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

www.ocrwm.doe.gov

Perspective on Sustainable Design for the Monitored Geologic Repository at Yucca Mountain

Presented to:
Pollution Prevention Televideo Conference

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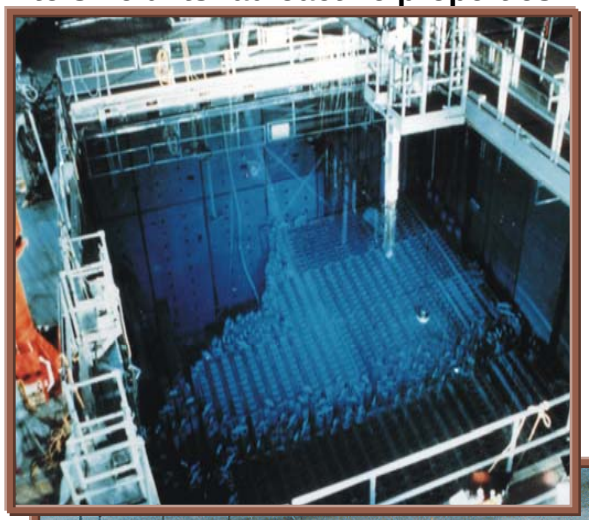
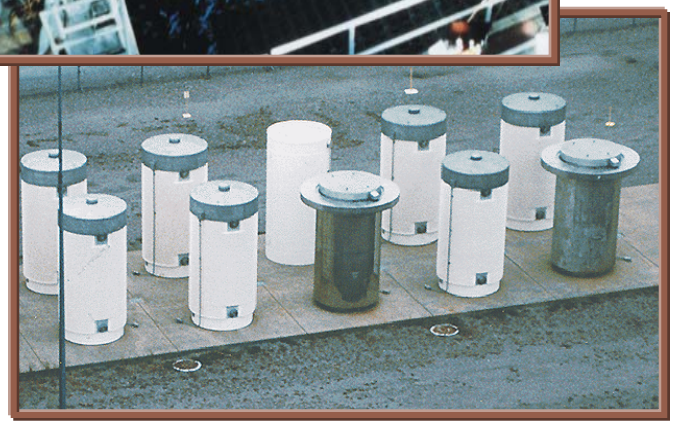
Our Vision

We are valued by our nation for integrity, safety, security, and efficiency for achieving enduring operations for spent fuel and high-level waste disposal at Yucca Mountain.

Spent Nuclear Fuel Statistics

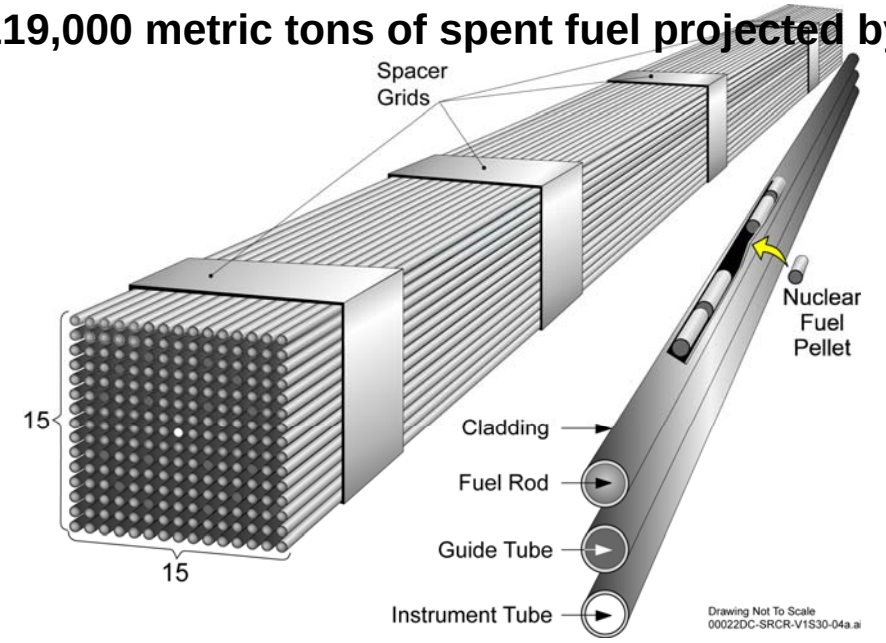
Spent fuel is stored in large pools of water to shield its radioactive properties



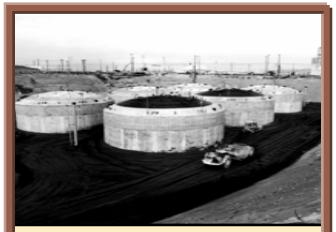


Or, spent fuel is stored in above-ground dry casks

- **Nuclear power plants are producing about 20% of the electricity in the U.S.**
  - **72 plant sites with spent fuel**
  - **5 DOE sites with spent fuel**
  - **39 states with spent fuel**
  - **47,000 metric tons of spent fuel exist in 2003**
  - **119,000 metric tons of spent fuel projected by 2035**



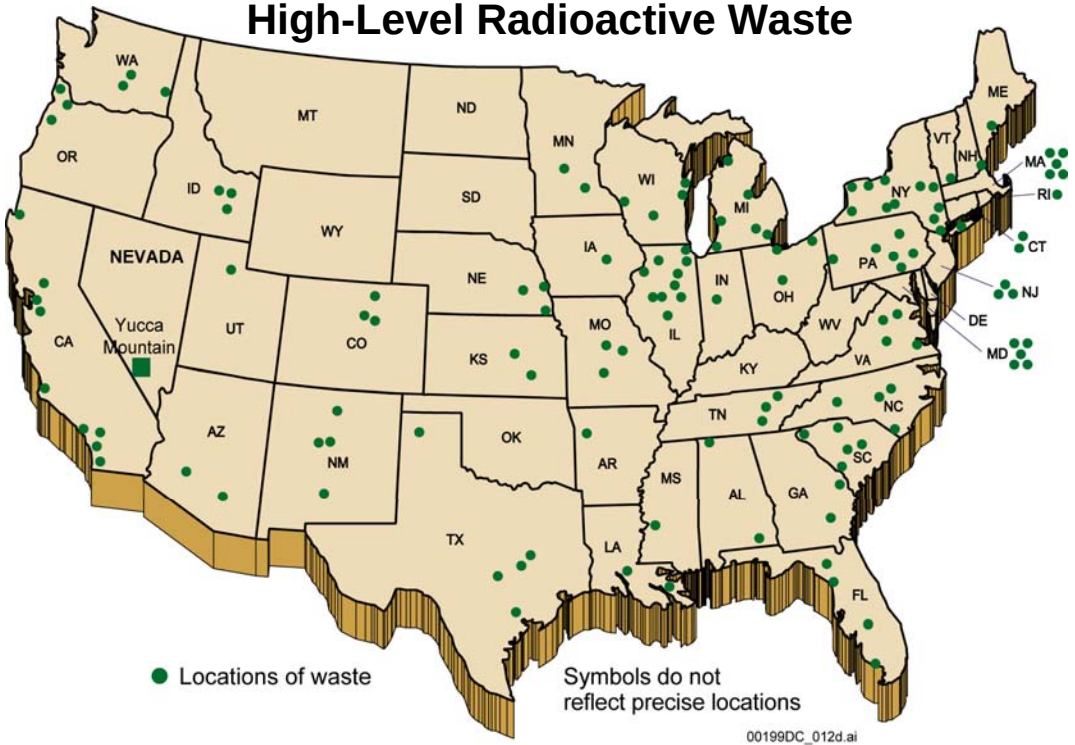
Geologic Disposal Addresses Multiple Missions



