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Current Status of the Proposed Yucca Mountain Repository

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Albuquerque, NM
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National Nuclear Security Administration

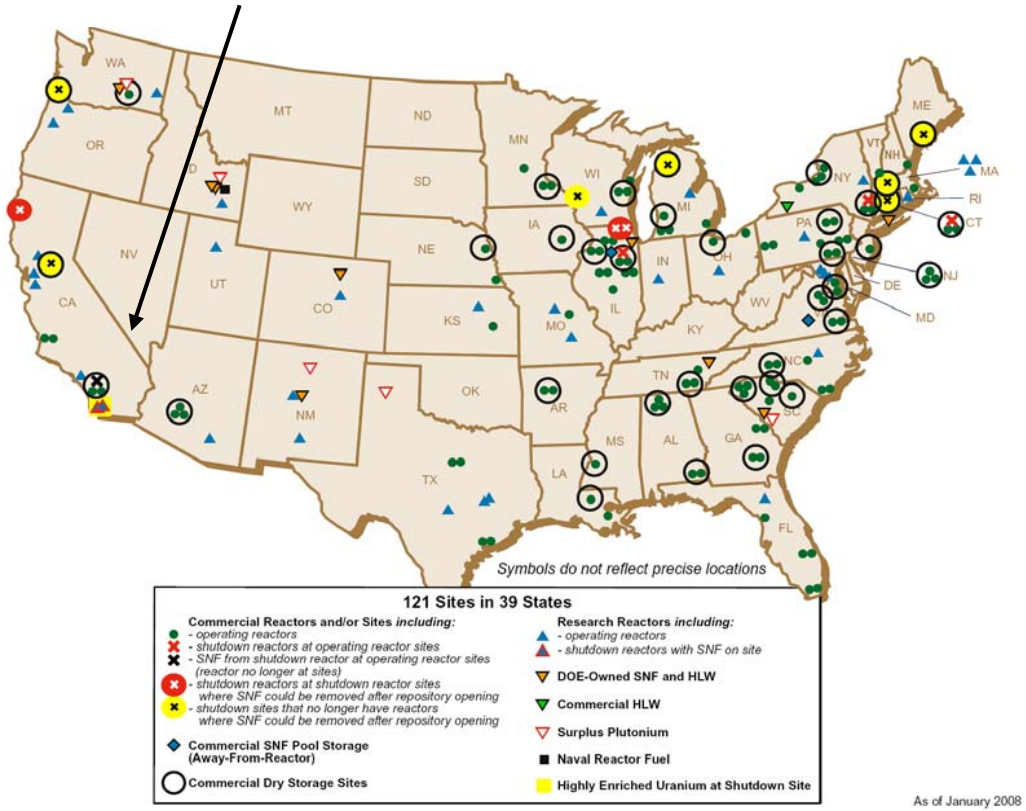
The Yucca Mountain Mission

Current locations of spent nuclear fuel (SNF) and high-level radioactive waste (HLW) destined for geologic disposal:

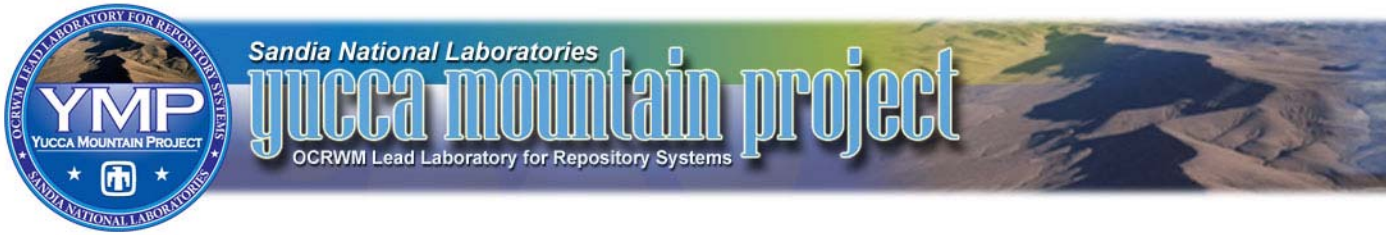
121 sites in 39 states

United States Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM) Mission: to manage and dispose of high-level radioactive waste and spent nuclear fuel in a manner that protects health, safety, and the environment; enhances national and energy security; and merits public confidence.

