Science, Society, and America's Nuclear Waste

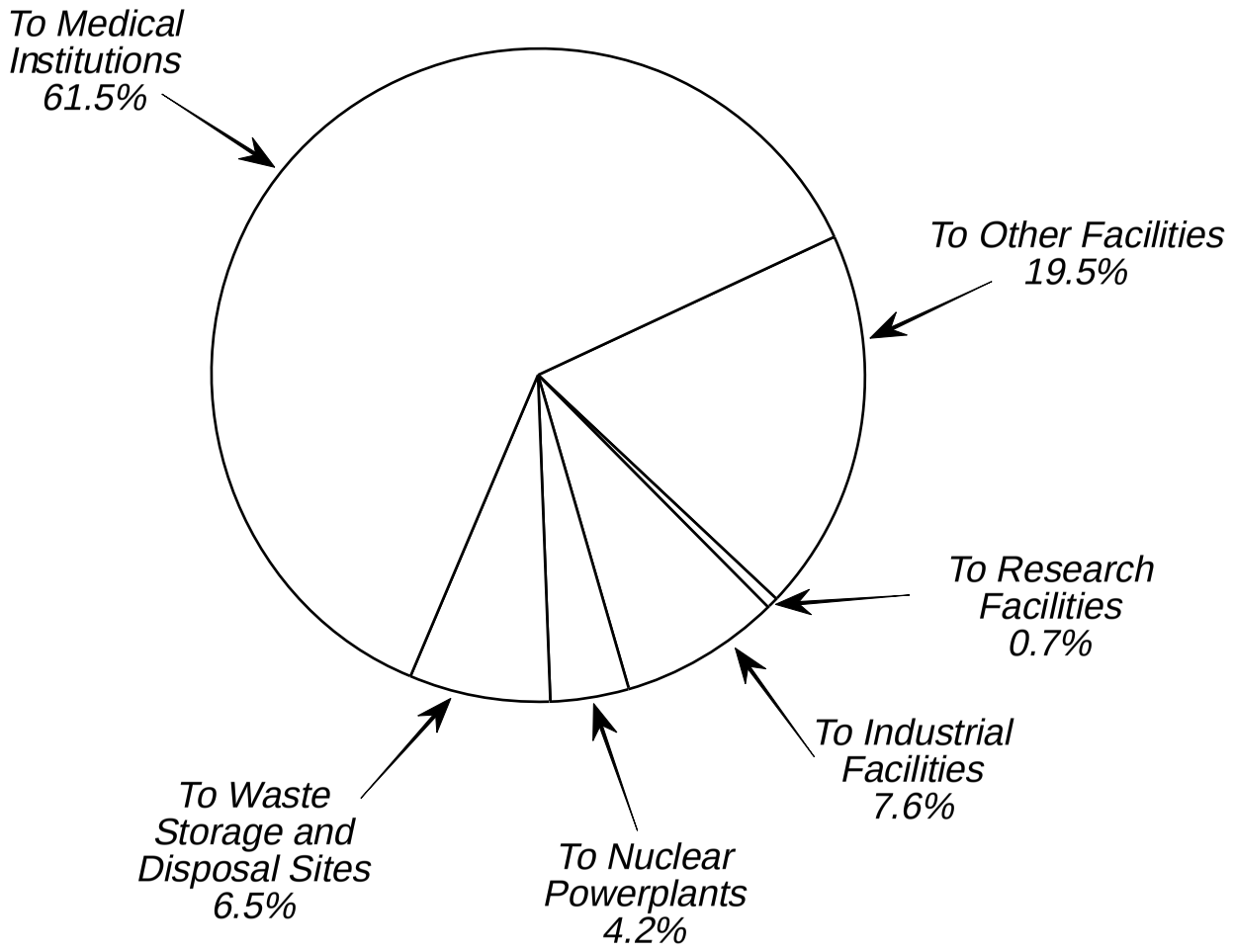
Transparency Masters & Student Activities