Defense Complex Clean-Up

Support of Nonproliferation Initiatives, e.g. Disposal of DOE Foreign Research Reactor Spent Fuel

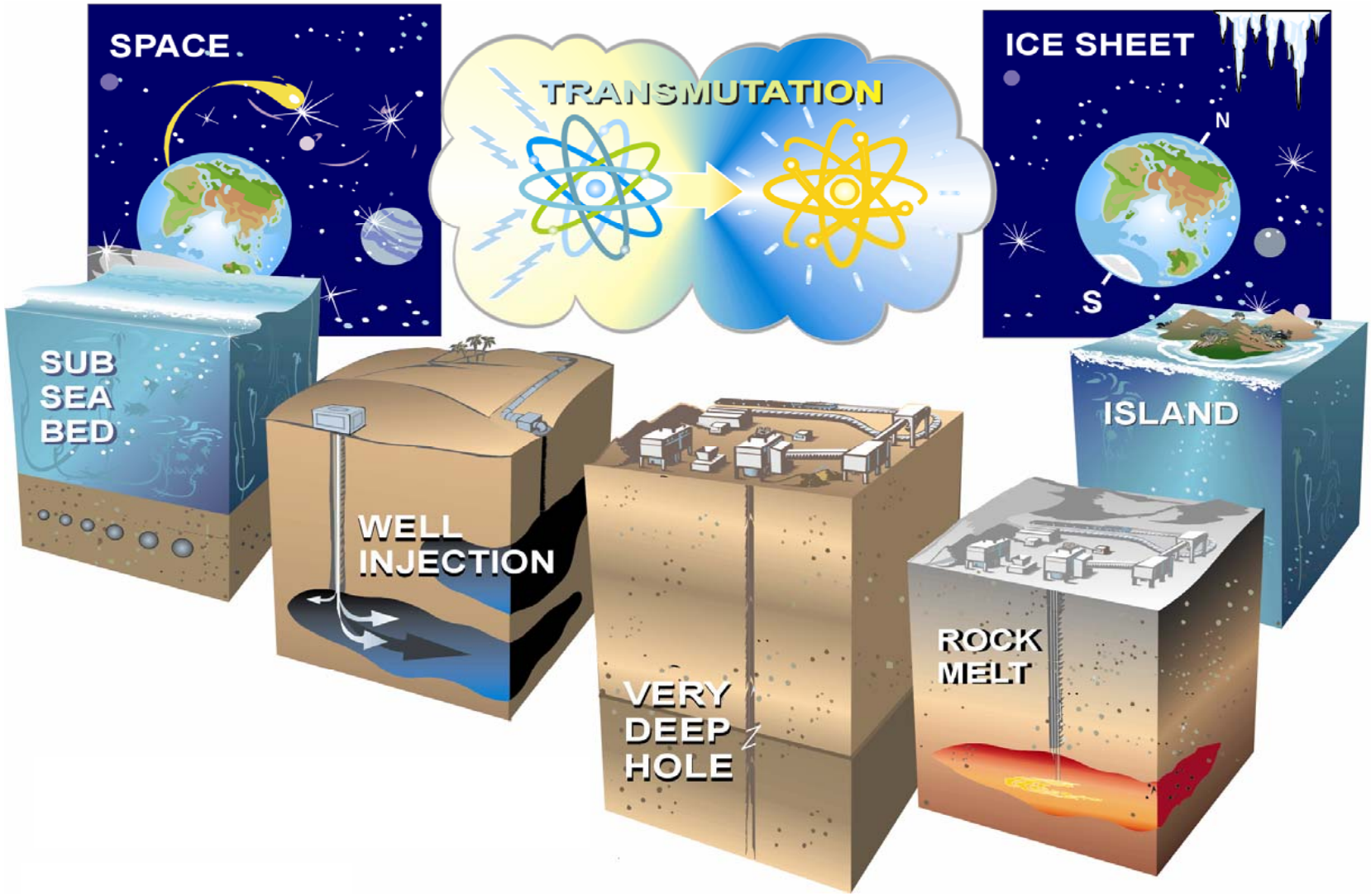
Locations of Spent Nuclear Fuel and High-Level Radioactive Waste



Commercial Spent Nuclear Fuel

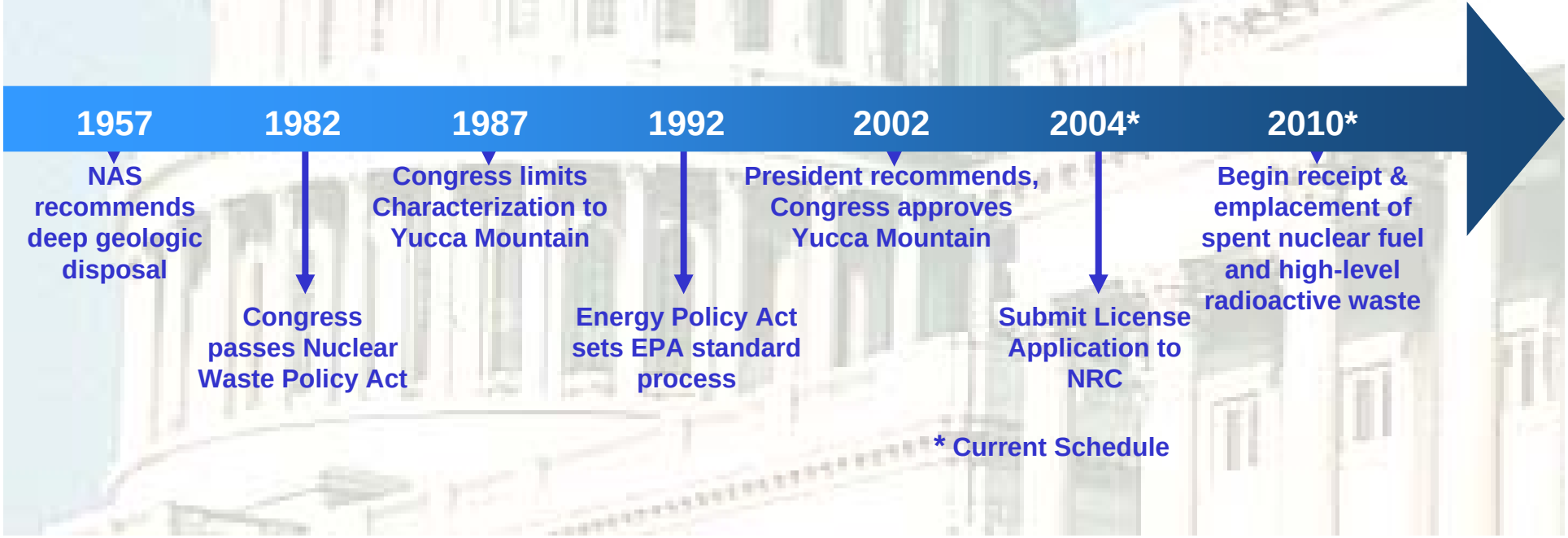
Disposition of Naval Reactor Spent Nuclear Fuel