Proposed Yucca Mountain Repository



Partners in the Long-Term Performance Assessment for the Yucca Mountain License Application



Sandia National Laboratories

Los Alamos NATIONAL LABORATORY

ornl OAK RIDGE NATIONAL LABORATORY

BERKELEY LAB

INL Idaho National Laboratory

Science in the National Interest
Lawrence Livermore National Laboratory

Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

THE UNIVERSITY OF TEXAS AT AUSTIN

Argonne NATIONAL LABORATORY

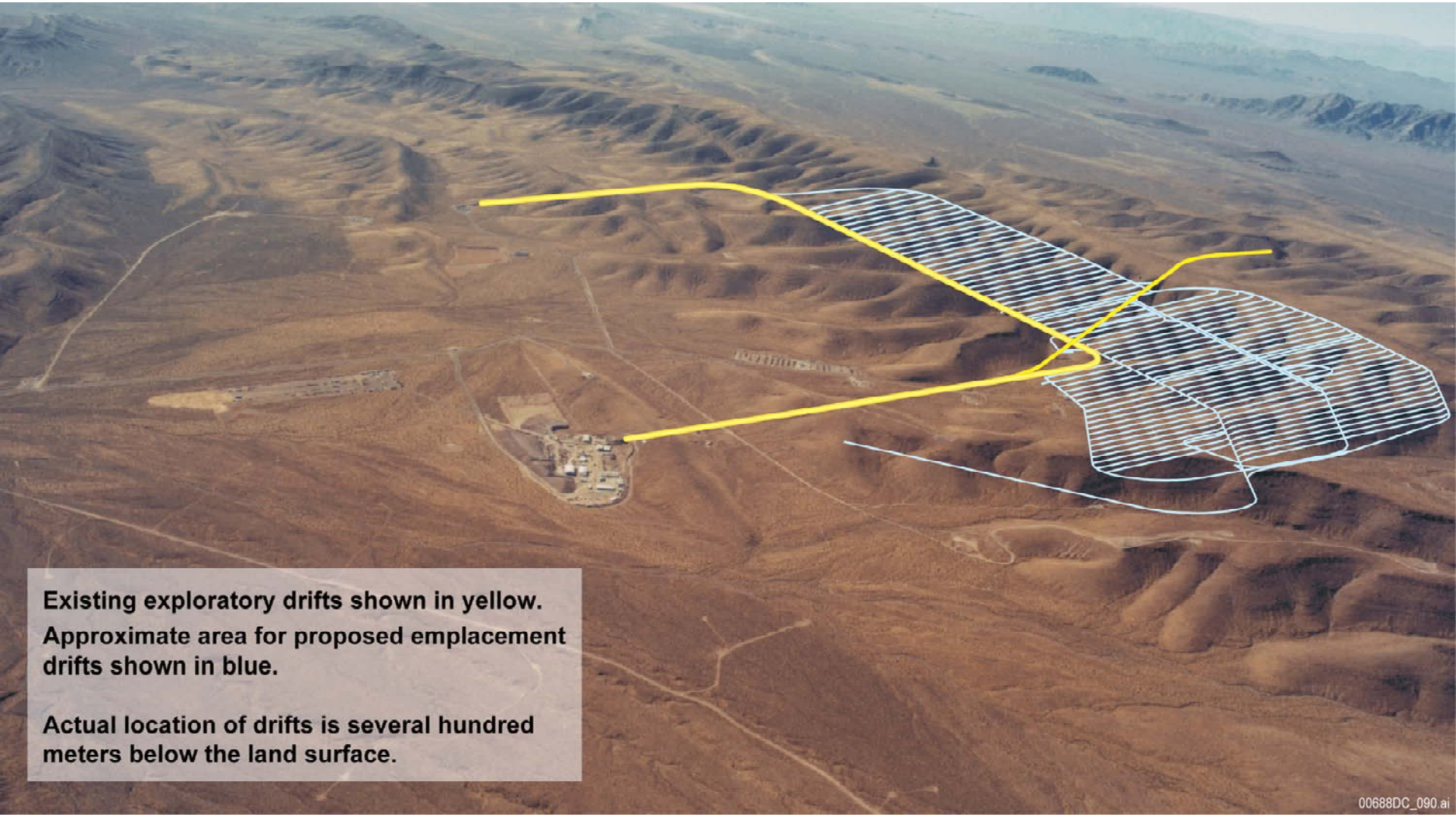
UNLV UNIVERSITY OF NEVADA LAS VEGAS

THE UNIVERSITY OF NEVADA RENO

DRI Desert Research Institute

- Apogen / QinetiQ
- Areva
- Beckman & Associates
- Galson Sciences
- Geotrans
- Intera
- ISSI
- Itasca
- John Hart and Associates
- JKRA
- Kleinfelder
- Longenecker & Associates
- RESPEC
- RHYM
- SAIC
- Sala & Associates
- Stoller
- URS

