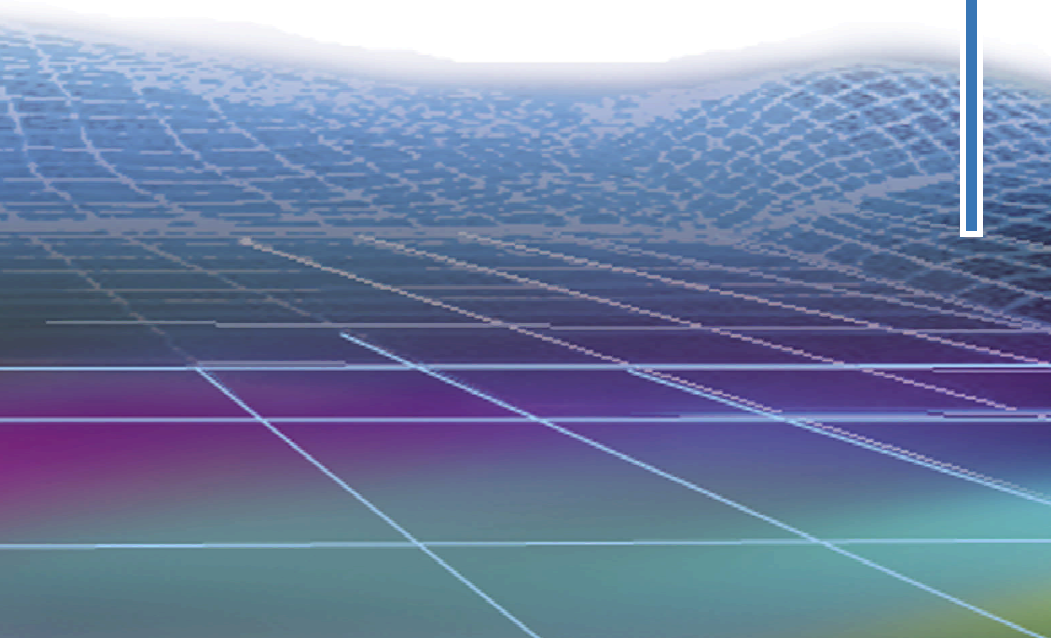
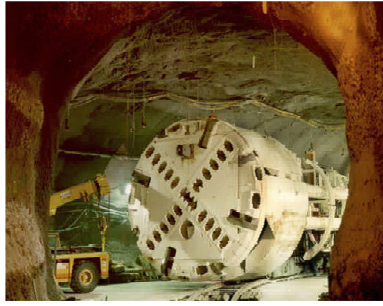
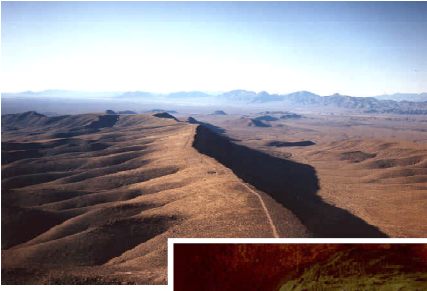


# Welcome to the Yucca Mountain Project



Dear Visitor:

Thank you for visiting the Yucca Mountain Project. We appreciate the opportunity to share with you the work of our scientists, engineers, and support personnel.

In February 2002, after more than 20 years of study, the Department of Energy recommended the Yucca Mountain site to the president for development as the nation's first geologic repository for high-level radioactive waste. Following an affirmative vote in both houses of Congress, the site designation became effective on July 23, 2002, when President George W. Bush signed House Joint Resolution 87.

As President Bush stated in his letter to Congress recommending Yucca Mountain, "This recommendation is the culmination of two decades of intense scientific scrutiny involving application of an array of scientific and technical disciplines necessary and appropriate for this challenging undertaking."

