

United States Program on Spent Nuclear Fuel and High-Level Radioactive Waste Management

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INTRODUCTION

The President signed the Congressional Joint Resolution on July 23, 2002, that designated the Yucca Mountain site for a proposed geologic repository to dispose of the nation's spent nuclear fuel (SNF) and high-level radioactive waste (HLW). The United States (U.S.) Department of Energy's (DOE) Office of Civilian Radioactive Waste Management (OCRWM) is currently focusing its efforts on submitting a license application to the U.S. Nuclear Regulatory Commission (NRC) in December 2004 for construction of the proposed repository. The legislative framework underpinning the U.S. repository program is the basis for its continuity and success. The repository development program has significantly benefited from international collaborations with other nations in the Americas.

LEGISLATIVE FRAMEWORK

Permanent geologic disposal is the cornerstone of the U.S. radioactive waste management strategy and became official policy with passage of the Nuclear Waste Policy Act of 1982 (Act). The Act established the Federal government's role in the management of the nation's spent fuel and high level radioactive waste and authorized DOE to develop geologic repositories for the permanent disposal of the Nation's spent nuclear fuel and high-level radioactive waste. The repositories must be licensed to operate under NRC regulations, and must provide for protection of public health and safety and the environment in accordance with United States Environmental Protection Agency (EPA) radiological standards. The Act was amended in 1987 and DOE was directed to characterize a site at Yucca Mountain in Nevada for its suitability as a repository for the geological disposal of the nation's SNF and HLW. Capacity is limited to 70,000 metric tons of heavy metal (MTHM).

The law is based on the principle that the generation benefiting from nuclear energy is responsible for safely disposing of the nuclear wastes it creates. In this regard, the Act affirms the responsibility of the generators of the waste - the nuclear utilities and the federal defense nuclear program - to pay the costs of disposal.

The Act also establishes legal requirements for: a repository site recommendation by the Secretary of Energy, a decision by the President, approval by Congress and licensing by the NRC. The Energy Policy Act of 1992 directs the EPA to establish standards for a potential repository at Yucca Mountain to protect public health and safety and directs the NRC to revise its regulations for a repository as needed to ensure compliance with those health and safety

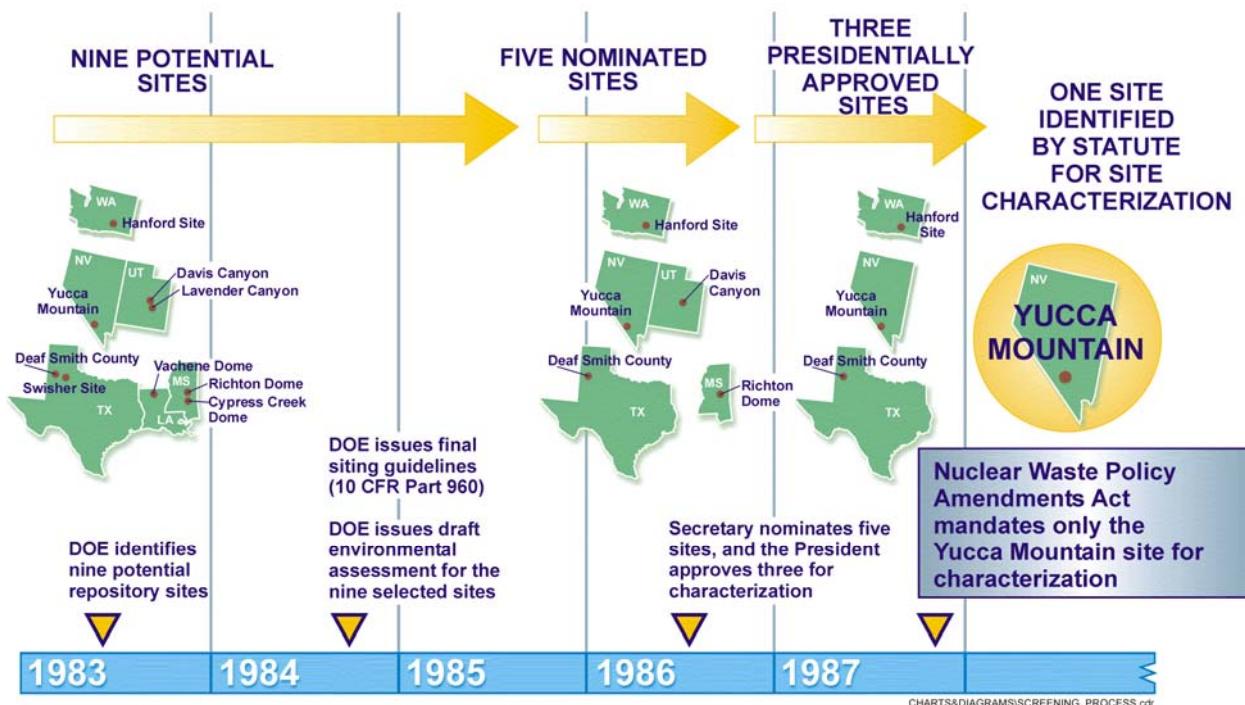
standards. In part, the EPA standards (40CFR Part 197) and NRC criteria (10 CFR Part 63) prescribe radiation exposure limits that the repository, based on performance assessment, must be designed not to exceed during a 10,000-year period after closure.