Proposed Repository for High-Level Waste and Spent Fuel at Yucca Mountain



Waste for Yucca Mountain

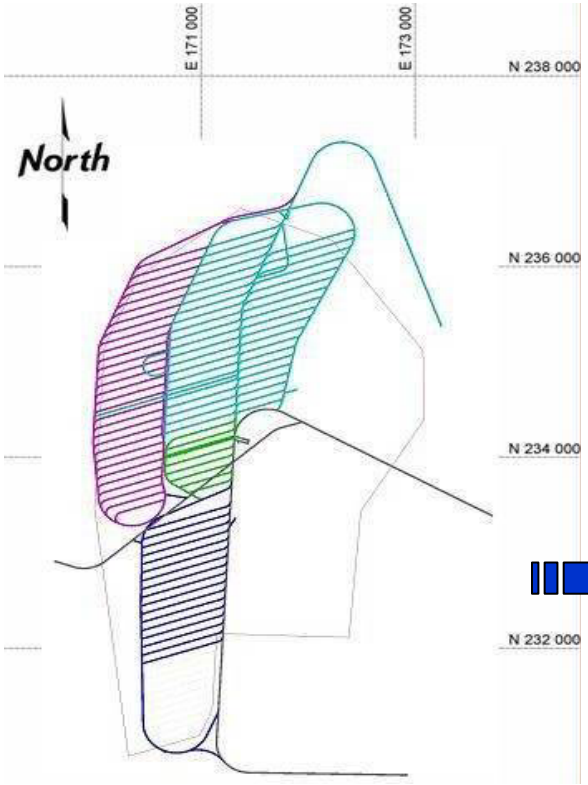
Commercial Spent Nuclear Fuel:
63,000 MTHM (~7500 waste packages)

DOE & Naval Spent Nuclear Fuel:
2,333 MTHM
(~400 naval waste packages)
(DSNF packaged with HLW)

DOE & Commercial High-Level Waste:
4,667 MTHM
(~3000 waste packages of co-disposed DSNF and HLW)

DSNF: Defense Spent Nuclear Fuel
HLW: High Level Radioactive Waste
MTHM: Metric Tons Heavy Metal

Yucca Mountain Subsurface Design



Emplacement drifts

5.5 m diameter

approx. 100 drifts, 600-800 m long

Waste packages

~11,000 packages

~ 5 m long, 2 m diameter

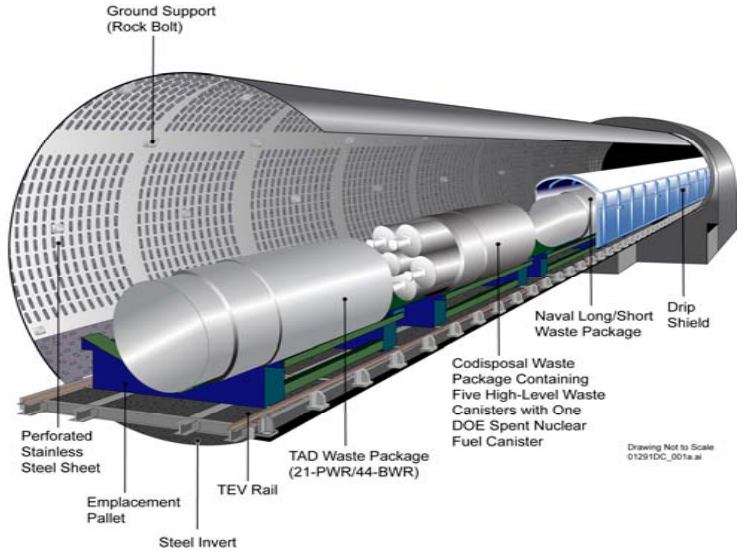
outer layer 2.5 cm Alloy 22 (Ni-Cr-Mo-V)