If you have questions after your visit, feel free to contact us toll-free at 800-225-6972 or at the following address:

United States Department of Energy  
Office of Civilian Radioactive Waste Management  
Office of Repository Development  
P. O. Box 364629  
North Las Vegas, NV 89036-8629

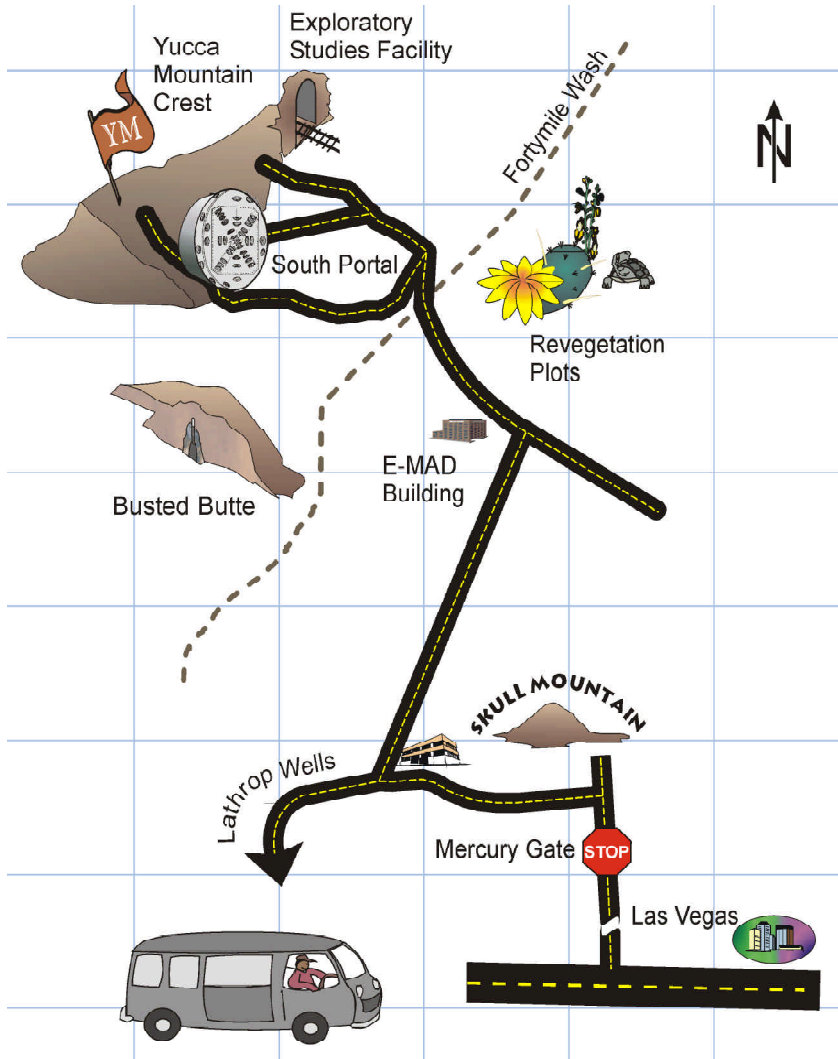
You may also wish to visit our Internet site at [www.ocrwm.doe.gov](http://www.ocrwm.doe.gov) for additional information and links to related Web sites.

Again, thank you for visiting the Yucca Mountain Project. I encourage you to share information about the Project with your friends and neighbors, and to learn more about our work on developing a safe, permanent solution to the challenge of radioactive waste management.

Sincerely,  
*W. John Arthur, III*  
W. John Arthur, III  
Deputy Director

# Discovering Yucca Mountain

As you visit the Yucca Mountain Project, located 100 miles northwest of Las Vegas, you will learn about different areas of the Project and why scientists and engineers believe a repository at Yucca Mountain will protect public health and safety while preserving the quality of the environment.



# Congress directs the study of Yucca Mountain

In 1982, Congress – through its Nuclear Waste Policy Act – directed the Department of Energy (DOE) to develop a geologic repository for the safe disposal of spent nuclear fuel and high-level radioactive waste. A year later, the DOE selected nine locations in six states for consideration as potential sites. In 1986, this list was reduced to three sites in three states. In 1987, Congress amended the act and directed the DOE to study only Yucca Mountain in Nevada. If at any time it was determined that the site was unsuitable, the act directed the department to stop work, restore the site, and seek new direction from Congress.