- What Measures Ensure Safe Transportation of High-Level Nuclear Waste?
- What Will a Geologic Repository Be Like?
- What Is the Role of the Multi-Purpose Canister in the Waste Management System
- You Are Invited... The Stakeholders Public Meeting
- Designing for Safety
- Analyzing State Highway Maps
- Planning Hazardous Materials Shipment Routes
- Important Rock Characteristics
- Porosity & Permeability
- Solubility, Mineral Solubility
- Thermal Stability
- Ion Exchange & Zeolites
- Topographic Map Skills
- Practice with Scale, Latitude, and Longitude
- Contouring
- Topographic Maps of Landscapes
- Topography of the Yucca Mountain Site
- Considerations for siting the High-Level Nuclear Waste Repository
- Crossword Puzzle
- Metric & U.S. Unit Conversions

The Waste Management System

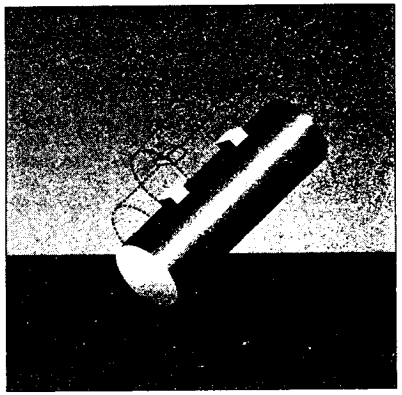
Unit 4 Second Edition
Teacher Guide

Where Is Radioactive Material Shipped?



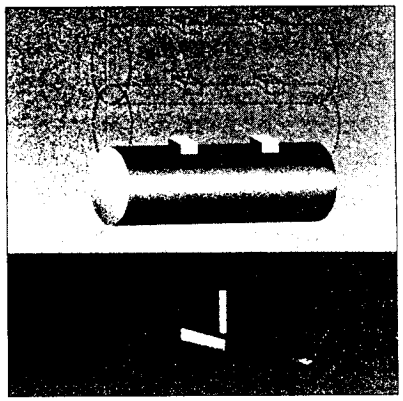
Source: Transporting Radioactive Materials . . . Answers to Your Questions (DOE/EM-0097), April 1993.

Standards for Spent Fuel Casks

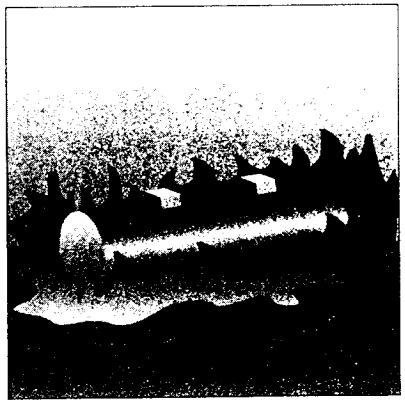


Mechanical

Free Drop – Nine meter (30-foot) drop of the spent fuel cask onto a flat, horizontal, unyielding surface with the cask positioned so that its weakest point is struck. Drop tests have been conducted at much greater heights 610 meters (2,000 feet) without breaching the cask containment.

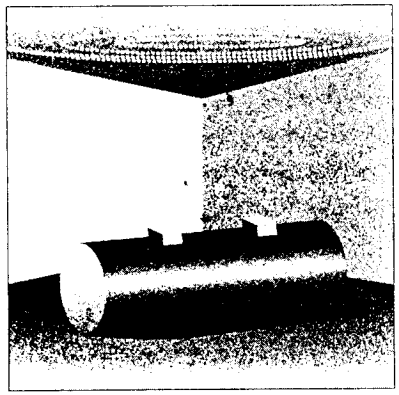


Puncture – One meter (40-inch) free drop of the cask onto a 15 centimeters (6-inch) diameter steel bar at least 20 centimeters (8 inches) long; the bar is to strike at its most vulnerable spot.