Alternative Concepts for Waste Disposal



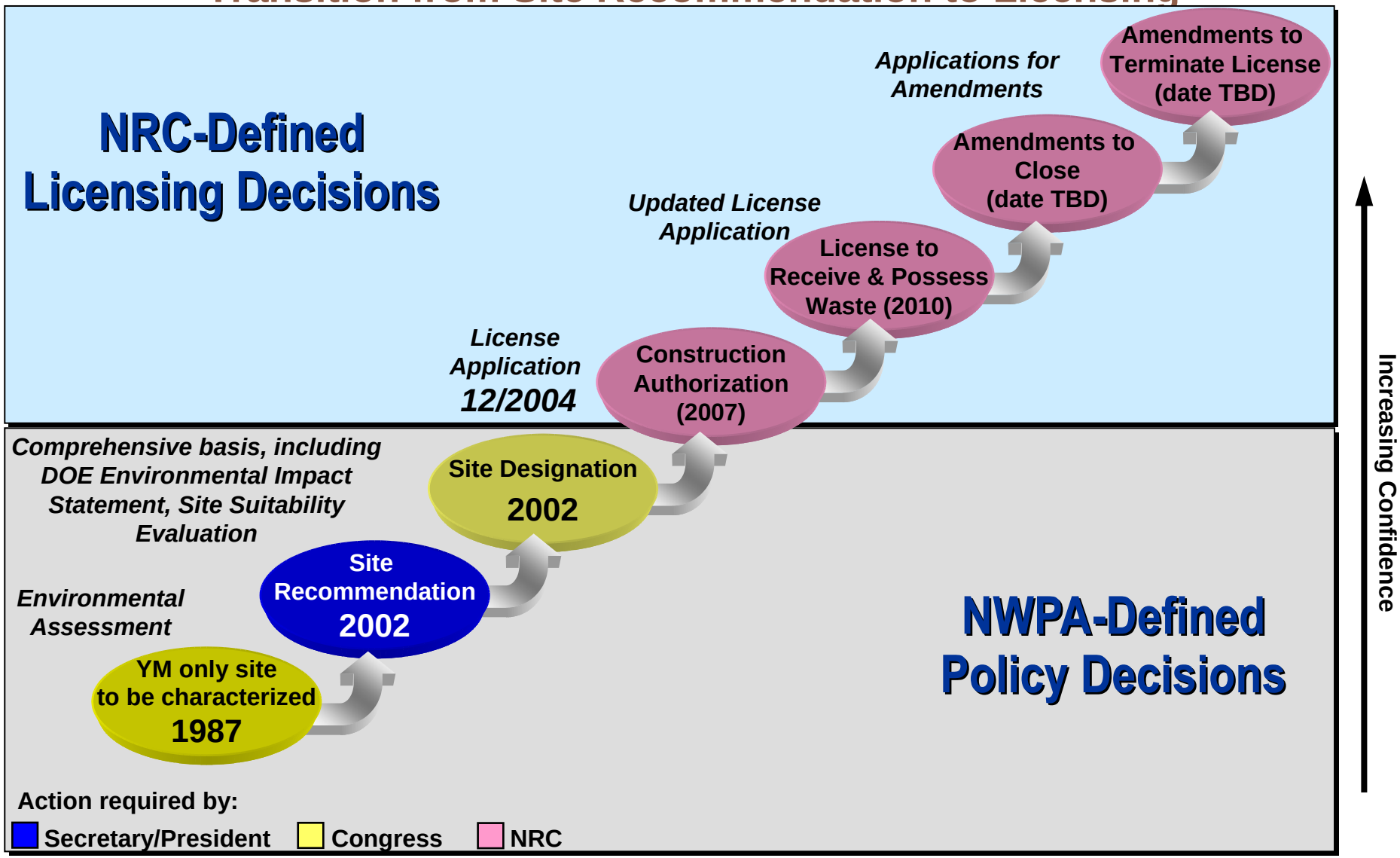
Congress Created a Legal Obligation to Dispose of Nuclear Waste

- **1982 - Nuclear Waste Policy Act (NWPA) established national policy for the disposition of high-level radioactive waste and commercial spent nuclear fuel**
- **1987 - Congress directs DOE to characterize only the Yucca Mountain site**
- **2002 - Congress passes a joint resolution approving the Yucca Mountain site for development as a repository**



Step-Wise Decision Process

Transition from Site Recommendation to Licensing



Project Regulators and Oversight

Regulation

- Nuclear Regulatory Commission
- Environmental Protection Agency
- Department of Transportation

Oversight

- Federal Government
  - General Accounting Office
- State/Local Government
- Other Stakeholders