## Solving a national environmental problem

2 Some of the nation's top scientists and engineers studied Yucca Mountain for more than 20 years to determine if it would be a suitable site for our nation's first repository for spent nuclear fuel and high-level radioactive waste. Spent nuclear fuel is created when the fuel used to generate power in nuclear reactors is no longer able to produce electricity efficiently. This spent, or used, fuel is removed from nuclear reactors and stored temporarily in pools of water or in dry casks at the nuclear power plants. Storing spent nuclear fuel at reactor sites is only a temporary measure.



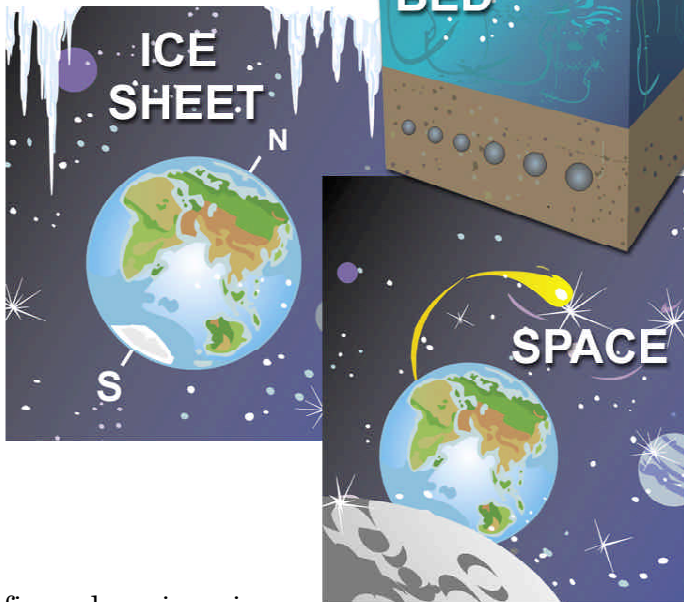
Yucca Mountain is located at the southwestern part of the Nevada Test Site in Area 25, about 100 miles northwest of Las Vegas, Nevada.

Nuclear weapons production also creates waste, some of which is highly radioactive. A large volume of waste was created in the past when spent nuclear fuel was reprocessed to extract plutonium for weapons use. The cleanup and decommissioning of the former weapons production sites will require permanent disposal of these materials.

### Several options for waste disposal considered

Before the Nuclear Waste Policy Act, scientists and engineers discussed a range of options for the disposal of waste including:

- Leaving it where it is
- Burying it in the ocean floor
- Placing it in polar ice sheets
- Launching it into space
- Burying it deep underground
- Transmutation



Scientific and engineering organizations throughout the world prefer burying the waste deep underground. ■

# Scientific program focuses on safety

Experts from around the world contribute to this Project, including scientists and engineers from the DOE's national laboratories in New Mexico and California, major universities, and leading scientific and engineering firms. Since 1978, detailed tests and studies have been performed in geology, geochemistry, hydrology, archaeology, climatology, seismology, volcanology, materials science, and environmental science.



Project scientist monitors water migration experiment in Alcove 1 of the Exploratory Studies Facility.

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Protecting the public and our employees — and safeguarding the environment — is our priority at Yucca Mountain. We review our work regularly for safety and quality issues, continuously looking for better ways to perform our tasks.

Independent organizations also review the work being done at Yucca Mountain. These organizations include the Nuclear Regulatory Commission, the Nuclear Waste Technical Review Board, and external peer reviews.