The State of Nevada challenged the constitutionality of the resolution approving Yucca Mountain and other federal actions regarding the Yucca Mountain site. With regard to a challenge to one aspect of the EPA's radiation protection standard for Yucca Mountain, on July 9, 2004, the U.S. Court of Appeals determined that the EPA's 10,000 year compliance period cannot be reasonably considered to have been "based upon and consistent with" the findings and recommendations of the National Academy of Sciences, as Congress had directed. The DOE is working with the EPA and Congress to determine appropriate steps to address this issue.

REPOSITORY SITING HISTORY

Years of scientific study, culminating in a 1986 comparison and ranking of the nine sites then under consideration for characterization, led the DOE to conclude that Yucca Mountain ranked at the top of all sites studied (Figure 1).

Figure1: Repository Site Selection Process



At the time of the 1987 amendment to the Act, significant information and data had already been collected on the Yucca Mountain site from field and laboratory studies. Additionally, the U.S. Geological Survey and national laboratories had been studying the area's geology and hydrology since the start of nuclear weapon tests in 1951 at the nearby Nevada Test Site.

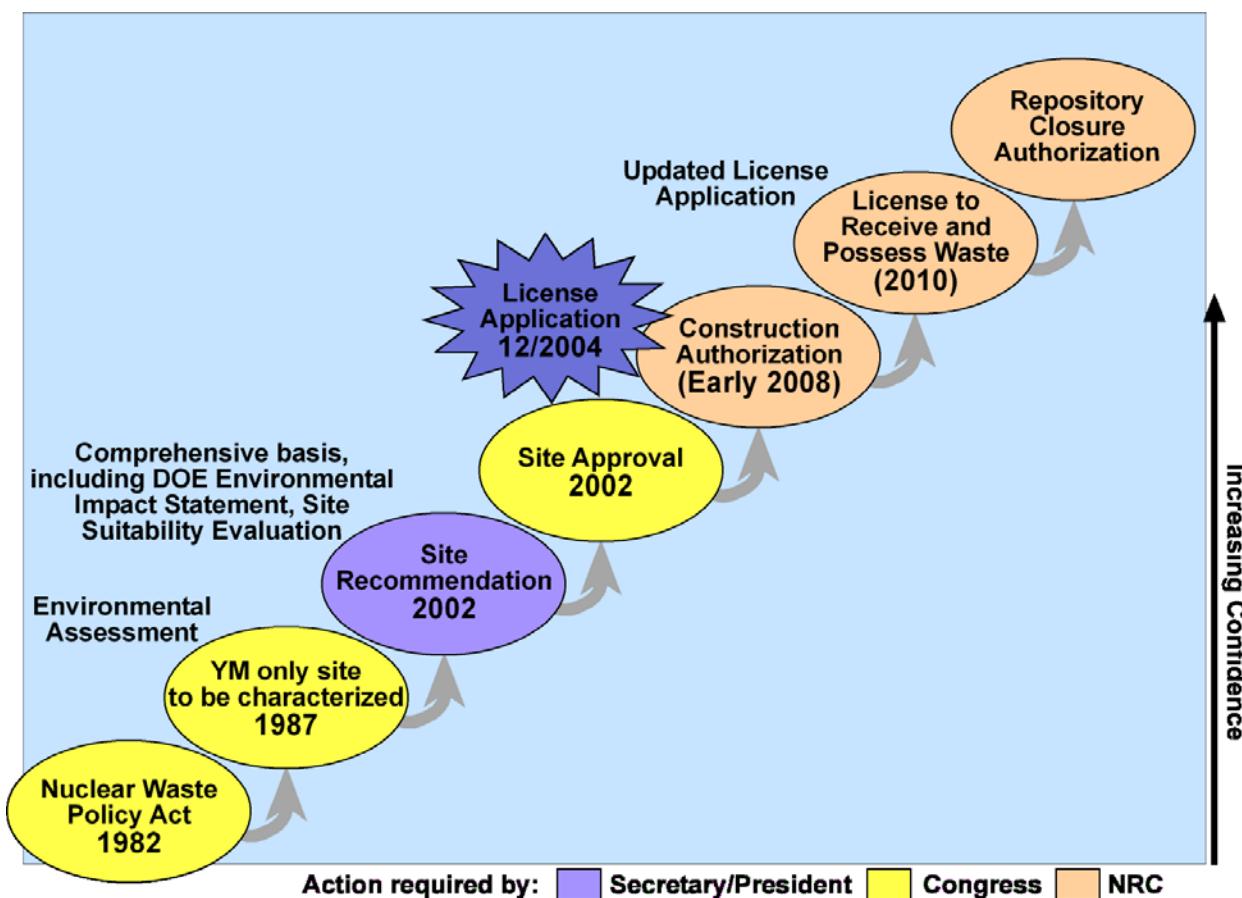
Subsequent characterization has confirmed the positive attributes of Yucca Mountain that would support the safe geologic disposal of radioactive waste. From a security perspective, Yucca Mountain is located on land controlled by the federal government with restricted access.

