



General Information

2002

Viability Assessment of a Repository at Yucca Mountain

Over the past 15 years, the U.S. Department of Energy (DOE) has been studying a site at Yucca Mountain, Nevada, to determine whether it is a suitable place to build a geologic repository for the Nation's spent nuclear fuel and high-level radioactive waste. In 1996, the DOE announced that it would prepare a Viability Assessment of a Repository at Yucca Mountain to present the results of the DOE's study thus far and identify the critical issues that need to be addressed.

What are the results of the Viability Assessment?

- No show stoppers have been identified to date at Yucca Mountain.
- Work should proceed toward a decision in 2001 on whether to recommend the site to the President for development as a geologic repository.
- Uncertainties remain about key natural processes, the preliminary design, and how the site and the design would work together.
- To address these uncertainties, the DOE plans to improve the preliminary design, complete critical tests and analyses, and include a description in a final environmental impact statement.
- When this work is completed in 2001, a decision will be made by the Secretary of Energy on whether to recommend the site to the President for development as a repository.

2000

What is in the Viability Assessment?

The Overview of the Viability Assessment of a Repository at Yucca Mountain describes the worldwide nuclear waste problem and explains why the United States and other nations are considering deep geologic disposal as the solution. The overview then discusses highlights of the research described in Volumes 1 through 5 of the *Viability Assessment*.

Volume 1: "Introduction and Site Characteristics"

Yucca Mountain is located about 100 miles northwest of Las Vegas, Nevada. Yucca Mountain is on the edge of the Nation's nuclear weapons test site, where more than 900 nuclear tests have been conducted. This unpopulated land is owned by the federal government.

Yucca Mountain is a flat-topped ridge running six miles from north to south that has changed little over the last million years. Based upon what is known about the site, disruption of a repository at Yucca Mountain by volcanoes, earthquakes, erosion, or other geologic processes and events appears to be highly unlikely.

Yucca Mountain has a desert climate. This is important because water movement is the primary means by which radioactive waste could be transported from a repository to the accessible environment. On average, Yucca Mountain currently receives about seven inches of rain and snow per year. Nearly all the precipitation, about 95 percent, either runs off or evaporates. Geological information indicates that the regional climate has changed over the past million years, and the long-term average

2001

1998



precipitation has been about 12 inches per year (comparable to that of present-day Santa Fe, New Mexico). Even if this were to be the case in the future, it is believed that most of the water would run off or evaporate rather than soak into the ground and possibly reach the repository.

A repository would be built about 1,000 feet below the surface and 1,000 feet above the water table. Any precipitation that does not run off or evaporate at the surface would have to seep down nearly 1,000 feet before reaching the repository and through another 1,000 feet of the unsaturated zone before reaching the water table. The groundwater in the region is trapped within a closed desert basin and does not flow into any river that reaches the ocean.

Volume 2: “Preliminary Design Concept for the Repository and Waste Package”

The primary design objectives for the repository follow: (1) protecting the health and safety of both the workers and the public during the period of repository operations, (2) minimizing the amount of radioactive material that may eventually reach the accessible environment, and (3) keeping costs down to an acceptable level. To achieve the design objectives, engineers work with scientists to design the man-made components of a repository to work with the natural barriers—the geology and climate of Yucca Mountain—to contain and retard the movement of waste for thousands of years.

According to the preliminary design, spent nuclear fuel and high-level radioactive waste would be transported to Yucca Mountain by truck or rail in specially designed shipping containers approved by the Nuclear Regulatory Commission. It would then be (1) removed from the shipping containers and placed in long-lived waste packages for disposal, (2) carried into the under-