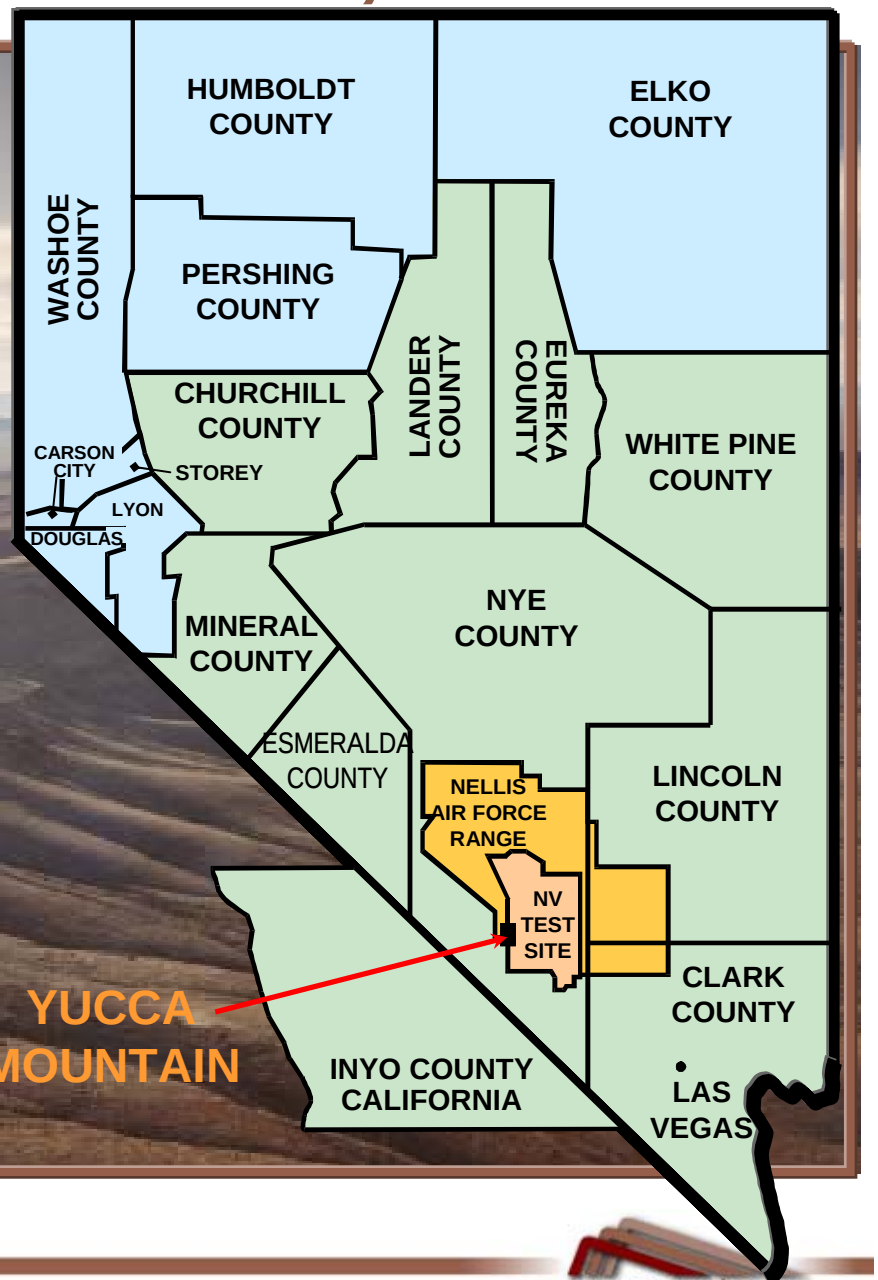
Review

- National Academy of Sciences
- Nuclear Waste Technical Review Board
- Advisory Committee on Nuclear Waste

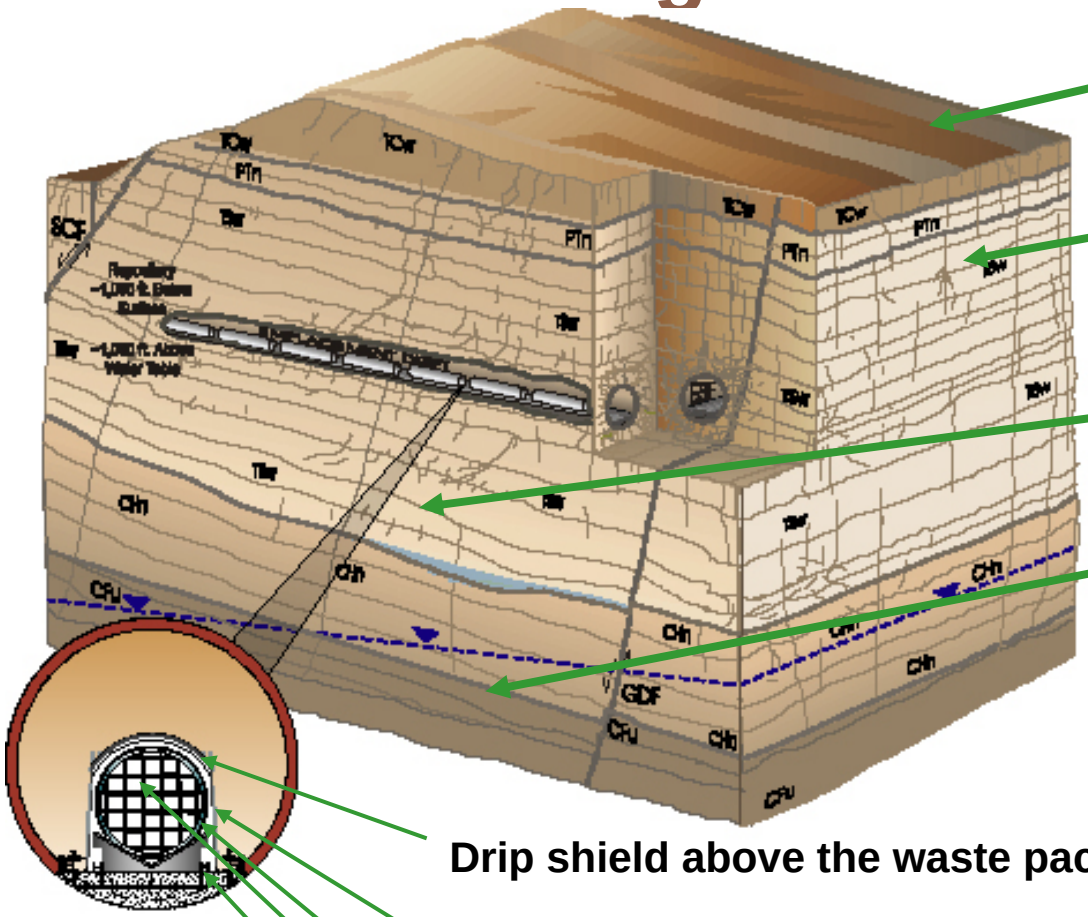
Location of Yucca Mountain, Nevada

Counties designated as Affected Units of Local Government

- 100 miles northwest of Las Vegas in Nye County
- Located on western boundary of the Nevada Test Site, a DOE facility