Thermal

Fire – After the mechanical tests are completed, the package is totally engulfed in a fire or furnace at 800°C (1,475°F) for 30 minutes.



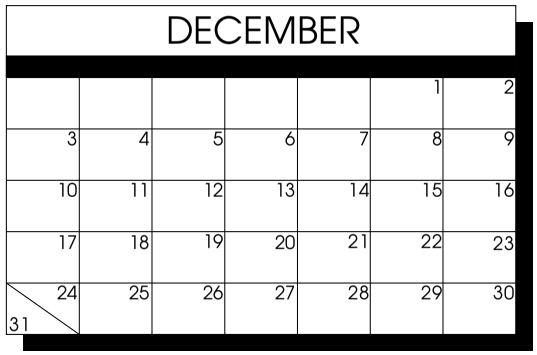
Water Immersion

Immersion of all packaging surfaces under at least 1-meter (3 feet) of water for 8 hours; immersion of entire packaging under 15 meters (50 feet) of water for 8 hours.

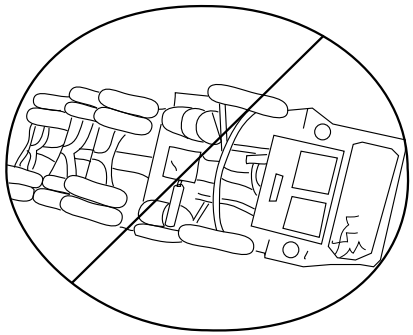
Factors Considered in Selecting Highway Routes

Transit Time

Population Density



Time of Day and Week



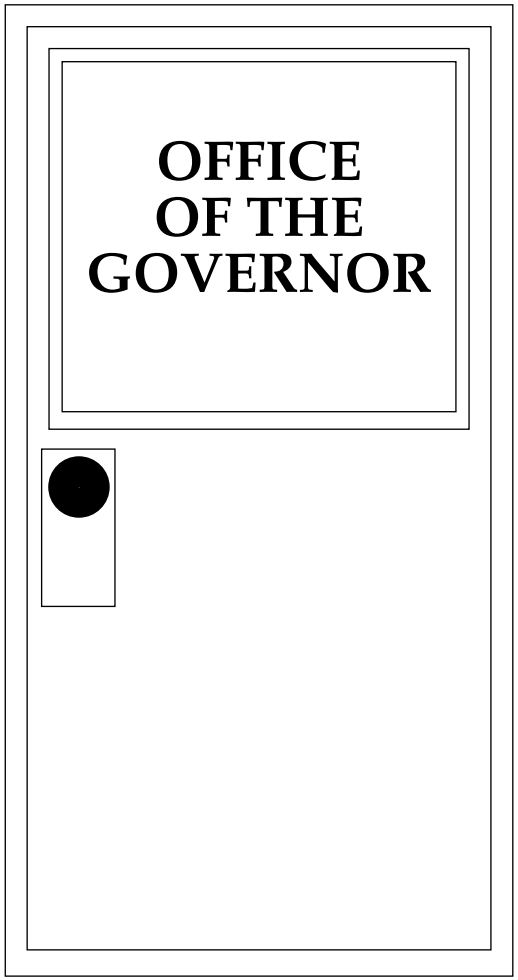
Accident Rates

The carrier must consider accident rates, transit times, population density and activities, and time of day and week when selecting a shipping route.

Source: Transporting Radioactive Materials. . . Answers to Your Questions (DOE/EM-0097), April 1993.