## Natural features will enhance the repository

From the top of Yucca Mountain you can see the distinctive geology of the area that led to the study of the mountain. Our studies show that Yucca Mountain has the following characteristics:

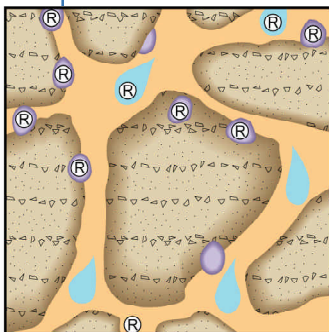
- Yucca Mountain is volcanic rock — called tuff — formed millions of years ago by hot ash deposits that cooled and solidified. There has been no volcanic activity in the area during the last 80,000 years. Experts have concluded that the chance of future volcanic activity disrupting the site is very low.

- While there are earthquakes in Nevada, a repository in Yucca Mountain would be in stable rock that has resisted earthquakes for hundreds of thousands of years. The Nuclear Regulatory Commission requires all licensed nuclear facilities, including a repository, be designed and constructed to withstand the effects of earthquakes.







Project scientists explain geologic features of the area from the top of Yucca Mountain.

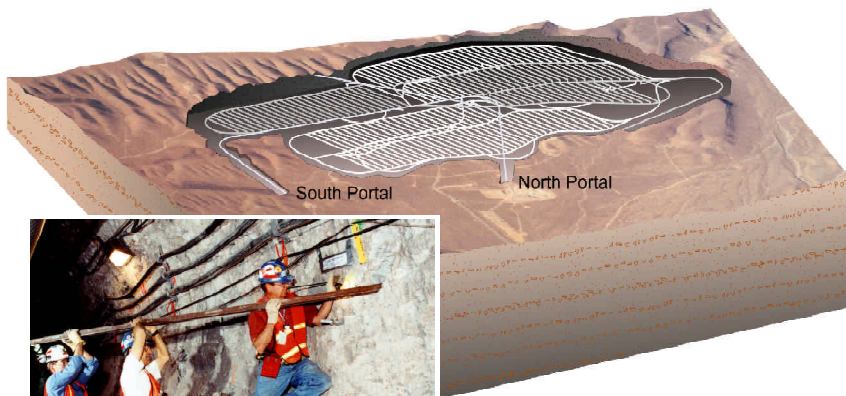
- The rock within Yucca Mountain contains zeolites — minerals that can slow the movement of radioactive materials. Scientists have confirmed the effectiveness of zeolites at the Busted Butte facility, which is located southeast of the repository.
- The groundwater table is very deep at Yucca Mountain and is contained within a closed basin that is separate from most cities and towns in Southern Nevada — including Las Vegas and Pahrump. Studies suggest that groundwater moves very slowly beneath Yucca Mountain. The DOE



**Zeolites slow radionuclide movement**

-  Moisture carrying radionuclides
-  Zeolites
-  Radionuclides sticking to zeolites
-  Tuff

If radioactive materials come in contact with zeolites, some would stick to the zeolites. In this conceptual drawing, moisture is shown moving in a cross-section of rock.



Project staff install heater element for thermal testing in the Exploratory Studies Facility. Data from these tests demonstrate how a repository would work.

and Nye County are working together on a cooperative science program that will help us better understand how the groundwater migrates from Yucca Mountain to Amargosa Valley.

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## Scientists conduct tests in underground laboratory

The Exploratory Studies Facility is a laboratory inside Yucca Mountain where scientists and engineers observe and test the mountain's geologic and hydrologic features. The main facility was excavated using a tunnel-boring machine 25 feet (7.5 meters) in diameter. It took almost three years to excavate the tunnel.

The underground laboratory's main tunnel is approximately five miles (eight kilometers) in length. From this tunnel, there are several tunnels and alcoves where Project scientists conduct research and tests that evaluate how heat affects the rock and how water and fluids move through it.