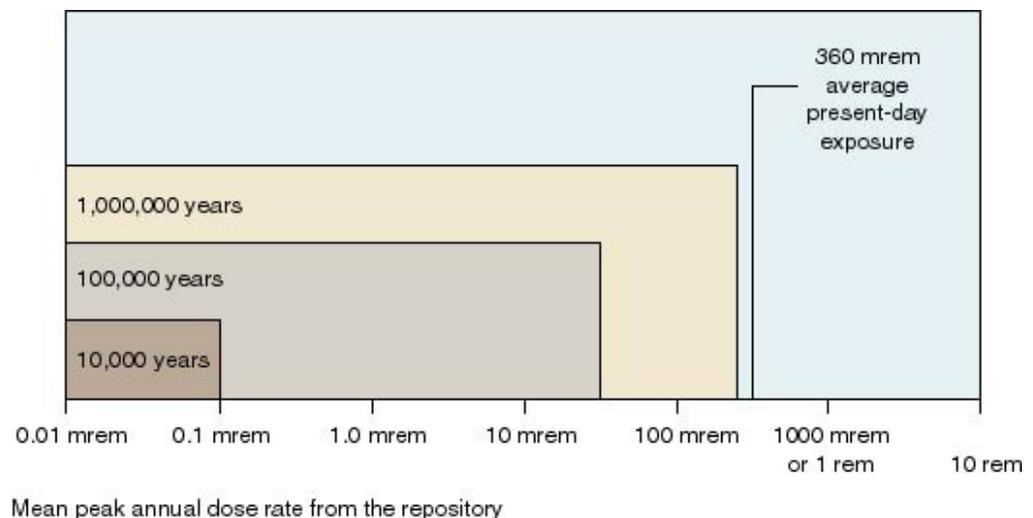
ground repository by rail cars, (3) placed on supports in the tunnels, and (4) monitored until the repository is finally closed and sealed. The DOE plans on improving the current design and is evaluating alternative designs and design features that could reduce uncertainties and improve performance.

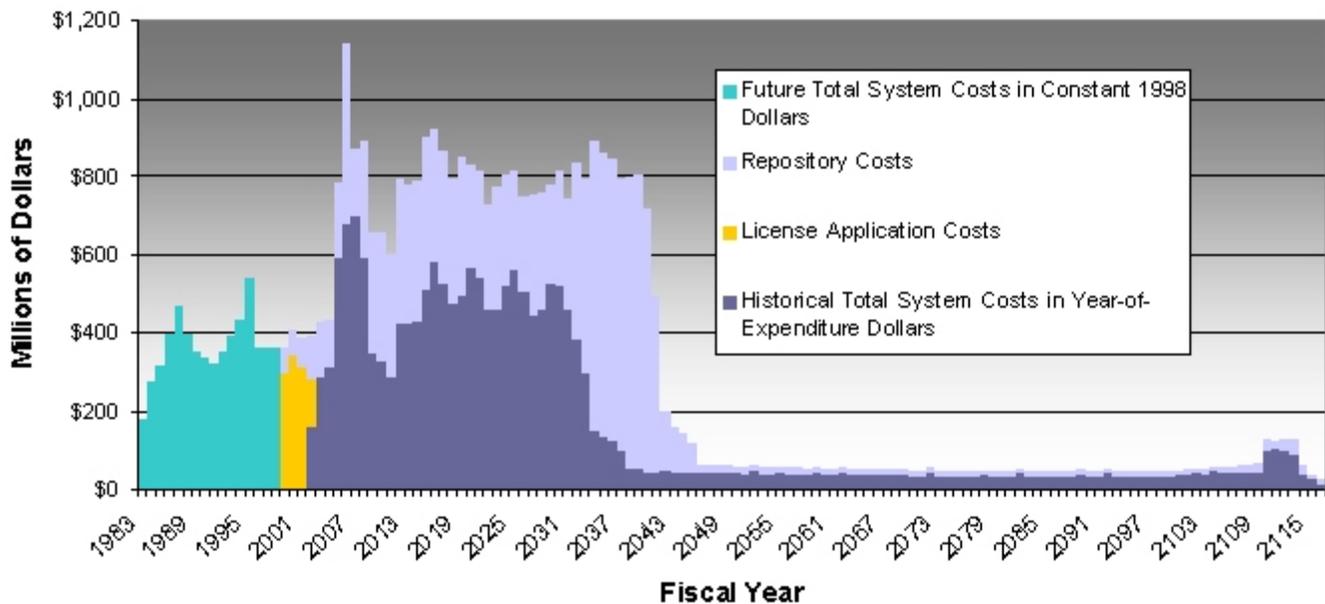
Volume 3: “Total System Performance Assessment”

Using data about the site and the preliminary designs, scientists build detailed mathematical models of the features, events, and processes that could affect the performance of a repository’s design if it were built and nuclear waste were emplaced. The performance assessment shows that the most significant single factor affecting the ability of the repository to protect public health and safety would be the amount of water that eventually contacts the waste.