Information Provided to States and Indian Tribes About Shipments of Radioactive Materials

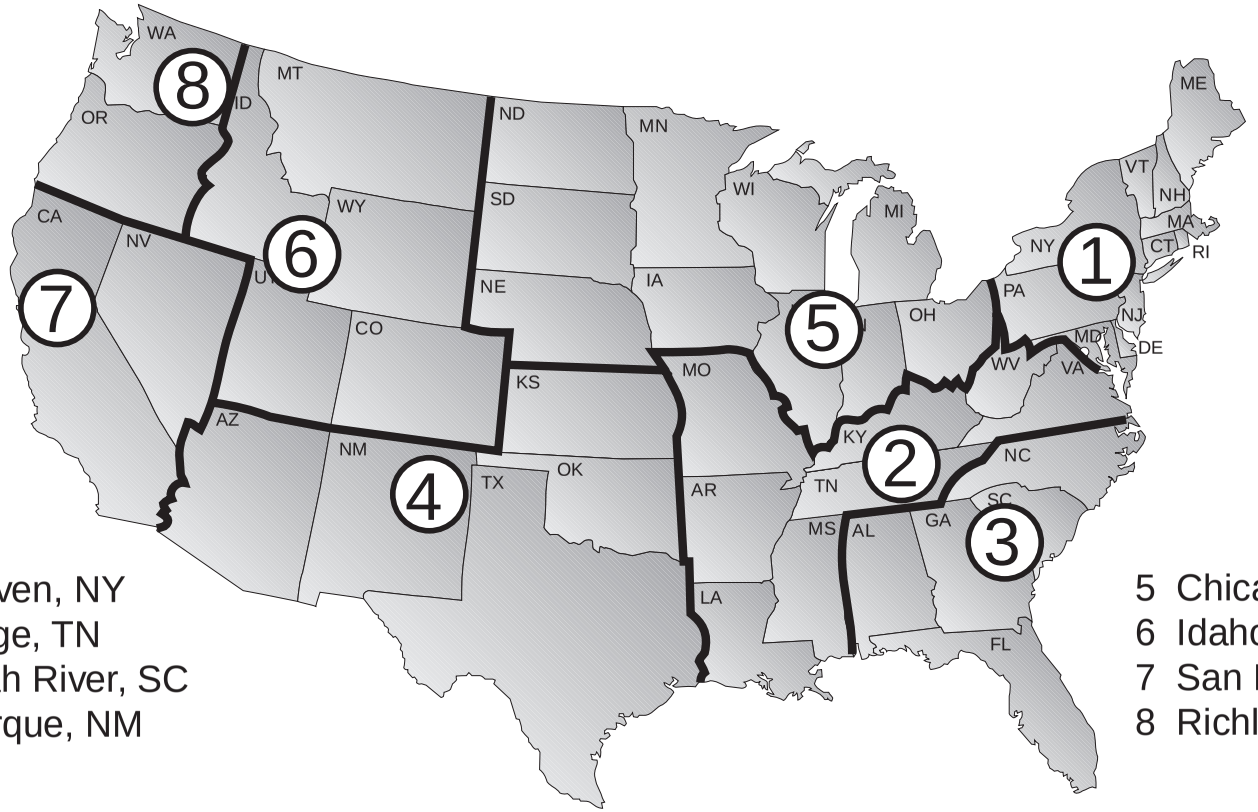
- Planned Schedule
- Route
- Description
- Carrier Name and Address



The Governor, designated State official, or Tribal representative receives written notice in advance of transporting certain radioactive material shipments through State or Tribal lands.

Source: Transporting Radioactive Materials... Answers to Your Questions (DOE/EM-0097), April 1993.

U.S. Department of Energy Regional Coordinating Offices Emergency Operations Centers

