually all utilities can meet their needs for storing spent fuel on-site by one means or another. They said that there may be a few reactors that might not be able to use dry storage technologies on-site because of space or some other limitations; however, they were unable to identify specific reactors for us. According to these industry representatives, a utility that, for some unanticipated reason, might not be able to use dry storage at a reactor site will have a significant incentive to find some alternative means of storing the waste—such as shipping them to another reactor owned by the same utility—to prevent the reactor's premature shutdown.

In the unlikely event that one or more utilities exhaust all possible storage alternatives and face shutting a reactor down due to lack of sufficient storage capacity, DOE could, if the Congress renewed the federal interim storage provision of NWPA, provide emergency storage at an existing federal facility at the utilities' expense. As noted in chapter 1, NWPA contained a provision—under which the contract authority has since expired—requiring DOE to provide limited storage capacity (up to 1,900 metric tons) at one or more federal facilities or reactor sites[2] to prevent disruptions in the orderly operation of any reactor due to a utility's inability to provide adequate on-site storage capacity when needed. The act assigned NRC to decide—on the basis of its assessment of whether a utility had exhausted all practical means to provide its own interim storage pending DOE's acceptance of the spent fuel at the repository—if a utility needed such assistance. Utilities needing additional storage would pay all costs associated with federal storage through fees paid into an interim storage fund.

Any utility needing federal interim storage was to have entered into contracts with DOE by January 1, 1990. The Congress limited the amount of time that this storage service could be offered because, at the time NWPA was passed, a repository was expected to be operating by 1998. Because no utilities anticipated the need for federal interim storage, none requested assistance by 1990, and the authority to contract to provide for federal interim storage expired.

[2]Prior to the expiration of this provision in NWPA, DOE investigated existing federal facilities and concluded that some could serve as interim storage sites. However, DOE did not determine the specific feasibility of these facilities for interim storage. DOE considered it premature to identify specific sites because of uncertainties about the quantities of spent fuel that might require interim storage and the alternative storage methods that might be available when interim storage would be needed.

Cost Differences Between Storage Options Estimated to Be Small

The MRS Review Commission reported that total costs of waste management systems with and without an MRS facility do not vary greatly, given the uncertainty of the costs for dry storage technologies.[3] According to the Commission, the principal determinant of the cost differences is the trade-off between on-site storage costs (which are not charged to the Nuclear Waste Fund) and the cost (to the Fund) of including an MRS facility in the system. The Commission also found that if the repository does not begin operating until around 2013—when the cost of delaying the removal of spent fuel from reactors whose licenses have expired begins to accumulate—the cost differences between systems without an MRS facility and with a facility whose schedule is not linked to the repository's become "negligible."

The actual ultimate costs of dry storage—which will be used on-site and at an MRS facility—are uncertain. These costs will depend on such factors as (1) which particular dry storage technology is selected for wide-scale use by utilities, (2) potential cost-saving improvements in technologies over time, and (3) the extent of competition among manufacturers. Given the uncertainty of the ultimate costs of dry storage, the relatively minor differences in costs between the two waste systems' configurations do not provide a meaningful basis for selecting one alternative over the other, according to the Commission.

The MRS Review Commission examined, under various assumptions, the effects on the total costs of the waste management system of having (1) no MRS facility, (2) an MRS facility with its schedule linked to the repository's, and (3) a facility without its schedule linked to the repository's. Because the benefits and costs of the systems would, under different scenarios, be incurred at different times, the Commission made its cost comparisons on a discounted, present-value basis.[4] (See table 3.2.)

[3]The Commission's report and the other noted studies do not consider the effects of potential litigation on costs.

[4]For the government to make rational decisions about how resources should be allocated over time, differences in the value of these resources over time must be accounted for. The accepted way to do this is to discount future costs at a rate reflecting the cost that would have been paid today. The discounted value is called the "present value." The higher the discount rate used to compute the present value, the lower the present value will be, all else being equal. According to the Commission, since the costs are adjusted to correct for expected inflation, the discount rate reflects only the implied value of the resources foregone and does not reflect expected increases in price. The MRS Review Commission discounted these costs at a 4-percent annual rate.

Table 3.2: Estimated Costs for Alternative Waste Management Systems

Discounted 1989 Dollars in Billions

	Costs[a]		
	With no MRS	With MRS linked to repository[b]	With MRS not linked to repository[c]
Costs from Nuclear Waste Fund	$7.4	$8.2	$9.1
[Portion of fund's costs for MRS]	[—]	[0.6]	[1.2]
Utilities' on-site costs[d]	1.8	1.5	0.6
Total costs	**$9.2**	**$9.7**	**$9.7**

[a]Costs are over the life of the waste management program.