inner layer 5 cm stainless steel

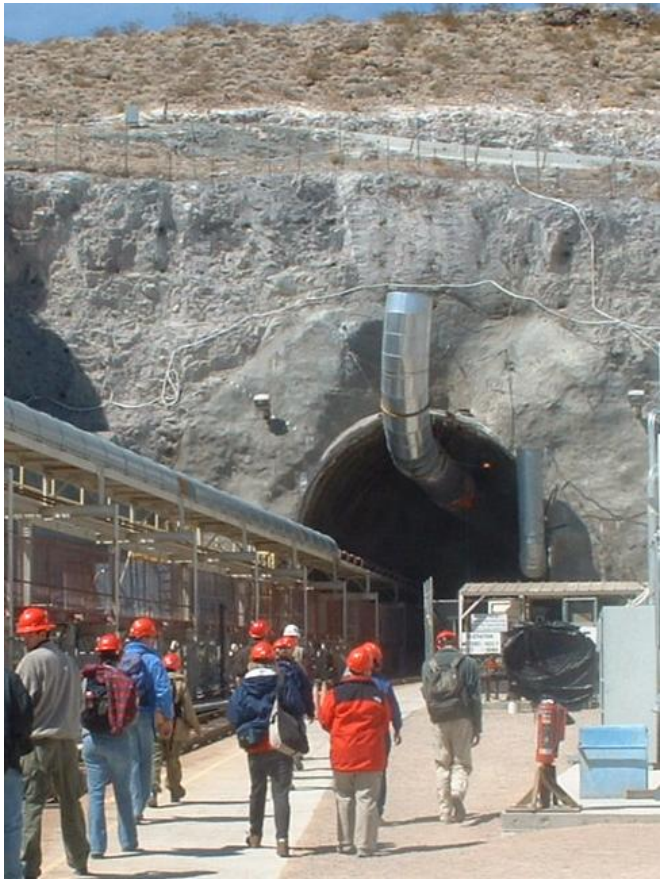
Internal TAD (transportation, aging, and disposal) canisters for commercial spent fuel, 2.5 cm stainless steel