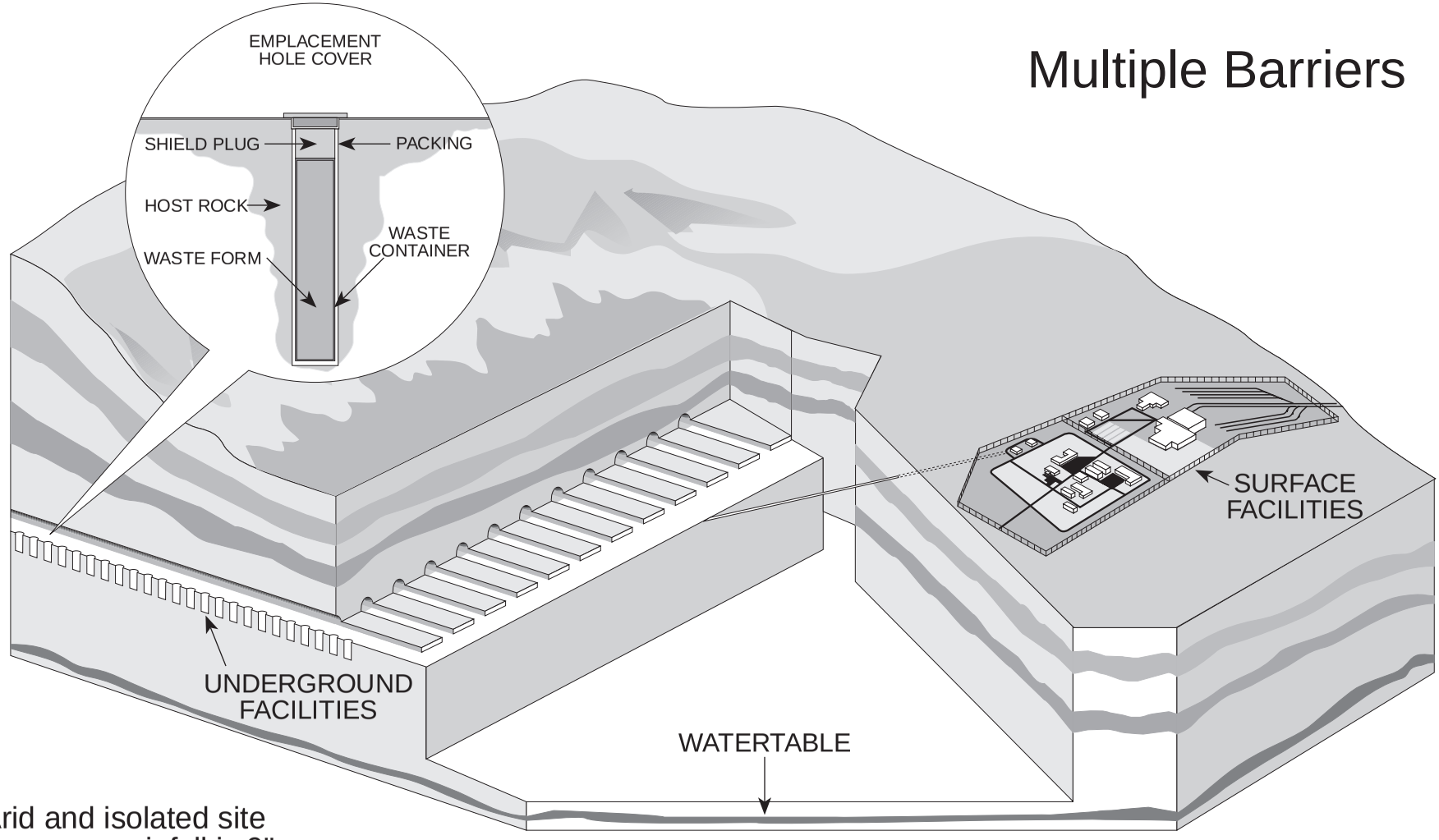


1 Brookhaven, NY
2 Oak Ridge, TN
3 Savannah River, SC
4 Albuquerque, NM
5 Chicago, IL
6 Idaho Falls, ID
7 San Francisco, CA
8 Richland, WA

There are eight DOE Regional Coordinating Offices and Emergency Operations Centers that can dispatch radiological assistance teams to support State and local responders.

Source: DOE/Oak Ridge Regional Coordinating Office and Emergency Operations Center, 1994.