[b]MRS facility begins operations in 2010. Repository begins in 2013.

[c]MRS facility begins operations in 2000. Repository begins in 2013.

[d]Estimates include costs of delays in removing spent fuel from shutdown reactors.

Source: Prepared by GAO using data from MRS Review Commission.

The Commission found that the total costs between alternative systems do not vary greatly; however, the differences in the incidence and distribution of the cost components are significant. According to the Commission, the principal factor determining the cost differences among the alternative system configurations is the trade-off between on-site storage costs in a system without an MRS facility and the costs of including a facility in the system. Adding an MRS facility to the system would decrease utilities' direct on-site storage costs. Although utilities' on-site storage costs are shown collectively and compared to the total costs for an MRS facility, it is important to note that on-site storage costs would be incurred by each utility based on its need for additional storage, and the costs for an MRS facility would be paid by all nuclear utilities—regardless of need—through their contributions to the Nuclear Waste Fund.

According to the Commission, a system without an MRS facility has a cost advantage over a system with an MRS facility whose schedule is linked to the repository's because on-site storage costs would be less than the cost of adding the MRS facility to the system. With the assumption that a repository begins operating in 2013, total costs of a system without an MRS facility are $0.5 billion less than those of a system with an MRS facility: On a present-value basis, the former alternative has a cost advantage of about 5 to 6 percent over the latter alternatives. The Commission noted that these cost differences are small relative to the inherent uncertainty in the cost data from which they were derived.

DOE's MRS system studies reported similar results. DOE's studies examined, among other things,the implications of a repository opening in 2013 on the requirements for on-site storage and on costs in a system (1) without an MRS facility, (2) an MRS facility operating in 2010 whose schedule is linked to the repository's, and (3) an MRS facility operating in 2000 whose schedule is not linked to the repository's (see table 3.3.)

Table 3.3: Requirements and Costs of Additional On-Site Storage for Waste Systems With Repository Operating in 2013

System configuration	Total additional storage requirements (metric tons)	Number of sites	On-site storage costs[a] (1988 dollars in millions)
No MRS facility	25,003	66	$1,907
MRS facility operating in 2010[b]	18,315	63	1,403
MRS facility operating in 2000[c]	5,317	38	$424

[a]Costs based on an estimated average unit cost of $77 per kilogram of spent fuel.

[b]The schedule for this facility would be linked to the repository's schedule.

[c]The schedule for this facility would not be linked to the repository's schedule.

Source: Prepared by GAO using DOE's data.

DOE estimated that (1) utilities would incur the largest additional on-site storage costs in a system without an MRS facility, (2) an MRS facility with a schedule linked to the repository's and operating in 2010 could reduce these costs by about $0.5 billion ($1.9 billion minus $1.4 billion), and (3) an MRS facility not linked to the repository schedule and operating in 2000 could reduce these costs by about $1.5 billion ($1.9 billion minus $0.4 billion). However, as noted earlier, these savings to individual utilities must be balanced against the increased costs to all utilities (paid from the Nuclear Waste Fund) of adding an MRS facility to the waste management system.

Unlike the MRS Review Commission's cost estimates, DOE's systems studies did not include the costs of delaying the removal of spent fuel from shutdown reactors as a component of at-reactor storage costs. If there is no federal facility to accept the waste, spent fuel stored at shutdown reactors would have to remain there. Under these circumstances, a utility would incur considerably more expense for spent fuel management and security than if the waste could be removed. These costs, according to the Commission, can be quite substantial the later a federal facility becomes available to begin taking the waste. The Commission believes that these cost factors should be considered in evaluating the need for the MRS facility. Although DOE's estimates did not include these cost factors, DOE officials recently stated that, in addition to considering

the costs of on-site storage, the cost of maintaining storage facilities at shutdown reactors—as well as the cost of delaying decommissioning of these reactors—must also be considered in comparing storage options.

Storage and Transportation Risks Considered Very Small for Both Options

Numerous studies show that storage and transportation risks do not significantly distinguish one storage option from the other, in large part because both options would use similar storage technologies and transportation modes to a repository. Utilities have been safely storing and transporting radioactive waste for years, and these conditions would not change markedly with an MRS facility.

The MRS Review Commission compared the estimated health and safety effects of waste management systems with and without an MRS facility over the life of the nuclear waste program. (See table 3.4.) Radiological risks—risks of negative health effects from exposure to radioactivity—such as those that would arise from managing spent fuel at both reactor sites and an MRS facility are commonly measured in terms of theoretical numbers of deaths from cancer in the future due to exposure to radioactivity today. Calculations of fatalities are based on an estimate that 10,000 person-rems[5] of radiation will produce 4 fatalities caused by cancer. As used in table 3.4, fatalities due to occupational exposure result from the total radiation dose to workers from all activities involved in storing, handling, shipping, and disposing of spent fuel. Fatalities due to public exposure result from the total radiation dose to the public from these activities. The estimates for public exposure in table 3.4 also include theoretical fatalities of truck and train crews due to in-transit operations; excluding these would reduce public exposure by about 75 percent, according to the MRS Review Commission's report.