NEAR TERM GOALS

The next steps (Figure 2) for the Yucca Mountain Program are to:

- prepare and submit a license application in December 2004 to the NRC for Construction Authorization, and
- accelerate the development of a transportation program for the receipt of waste in 2010.

Figure 2: Step-Wise Decision Process



A. License Application

DOE plans to submit a license application (LA) to NRC in December 2004 for construction authorization for the repository in 2008. The repository must be licensed in accordance with NRC licensing regulations in Title 10 CFR Part 63 that implement Environmental Protection Agency standards in Title 40 CFR Part 197. The LA will contain “General Information” and a “Safety Analysis Report”, and will be accompanied by an environmental impact statement. “General Information” includes a general description of the repository system; proposed schedules for construction, receipt, and emplacement of waste; a physical protection plan; a material control and accounting program plan; and a description of site characterization work. The “Safety Analysis Report” will contain preclosure repository safety; postclosure repository safety; a research and development program to resolve safety questions; a performance confirmation program; and administrative and programmatic requirements.

Should construction be authorized, the repository would be developed in stages. Prior to start-up of operations, a license amendment would be submitted to NRC to receive and possess radioactive waste

On July 26, 2004, DOE received the draft LA from its contractor for acceptance review. The draft LA does not currently address the DC Circuit Court of Appeals decision regarding the 10,000 year regulatory framework. However, the draft LA does explain the safety case for at least 10,000 years. DOE is presently reviewing the court's decision and will determine if any changes to the LA are required.

The Yucca Mountain repository is being designed to safely receive, handle temporarily store, emplace, isolate, and monitor SNF and HLW deep underground to ensure the protection of health and safety of the public for thousands of years. A flexible design approach is being used to:

- support a range of construction approaches;
- enable the disposal of a wide range of waste containers;
- support a range of thermal operating modes; and
- provide for design enhancements as additional understanding is developed.

The repository will include surface facilities to receive and package waste for placement in subsurface facilities. Capability will exist to load individual spent fuel assemblies arriving in non-disposable containers as well as SNF and HLW arriving in disposable packages. Both will be removed from transportation casks in hot cells and placed in robustly designed waste packages for underground emplacement. About 36,000 miles of underground tunnels and an estimated 10,000 waste packages will be needed to emplace the 70,000 MTHM. Most handling operations in surface and subsurface facilities will be remotely controlled to reduce worker exposure to radiation.

The waste packages will accommodate the variability in waste forms, sizes and nuclear characteristics. The waste package has been designed to take advantage of locating the

repository host horizon above the water table in an unsaturated zone, which consists of relatively dry rock. As long as the waste packages remain intact, the waste will be contained completely within the packages and prevented from contact with the host rock, air, or groundwater.

The design of the repository will permit it to be kept open, with only routine maintenance, for approximately 50 to 125 years from the start of waste emplacement. However, the design will not preclude keeping the repository open for as long as 300 years with appropriate maintenance and monitoring. This flexibility will enable repository operations to meet future societal needs.