During your visit to the Exploratory Studies Facility, you'll go underground and view exhibits explaining the tests performed inside the mountain. You will also learn how a geologic repository at Yucca Mountain would receive and package spent nuclear fuel and high-level radioactive waste in a safe and controlled manner. ■



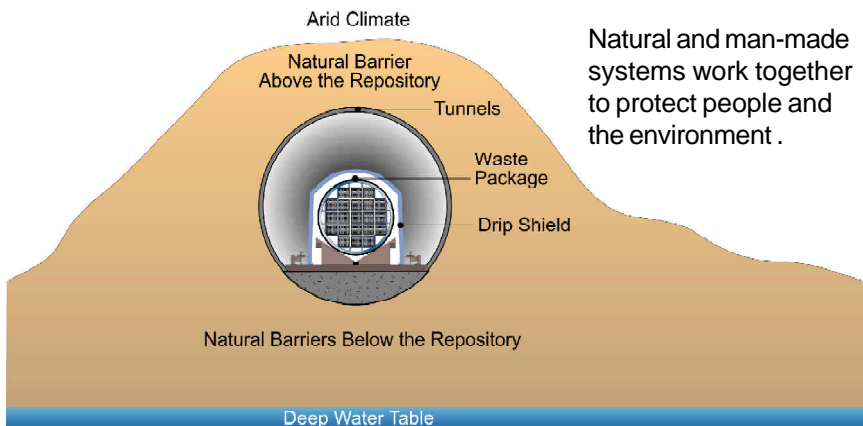
# Planning to protect people and the environment

The primary goal of a repository is to isolate radioactive materials so that they cannot damage the environment and endanger people. Since moisture moving through the ground is the main pathway for radioactive material to escape a repository, scientists and engineers carefully mapped fractures, joints, and other geologic features to test the mountain's suitability.

## Natural and man-made systems work together to contain waste

The United States' approach to nuclear waste management is to design a repository in which the natural and man-made, or engineered, barriers work together. Placing the waste into containers specifically designed to work with the mountain's natural barriers and environment will help keep the radioactive materials as dry as possible for as long as possible.

The natural features of Yucca Mountain include the desert climate, deep water table, and composition of the rock. The design for a repository includes the following engineered barriers: tunnels to house the waste packages,



structural support systems that hold the waste packages, the waste packages, and the solid form of the waste itself. Together, the natural and engineered barriers can keep water away from these materials for thousands of years.

## Repository design includes surface and subsurface facilities

Project engineers developed conceptual designs of a repository to show how DOE will safely handle and dispose of radioactive materials. A repository will include surface facilities, subsurface facilities, and waste packages.

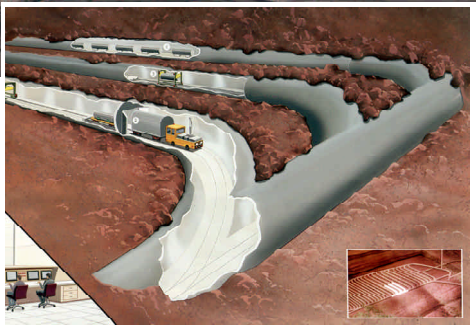
High-level radioactive waste will be received and packaged in the repository surface facility. This facility will support the following operations:

- Preparation of shipping casks for removal from trains and trucks

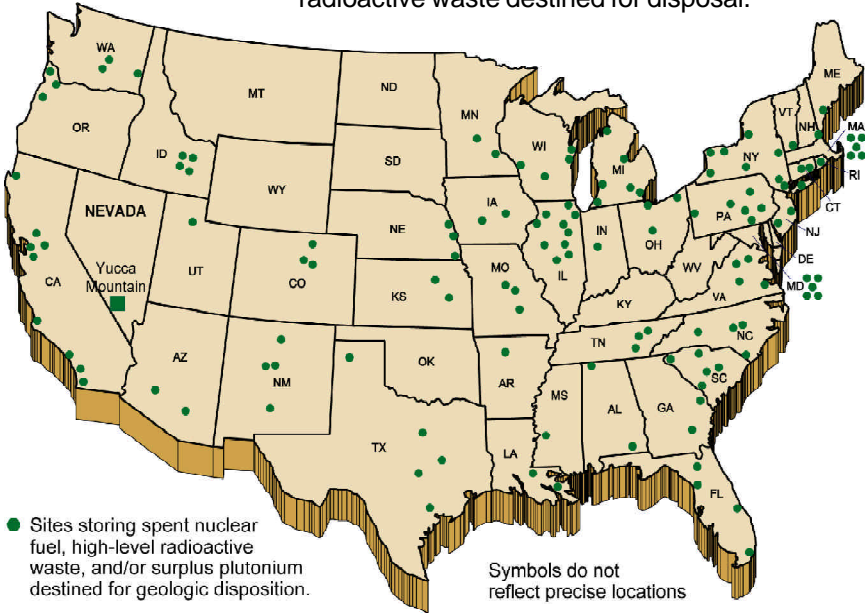
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The surface facilities of a repository would receive and package high-level radioactive waste, while the subsurface facilities would provide access underground for the emplacement of waste packages containing the solid radioactive waste forms.