Repository System
Natural and Engineered Features



Surficial soils and topography

Unsaturated rock layers overlying the repository

Unsaturated rock layers below the repository

Volcanic tuff and alluvial deposits below the water table

Drip shield above the waste packages

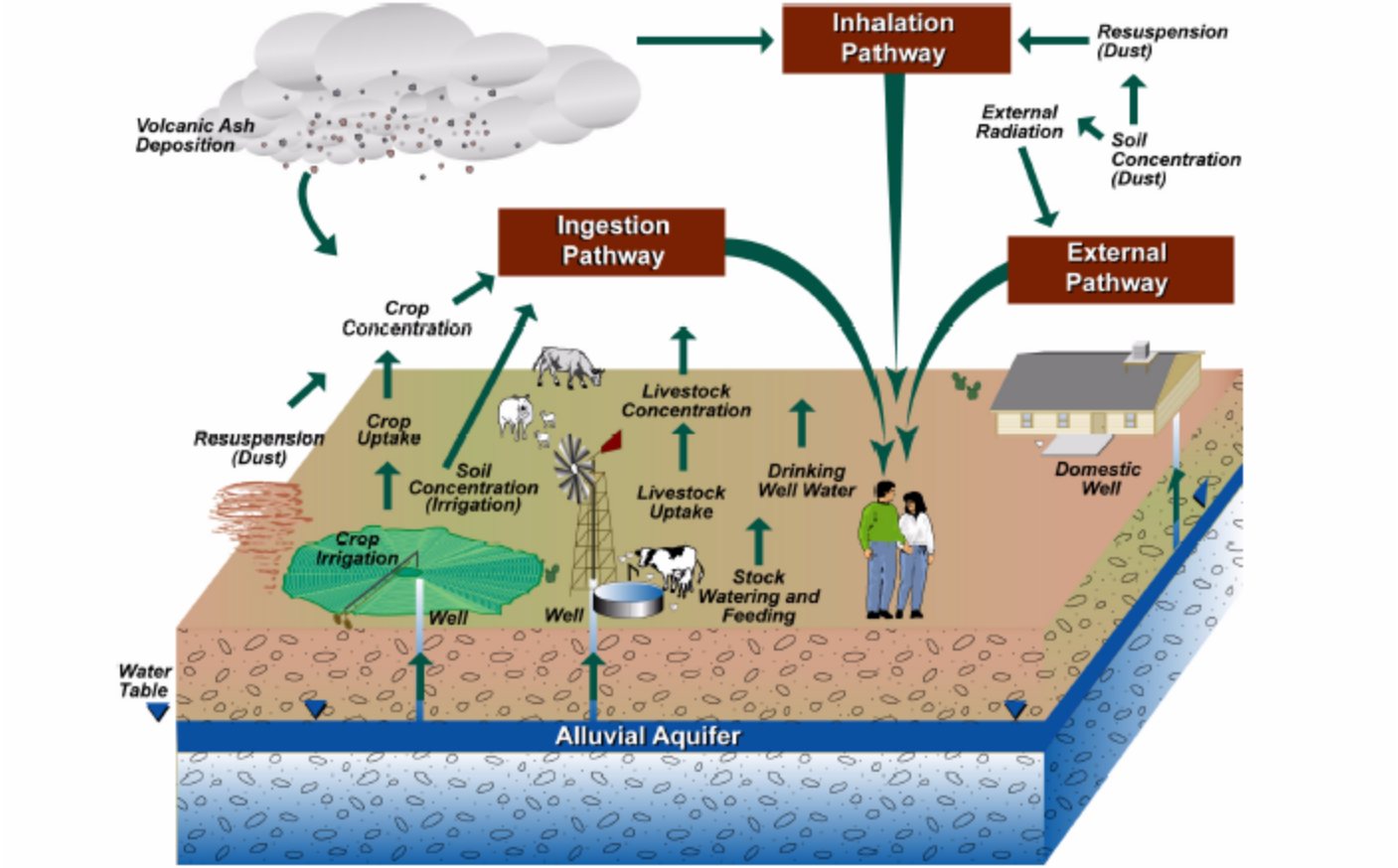
Waste package

Spent fuel cladding

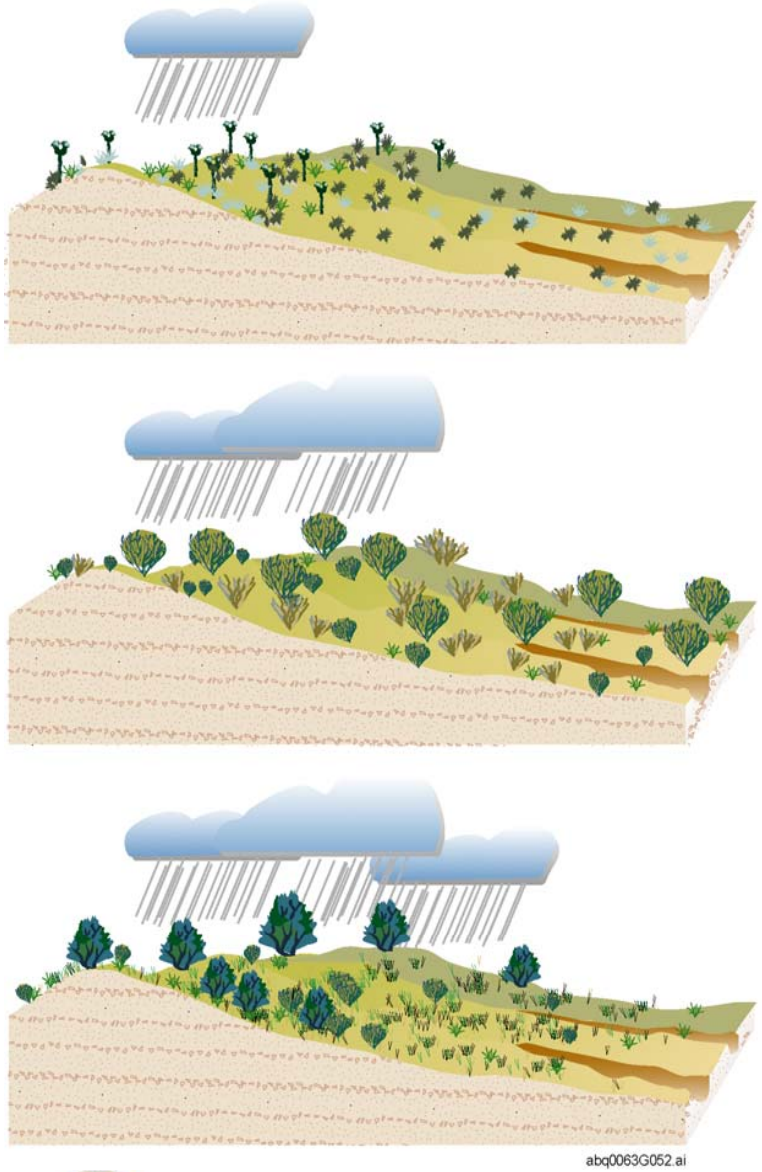
Waste form

Invert below the waste packages

Biosphere


Inhalation Pathway
Resuspension (Dust)
Volcanic Ash Deposition
External Radiation
Soil Concentration (Dust)
Ingestion Pathway
External Pathway
Crop Concentration
Resuspension (Dust)
Crop Uptake
Soil Concentration (Irrigation)
Livestock Concentration
Livestock Uptake
Drinking Well Water
Domestic Well
Crop Irrigation
Well
Well
Stock Watering and Feeding
Water Table
Alluvial Aquifer