B. Transportation

The Program issued the National Transportation Strategic Plan on November 18, 2003. The Plan addresses: overall transportation policies; interactions with States, local and tribal governments; identification of necessary activities and description of the approach to ensure a collaborative process is used to develop an operational transportation system by 2010. The scoping period for the Rail Alignment Environmental Impact Statement (EIS) closed on 6/1/04 and the Department is currently evaluating the wealth of comments received from the public as part of the evaluation of the final alignments in the document. The Nevada team has been regularly interacting with private land owners, grazing permittees, and mining interests along the corridor and initial fieldwork has begun. Subcontracts have been issued for an EIS contractor, geotechnical services, rail line optimization, and conceptual design and will soon be issued for hydrology (surface and groundwater analyses). All of these subcontracts will generate information needed for environmental compliance and ultimate design and subsequent construction of the rail line.

The DOE has developed a process for the cask acquisition. Cask Capability Assessment Reports have been prepared by each of the major cask vendors and submitted to DOE. These reports address the gap between existing cask capabilities and the needs of the program. DOE is currently analyzing the results of these reports to incorporate the information gained into the draft Request for Proposals. Initial Procurements of certified cask development support will begin in FY 2005.

DOE has been meeting with numerous industry representatives to prepare for the procurement of rolling stock. We are currently assembling the system requirements for the rail cars to be purchased. This work is being coordinated with other rail shippers of spent nuclear fuel, including the Naval Reactors program office in DOE. Meetings have been held with potential vendors to get their input on the acquisition process and project schedules. A Request for Proposals for the rail cars is expected to be issued in FY 2005.

The transportation program has been meeting with regional groups of states to advance the planning process for eventual shipments of spent nuclear fuel and high level radioactive waste to the repository. These meetings focused on project proposals addressing specific areas of transportation interest in their regions, such as the existing capability of emergency response programs, the potential for barge shipments from reactor sites to a railhead, modeling the transportation system resource requirements for efficient operations and collaborative development of emergency response training policies. Upcoming discussions with program

stakeholders will be directed towards other issues such as Section 180© [of the Act] financial and technical assistance, development of routing criteria, and operations security concerns.

REGIONAL COOPERATION/COLLABORATION

The U.S. has a long-standing involvement in joint technology development projects, information exchange programs, and joint technical cooperative programs with countries in the Americas including Argentina, Brazil, Canada, and Mexico. In the early years of the U.S. program, cost-shared international cooperative technical projects and activities resulted in the cost-effective transfer of technology that was mutually beneficial. Through these collaborations, the U.S. gained expertise from unique foreign facilities, data sets, scientists, techniques, and instruments not available within its own borders. For example:

- A specific provision of the NWPA enabled Argentina, Colombia, and Mexico (among other countries) to avail of U.S. technical assistance in the field of spent fuel and disposal during the period 1983-1988.
- In the late 1980's, DOE participated in the Pocos de Caldas natural analogue project in Brazil, which studied uranium and thorium deposits as analogues for processes related to a mined geologic repository.
- Until the late 1990's DOE was engaged in cost-sharing projects at AECL's Underground Research Laboratory (URL) in Manitoba, including tests on site characterization, instrumentation, radionuclide transport, sealing technology, and spent fuel dissolution modeling.
- The DOE has been conducting a science project with Mexico at the Peña Blanca natural analogue site in the Chihuahua region. Results of this project will provide a better understanding of potential radionuclide migration in welded tuffs, such as those found at Yucca Mountain. It will also test and build confidence in conceptual and numerical models of processes that are anticipated to occur in the unsaturated zone of a deep geologic radioactive waste repository.

The U.S. maintains a Cooperative Agreement with the Canadian Department of Natural Resources, as well as Joint Standing Committees on Nuclear Energy Cooperation with Argentina and Brazil. These vehicles enable DOE to participate in a range of activities including cooperation in the field of spent fuel and high-level radioactive waste management. There is also a trilateral agreement among the U.S., Canada, and Mexico on Cooperation in Science and Technology.

CONCLUSIONS

The Yucca Mountain site in Nevada has been designated for development as a repository for the geologic disposal of 70,000 MTHM of SNF and HLW. DOE plans to submit a license application to NRC in December 2004, for construction authorization in 2008. Given adequate funding and successful completion of the licensing process, nuclear waste could begin arriving at the repository by 2010. The DOE will continue to pursue international cooperation and collaboration with nations and organizations in the Americas to: share science and technology; promote regional understanding; and develop consensus on radioactive waste management issues.