Multiple Barriers

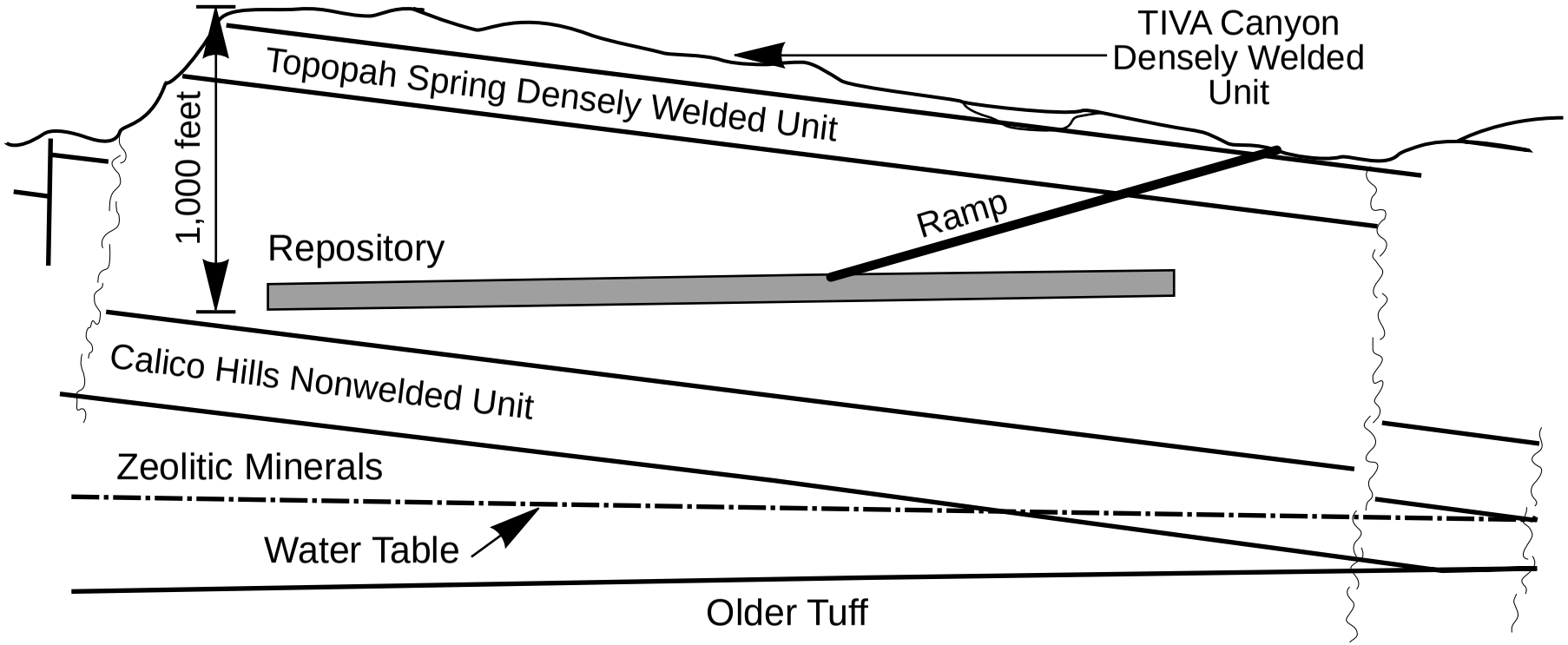


Arid and isolated site
- average rainfall is 9" per year
- most rainfall runs off or evaporates

Rock formation
- volcanic tuff rock is located in the unsaturated zone
- repository would be above water table
- zeolite minerals can trap radioactive contaminants

Multiple barriers provide protection of the environment. The natural barriers will be teamed with engineered barriers.

Rock Strata



Yucca Mountain features <u>can</u> contribute to long-term isolation of waste

- unsaturated environment
- probable occurrence of zeolite minerals that could trap radionuclides