Volume 4: “License Application Plan and Costs”

To obtain a Nuclear Regulatory Commission license, the DOE must demonstrate that a repository can be constructed, operated, monitored, and eventually closed without unreasonable risk to the health and safety of workers and the public. In the next four years, the DOE will focus on improving the repository and waste package design, strengthening the understanding of the natural processes, preparing the environmental impact statement, and developing the information needed to support a site recommendation decision.





Profile of total system life cycle costs

Volume 5: “Costs to Construct and Operate the Repository”

The additional cost to license, construct, operate, monitor, and close a repository is estimated to be \$18.7 billion in constant 1998 dollars. This cost estimate includes monitoring a repository for 100 years and disposing of 70,000 metric tons of spent nuclear fuel and high-level waste at Yucca Mountain, currently the legal limit that can be disposed of.

A monitored geologic repository is only one component of the total life cycle cost for the waste management system, however. Other components include the following: (1) transporting waste to, then storing it at the repository, (2) payments-equal-to-taxes and other benefits to the State of Nevada and affected units of local government, (3) expansion of the repository beyond the 70,000 metric-ton statutory limit, if authorized, and (4) overall system management. The total estimated future cost is \$36.6 billion in constant 1998 dollars. This covers 1999 through repository closure in 2116.

What is the long-term plan?

The Nuclear Waste Policy Act sets forth a multi-step process for deciding whether to proceed with development of a repository at Yucca Mountain, and the DOE has a tentative schedule for completing this process. A

negative decision at any step would stop the process and require the Secretary of Energy and the Congress to develop a different approach to solving the Nation’s nuclear waste problem.

- Before deciding whether to recommend the Yucca Mountain site to the President, the Secretary of Energy will conduct a formal evaluation of the site, hold public hearings in the vicinity of Yucca Mountain to inform the residents of the possible recommendation of the site, and receive the comments of interested parties. The current schedule calls for the Secretary of Energy to decide whether to recommend the site in 2001.
- If, after these considerations, the Secretary of Energy decides to recommend the site, the President would then decide whether to recommend the site to Congress.
- If the President recommends the site to Congress, the Governor or legislature of Nevada may submit a notice of disapproval. If either does so, Congress must decide whether to override the notice of disapproval and approve the Yucca Mountain site.
- If Congress approves the Yucca Mountain site, then according to the current schedule, in 2002,



the DOE would submit an application to construct a repository to the Nuclear Regulatory Commission.

- If the Nuclear Regulatory Commission approves the application, the DOE would construct a repository and apply for a license to begin receiving waste for disposal in the repository.
- If construction proceeds as currently planned, and the DOE receives a license to operate the repository, then waste emplacement could begin in 2010.

Concluding observations: achieving reasonable assurance

Based on the results of the Viability Assessment, the Department believes that scientific and technical work at Yucca Mountain should proceed to support a decision by the Secretary of Energy in 2001 on whether to recommend the site to the President for development as a geologic repository.

The performance of a geologic repository over such long time periods cannot be proven beyond all doubt. Forecasts about future geologic and climatic conditions, and engineering estimates of how long the waste packages will remain intact, cannot be directly validated. The mathematical models used in the performance assessment are subject to uncertainties that can be reduced but never completely eliminated.

The challenge in licensing a geologic repository is demonstrating compliance with long-term safety standards for many thousands of years. The Nuclear Regulatory Commission's general standard for meeting geologic repository regulatory criteria and objectives is reasonable assurance. While considerable uncertainties remain today, DOE believes that reasonable assurance should be achievable in the licensing process after the planned work is completed. The DOE believes, therefore, that ongoing work at Yucca Mountain should proceed as planned.



U.S. Department of Energy
Office of Civilian Radioactive Waste Management

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

P.O. Box 30307
North Las Vegas, NV 89036-0307
1-800-225-6972
<http://www.ymp.gov>

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