Drip shields

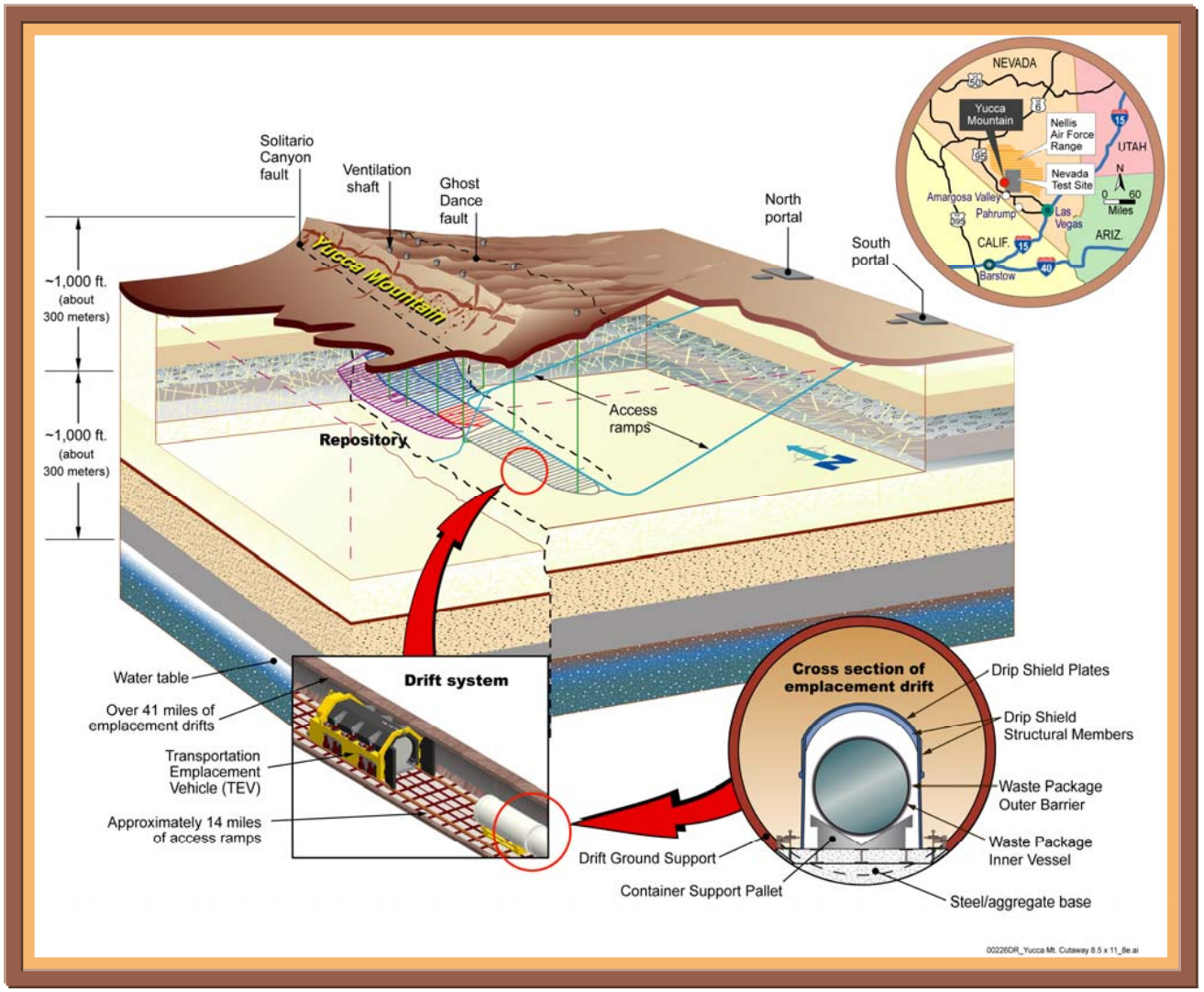
free-standing 1.5 cm Ti shell



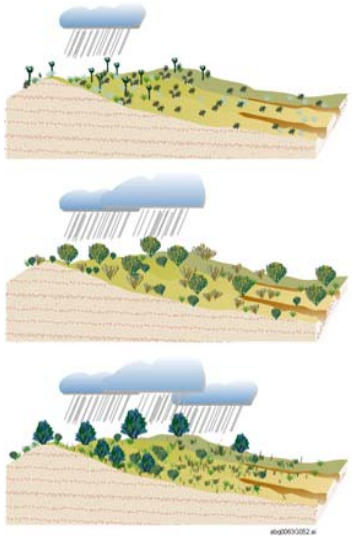
Yucca Mountain Exploratory Studies Facility

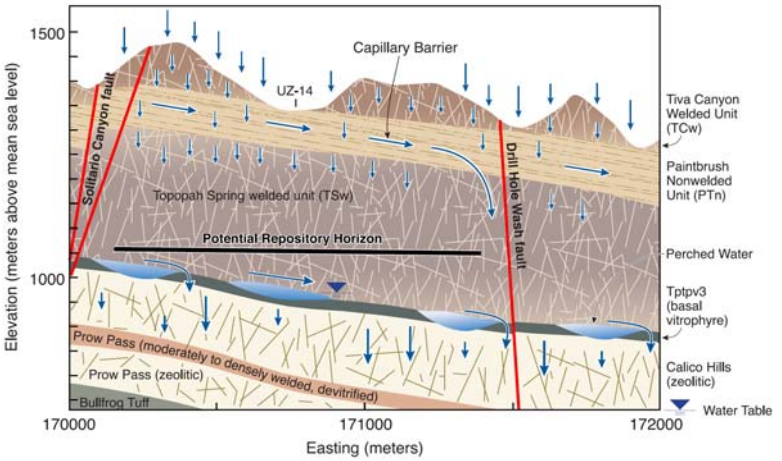


The Natural and Engineered Barrier System

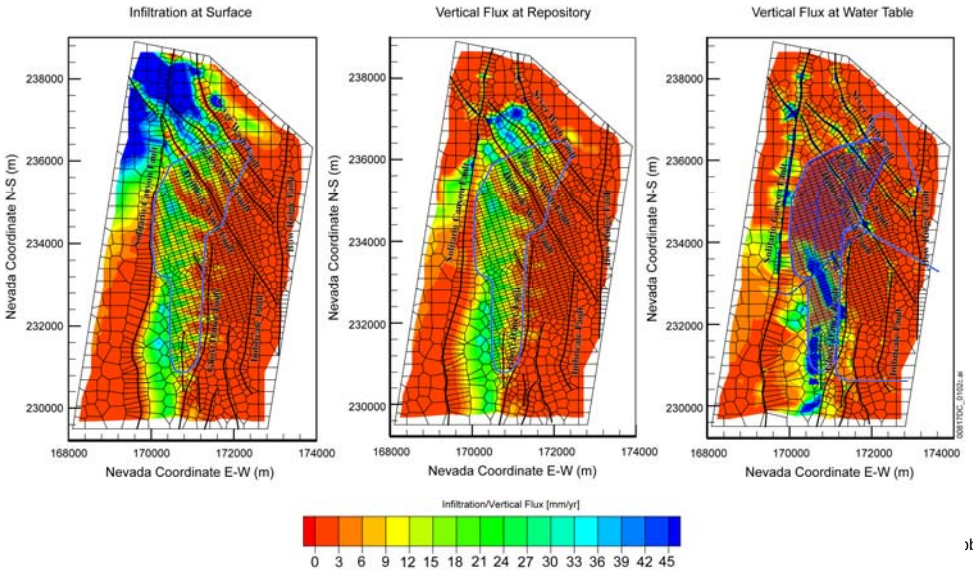


Groundwater Flow at Yucca Mountain





Field tests and models provide basis for understanding infiltration and flow in unsaturated rocks at Yucca Mountain