Sustainable Site - Climate Model



Present Day

Yucca Mountain

Monsoon

Lower-bound analog: Yucca Mountain
Upper-bound analog: Nogales, AZ
Higher precipitation and temperature than present-day

Glacial Transition

Lower-bound analog: Delta, UT
Upper-bound analog: Spokane, WA
Higher precipitation and lower temperature than present-day

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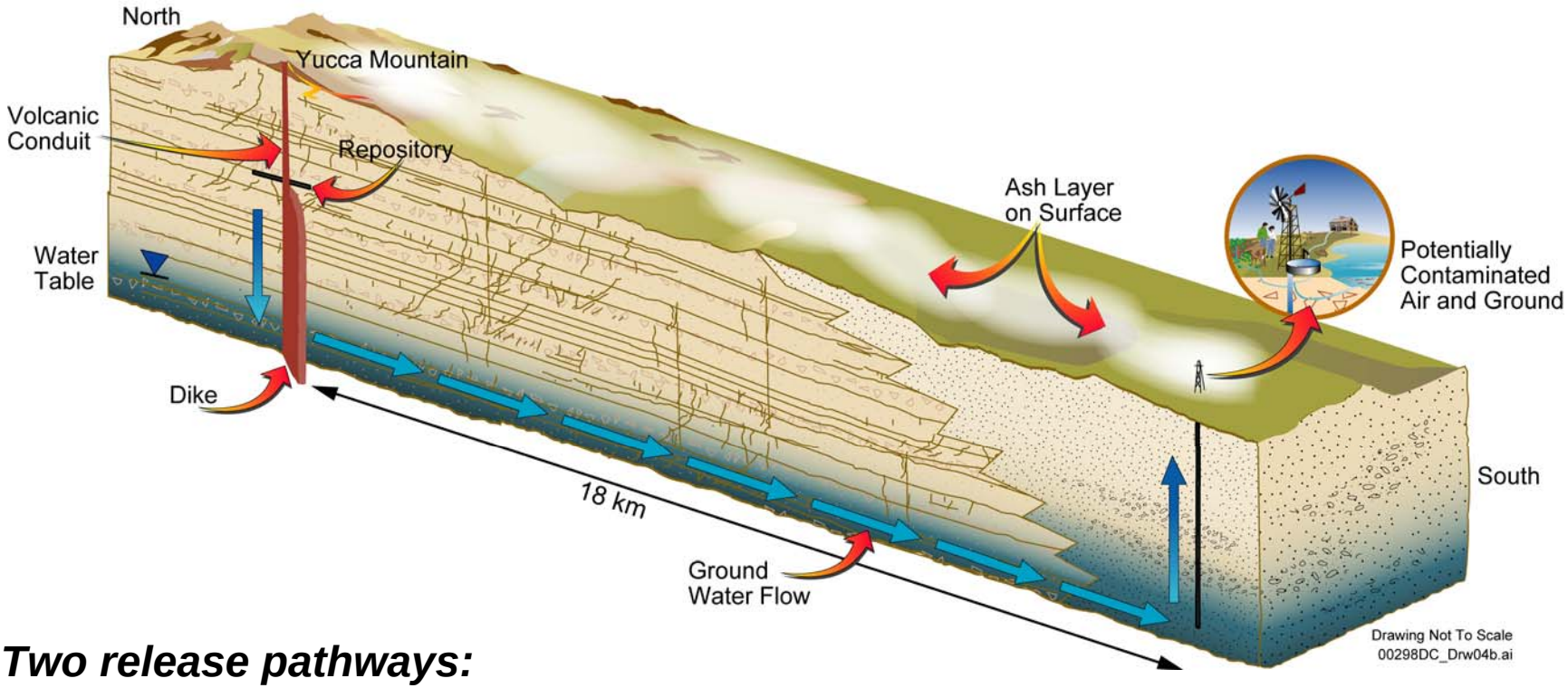
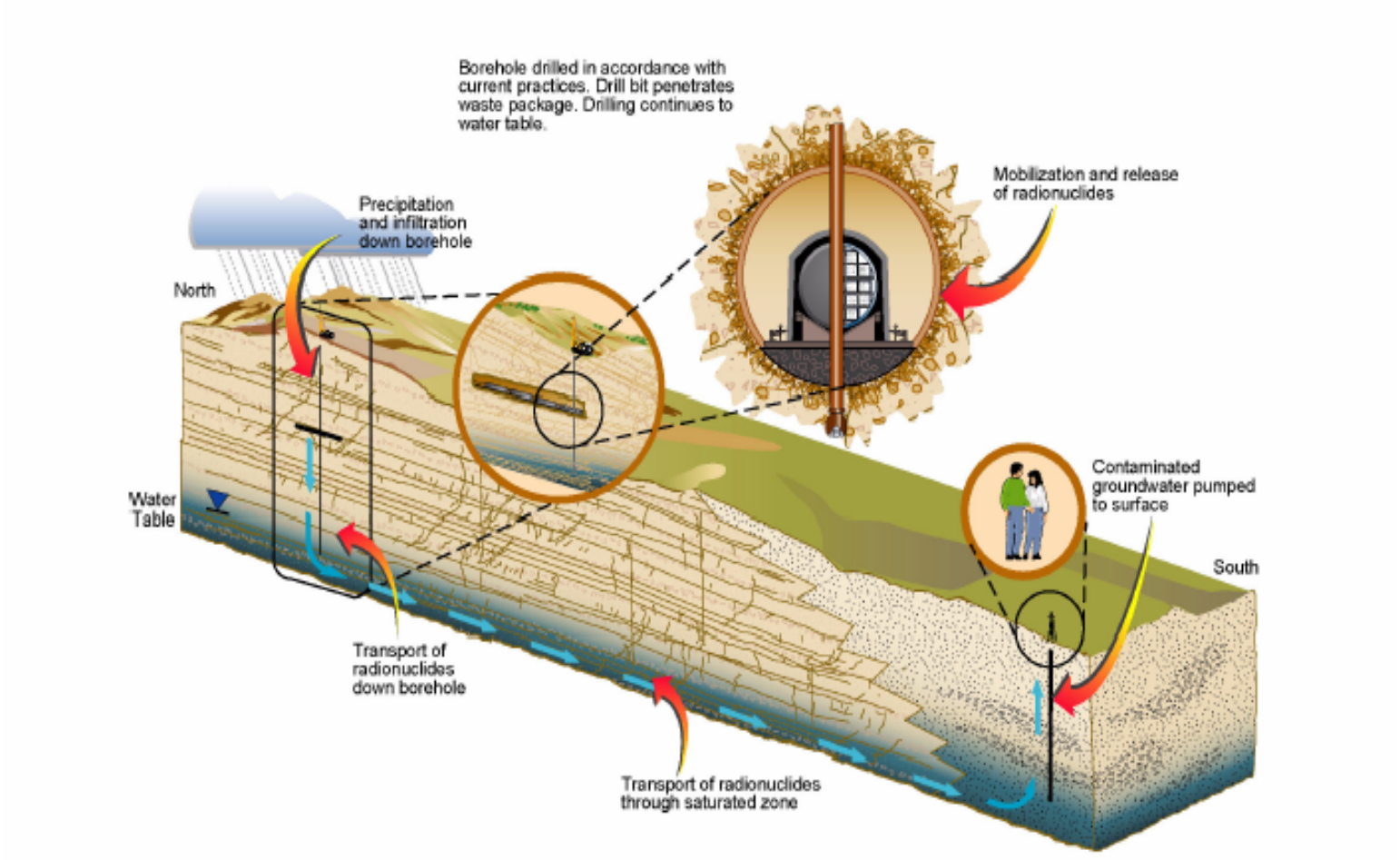
- **Present climate and two future states based on paleoclimate data and modern analogs**
- **Timing of climate changes is fixed based on evaluation of paleoclimate data**
- **Uncertainty in magnitude of changes in precipitation and temperature is included through the infiltration model**
- **Provides**
  - **Mean annual temperature and precipitation, timing of changes**
  - **Water table rise with wetter climates, shortens transport path**
  - **Increases flow rates for wetter climate states**