## Locations of spent nuclear fuel and high-level radioactive waste destined for disposal.



- Placing spent nuclear fuel assemblies and high-level waste into waste packages for placement in the repository

The subsurface facilities will include main tunnels for access, alcoves for monitoring, and tunnels for placement of the waste. The tunnels will be located away from major geologic faults and 1,000 feet above the water table.

## Transporting radioactive materials to a repository

The United States has safely transported spent nuclear fuel and high-level radioactive waste for more than 30 years. We will only use transportation casks certified by the Nuclear Regulatory Commission to transport spent nuclear fuel and high-level radioactive waste to the site. These casks are designed to protect public health and safety, and they have multiple layers of strong, dense materials to shield people from radiation and contain the contents in an accident. ■

# Repository development process moves ahead

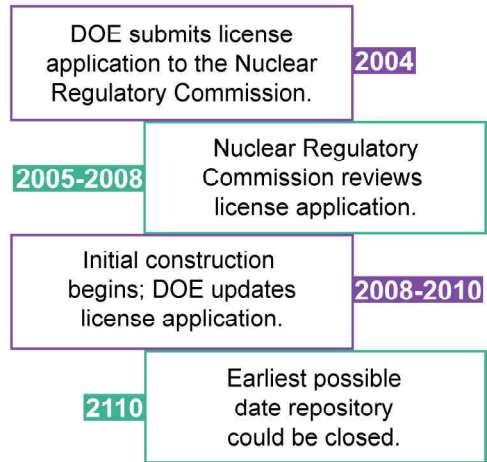
The DOE issued its Final Environmental Impact Statement in February 2002 as part of its recommendation to the president on the suitability of Yucca Mountain for development as a geologic repository. The site designation became effective in July 2002.

DOE intends to submit a license applica-

tion to the Nuclear Regulatory Commission in December 2004. This application will request permission to construct surface and underground facilities at Yucca Mountain. The application is scheduled to be updated and resubmitted in 2008 to support receipt of a license to receive and possess waste. Waste is expected to begin arriving at the site in 2010.

DOE also intends to begin the process of developing the transportation system, which will involve consulting affected local governments. ■

The next steps . . .



# Yucca Mountain Science Centers

If you have questions or concerns or would like additional information about the Project, be sure to visit our Yucca Mountain Science Centers in Las Vegas, Pahrump, and Beatty.



Science center staff explain volcanoes, earthquakes, and water movement through rock to the public.

Visitors to the Yucca Mountain Science Centers learn about the Project through hands-on activities.



## Las Vegas Science Center

4101 B Meadows Lane, Las Vegas, NV 89107  
702-295-1312

## Pahrump Science Center

1141 S. Highway 160, Pahrump, NV 89041  
775-727-0896

## Beatty Science Center

U.S. 95 & State Route 374, Beatty, NV 89003  
775-553-2130



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

## YUCCA MOUNTAIN PROJECT

YMP/DOE-0600

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February 2003

***Natural and man-made barriers  
working together to protect  
people and the environment***