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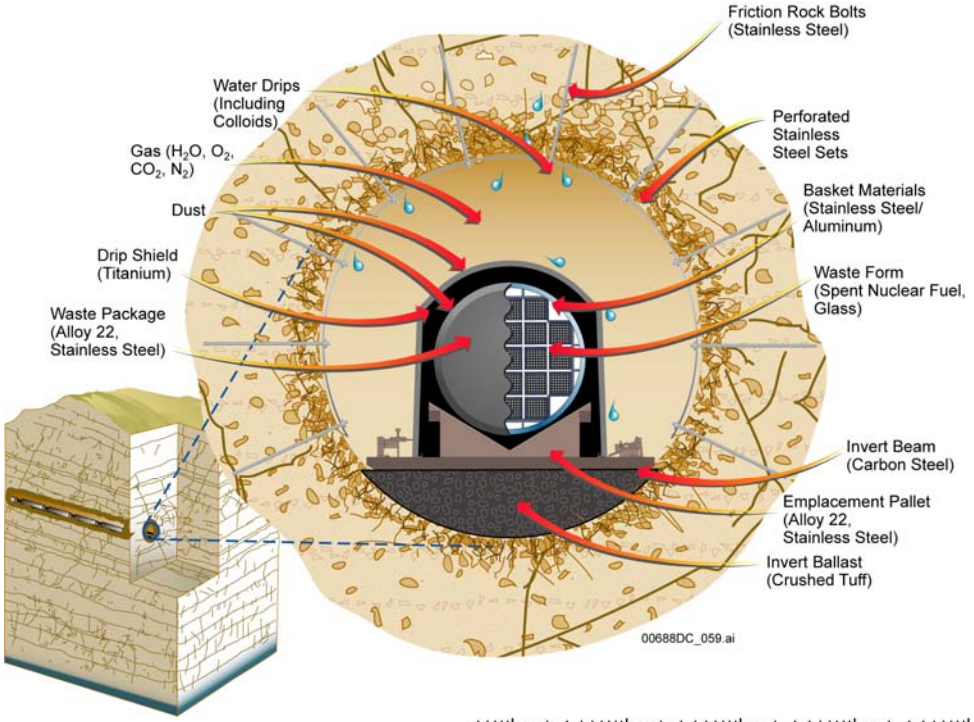
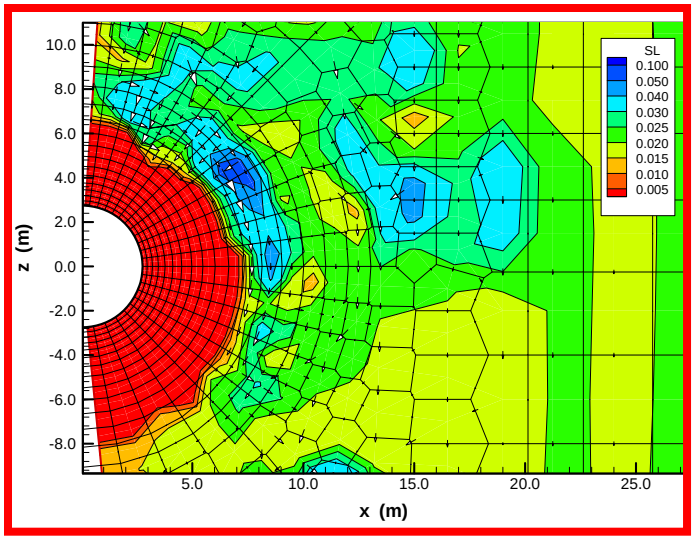
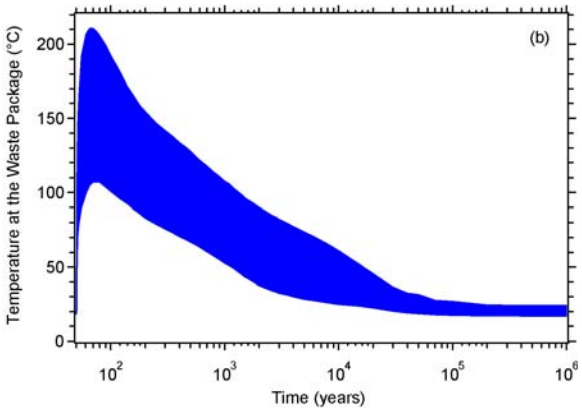
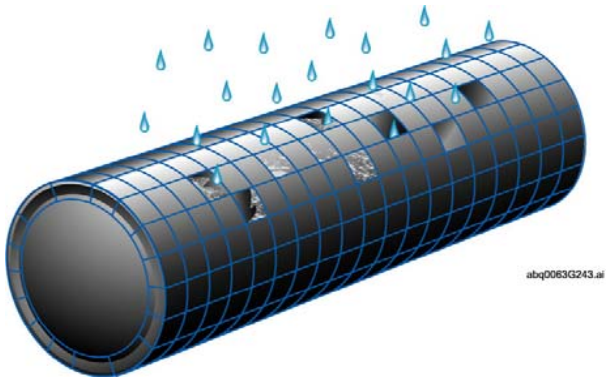
The Emplacement Environment at Yucca Mountain