Igneous Hazards: Scenario Classes



- ***Two release pathways:***
  - ***eruptive (ash plume) and***
  - ***intrusive (groundwater plume)***

Human Intrusion

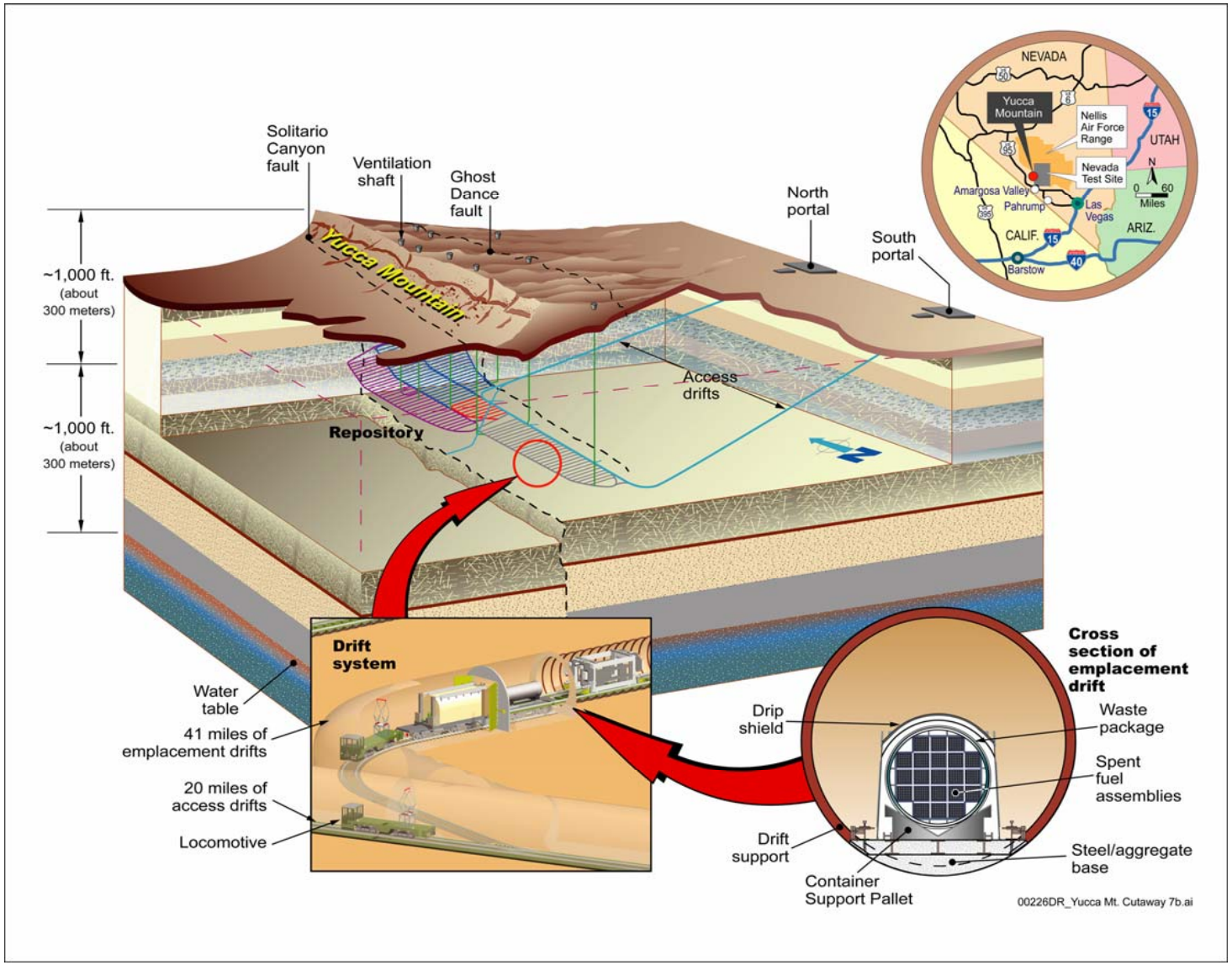


Continuing Studies Inside the Mountain

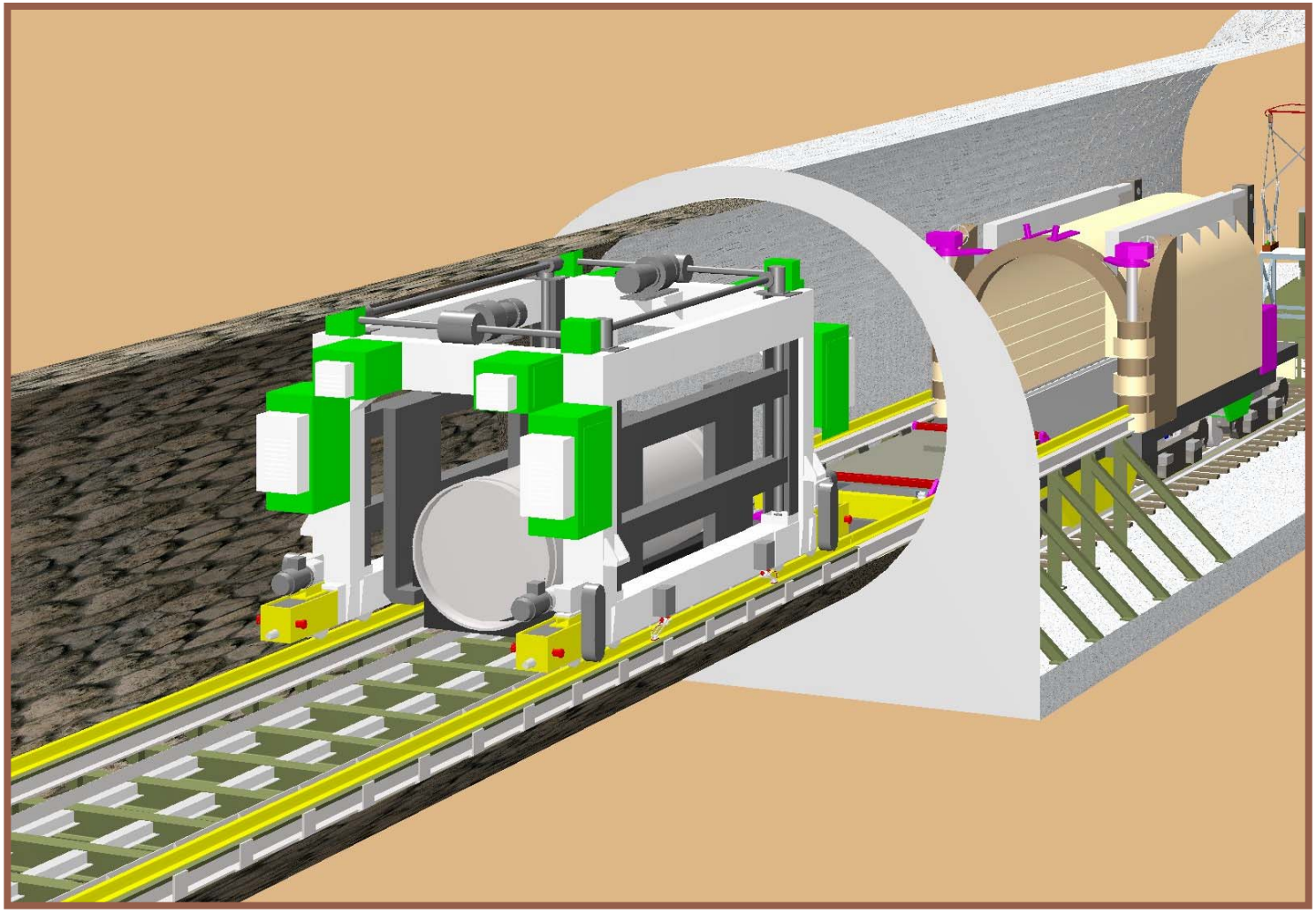
Purpose: To study the geologic environment at the potential repository horizon

- **The five-mile-long underground Exploratory Studies Facility provides direct access to rock layer of potential repository**
- **Two miles of exploratory cross drift allow study of rock layers above and below horizon of the repository in an east-west direction**
- **Eight testing alcoves accommodate experiments in rock layers at repository horizon**
- **Six niches allow for hydrology studies and experiments**

Repository Reference Design Concept



Performance Confirmation



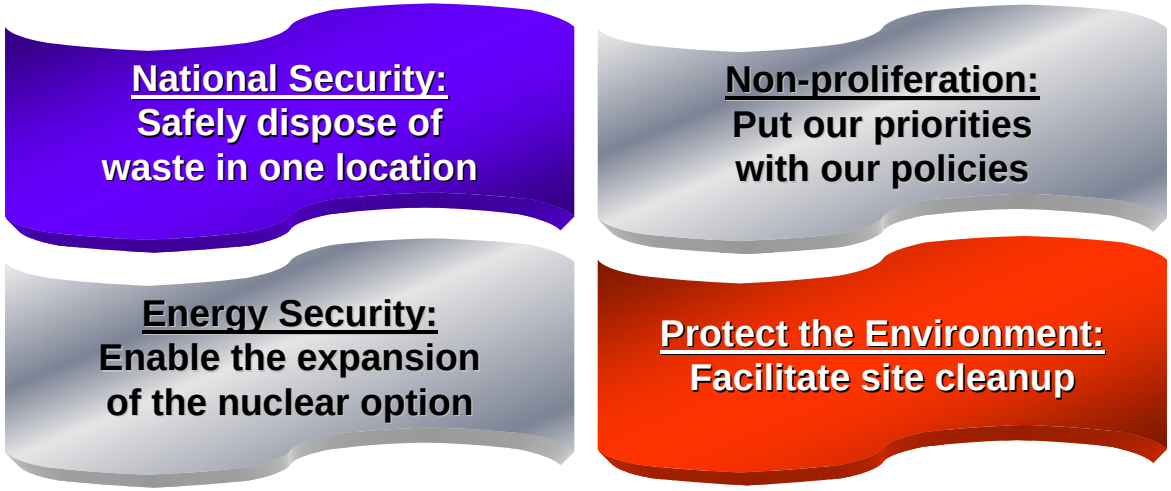
A National Solution

- **More than half of America's population currently lives within the vicinity of a nuclear facility where spent nuclear fuel and high-level radioactive waste continues to accumulate. In 1982, the U.S. Congress enacted the Nuclear Waste Policy Act, which established a comprehensive national program for the safe, permanent disposal of these wastes.**

Why this Program Matters

"Proceeding with the repository program is necessary to protect public safety, health, and the Nation's security because successful completion of this project would isolate in a geologic repository at a remote location highly radioactive materials now scattered throughout the Nation."

President G.W. Bush



- **Secretarial Performance Goal: Long-term goal remains repository operations by 2010, to address our Nation's need to isolate, secure, and safely dispose of spent nuclear fuel and high-level waste in a repository at Yucca Mountain**

QUESTIONS?