[5]A person-rem is a measurement of the amount of radiation a given population receives from exposure to a radioactive source.

Table 3.4: Estimated Fatalities Caused by Cancer for Waste Systems With and Without an MRS Facility

System configuration	Number of fatalities: Occupational exposure	Number of fatalities: Public exposure
No MRS facility	10.4	3.2
MRS facility operating in 2010[a]	8.9	1.4
MRS facility operating in 2000[b]	6.8	1.4

Note: Calculations made under the assumption that a repository will start operations in 2013; estimates are for the life of the waste management program, assumed by the Commission to be 40 years.

[a]The schedule for this facility would be linked to the repository's schedule.

[b]The schedule for this facility would not be linked to the repository's schedule.

Source: MRS Review Commission.

Based on its analysis, the Commission concluded that spent fuel storage and transportation would likely result in the public and workers experiencing only small radiological risks regardless of whether the system includes an MRS facility. The Commission's report further concluded that given the small size of the predicted risks and the uncertainty of the estimates, the differences in risks do not provide a basis for discriminating between alternatives with and without an MRS facility. DOE has reached a similar conclusion.

Both Storage Options Are Considered Safe

DOE and NRC have found that spent fuel can be safely stored for extended periods at both reactors and an MRS facility. DOE concluded in its study of dry storage that no significant health or environmental effects are expected from dry storage under either normal operating conditions or conditions associated with credible potential accidents. According to DOE, estimates indicate that radiation doses from dry storage will be "extremely low" and represent a small fraction of (1) NRC's regulatory limits, (2) the doses from natural background radiation, and (3) the doses received by the public and workers from normal reactor operations.

In 1989, NRC concluded that the safety and environmental impacts of extended spent fuel storage—at either reactors or storage facilities away from reactors—would be insignificant. NRC found that spent fuel can be stored safely and without significant environmental effects at reactors—in either wet (pool) or dry storage—for at least 100 years, and perhaps up to 140 years if pool storage occurs first and is followed by dry storage for no more than 70 years. Furthermore, NRC believes that its regulations are adequate to ensure the safe storage of spent fuel at reactor sites, at independent storage installations, and in an MRS

facility until sufficient capacity in a repository is available, even if this does not occur until 2025.

Adding an MRS facility to the waste management system would not introduce any substantial additional risks to the system. In a June 1989 report presenting its position on the MRS facility, DOE stated that the MRS facility would be designed so that public exposure to radiation from (1) normal operations, (2) postulated accidents, and (3) transportation would be below NRC's regulatory limits and less than 1 percent of the dose from naturally occurring background radiation.

Similarly, after evaluating DOE's 1987 proposal for an MRS facility, NRC staff concluded that (1) the facility would have a limited potential for accidents or adverse consequences because its operations would involve passive storage and relatively simple mechanical processes, (2) the facility's conceptual design appeared reasonable to protect public health and safety, and (3) the facility could meet NRC's regulatory requirements.

Although the MRS Review Commission concluded that differences in storage risks are extremely small, it also reported that some safety advantages may exist in having a central storage facility in which spent fuel would be under the full-time care of trained personnel and management whose exclusive responsibility is the safe storage and handling of spent fuel. According to the Commission, because the workers at an MRS facility would handle spent fuel each workday, they would be more experienced in the routine handling operations that would occur less frequently at reactors and would be better able to handle any emergencies. The Commission also found that centralized control of spent fuel may provide a potential safety benefit because it allows an opportunity for increasing the compatibility of equipment and processes used in different segments of the waste system (that is, at reactors and at the repository) and thereby potentially reducing handling and associated risks.

Transportation Under Both Options Is Considered Safe

Several studies have found that transportation risks for either storage option are low. Transporting spent fuel poses both radiological risks and nonradiological risks (risks not from radiation but from shipping any commodity) to workers and the general public under normal and accident conditions. The state of Tennessee,[6] DOE,[7] and the MRS Review Commission[8] have all examined the transportation risks associated with various configurations of the nuclear waste management system (see table 3.5). They concluded that transportation risks—with or without an MRS facility in the system—are very low. Two studies that included nonradiological risks agree that transportation in a system with an MRS facility would involve slightly smaller radiological risks, but slightly larger nonradiological risks than the present system of storage at reactor sites. However, these studies all conclude that the risks of transporting spent fuel—with or without an MRS facility—are so low as to be insignificant as a factor in choosing one system over the other.