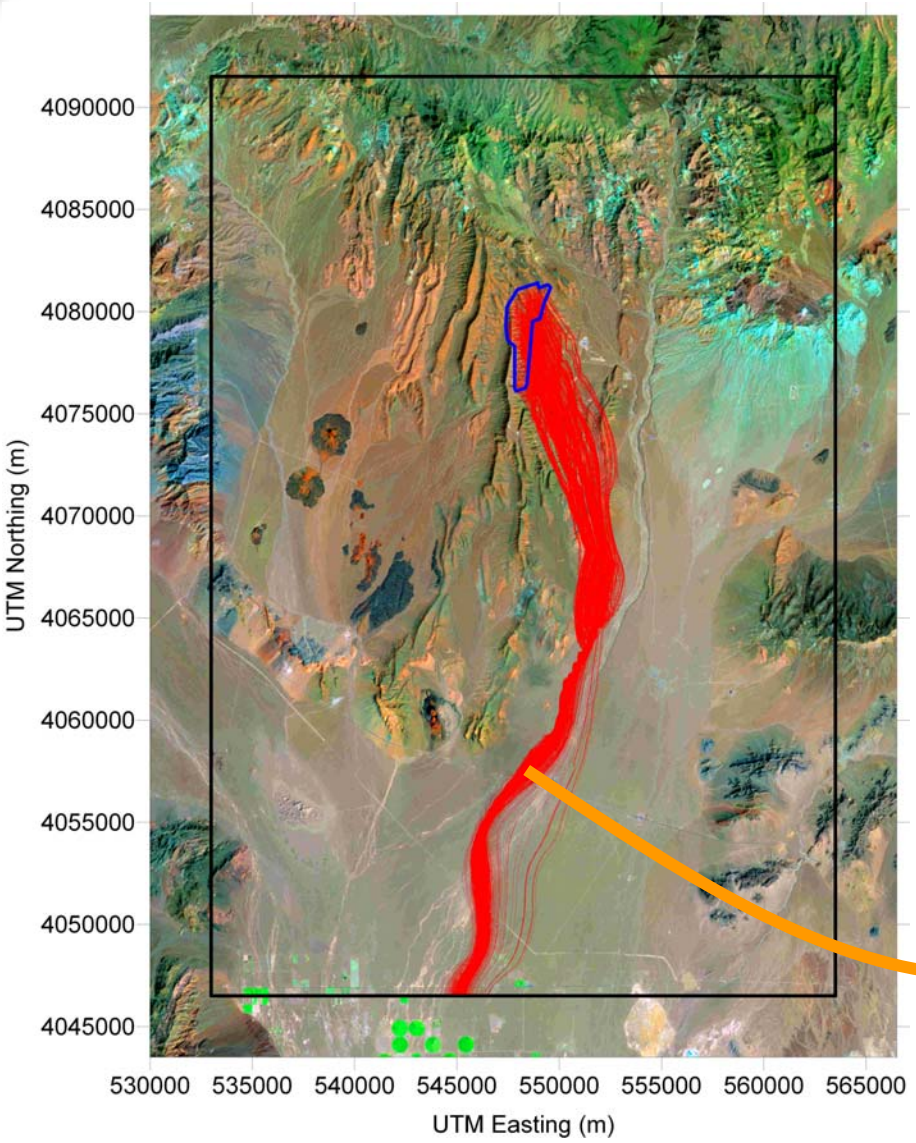


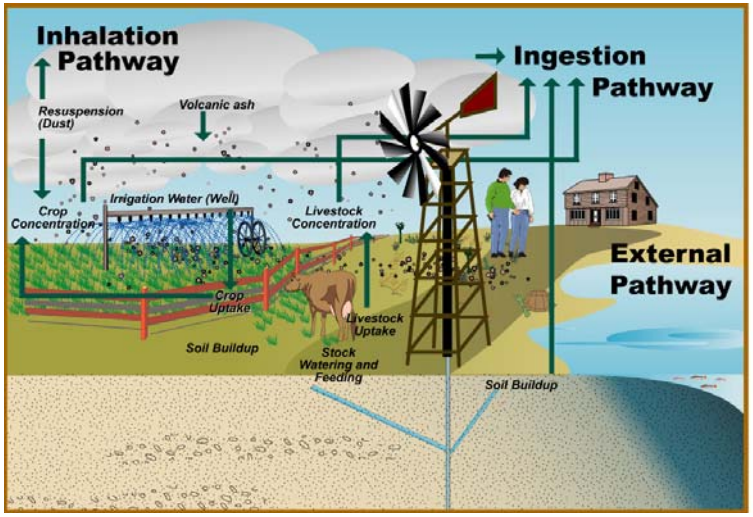
Material testing and models characterize performance of the engineered barriers