Table 3.5: Estimated Fatalities From In-Transit Transportation Risks in Systems With and Without an MRS Facility

	Number of calculated annual fatalities			
	From radiological risks		From nonradiological risks	
	In system without MRS	In system with MRS	In system without MRS	In system with MRS
Tennessee study	.04	.02	.9	1.1
DOE's study	.02[a]	.01[a]	[b]	[b]
Commission's study	.08	.03	.4	.4

Note: Estimated fatalities are per year over the life of the waste management program. MRS facilities in all scenarios are assumed to be "storage-only" facilities whose sole function would be to store spent fuel and prepare it for shipment to the repository rather than perform additional functions such as consolidating and packaging the spent fuel for disposal. In addition, the MRS facilities' schedules are assumed not to be linked to the repository's schedule. According to the MRS Review Commission's report, such linkage has little effect on transportation risks.

[a]Calculation based on assumption that 1 person-rem equals 0.0002 latent fatalities from cancer.

[b]DOE did not evaluate nonradiological transportation risks.

Source: Prepared by GAO using noted studies.

To put the data in table 3.5 in perspective, the MRS Review Commission's report noted that the background radiation dose from all sources would result in 120 cancer deaths per year to a population of a million people. By comparison, as the table shows, the number of estimated cancer

[6]Monitored Retrievable Storage of Spent Nuclear Fuel: Transportation Studies, University of Tennessee, Transportation Center (Oct. 20, 1986).

[7]MRS Systems Study, Task F: Transportation Impacts of a Monitored Retrievable Storage Facility, Battelle, Nuclear Systems Group, Office of Transportation Systems and Planning (May 1989). Prepared for the Department of Energy.

[8]Nuclear Waste: Is There a Need for Federal Interim Storage?, MRS Review Commission (Nov. 1989).

deaths over the life of the program from in-transit transportation, for systems both with and without an MRS facility, would be considerably less than 1 death per year for a much larger population—those persons along all waste transportation routes. Similarly, the Commission's report stated that each year, 45,000 traffic fatalities occur in the United States. In comparison, as table 3.5 shows, nonradiological or normal traffic risks of shipping spent fuel, in systems either with or without an MRS facility, would result in at most 1 fatality per year.

Conclusions

Although an MRS facility is critical to DOE's ability to accept spent fuel in 1998; solely from the perspectives of utility storage capacity, cost, and safety, the absence of the facility is not considered a cause for concern. Virtually all utilities are expected to be able to expand their storage capacities to accommodate all of their spent fuel. In fact, even with an MRS facility operating by 1998, some utilities will have to increase their storage capacity and are already doing so. Although it is considered unlikely that any utility will need emergency storage, providing for such a contingency would be prudent. As noted in chapter 1, the MRS Review Commission recommended that the Congress authorize construction of a facility to accommodate an emergency situation. However, if the Congress renewed the federal interim storage provisions of the 1982 act, DOE could provide emergency storage at an existing federal facility at the expense of any utility needing the storage.

Evidence also indicates that cost and safety factors do not favor an MRS facility over on-site storage. The MRS Review Commission and DOE found that the differences between the total costs of systems with and without an MRS facility are insignificant. Given the uncertainty of the ultimate costs of dry storage, the relatively minor differences in costs is not considered to provide a meaningful basis for selecting one alternative over the other, according to the Commission. Similarly, spent fuel can be safely stored at either reactor sites or an MRS facility for extended periods and can continue to be shipped safely. Radiological risks of storing and shipping spent fuel are very low. Moreover, the minor differences in estimated risks between systems with and without an MRS facility are so low as to be insignificant in choosing one option over the other.

Although an MRS facility is not likely to be operating by 1998, congressional debate is likely to continue on the need for and value of such a facility in the future. Policy or other factors might justify having an MRS facility, but the factors we reviewed do not support building the facility.

Nevertheless, the results of our analysis could prove useful to the Congress in any future debates on an MRS facility.

Recommendation to the Congress

To provide a safety net in the unlikely event that a utility would have to shut down a reactor because it could no longer accommodate its spent fuel on-site, we recommend that the Congress reinstate the contract authority under the federal interim storage provision of the 1982 act, which would allow DOE to provide limited storage at an existing federal facility at the utility's expense.

Matter for Consideration by the Congress

In future debates on the need for and value of an MRS facility, the Congress may wish to consider utilities' capabilities to expand waste storage capacity at their nuclear plant sites and the cost and safety differences between expanded storage of waste at these plants and storage at an MRS facility.

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