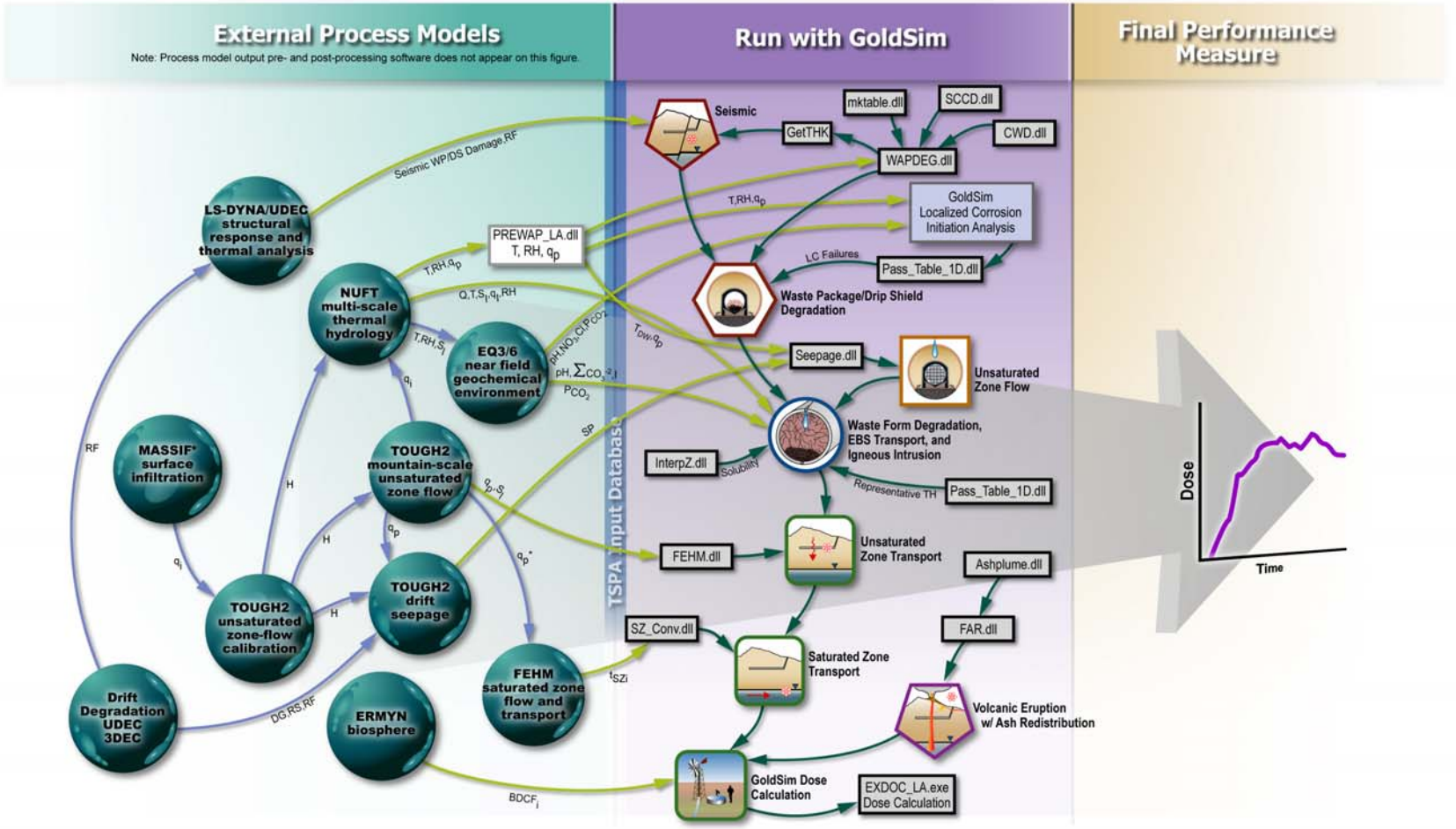
Estimating Dose to Hypothetical Future Humans





Modeled groundwater flow paths and hypothetical exposure pathways

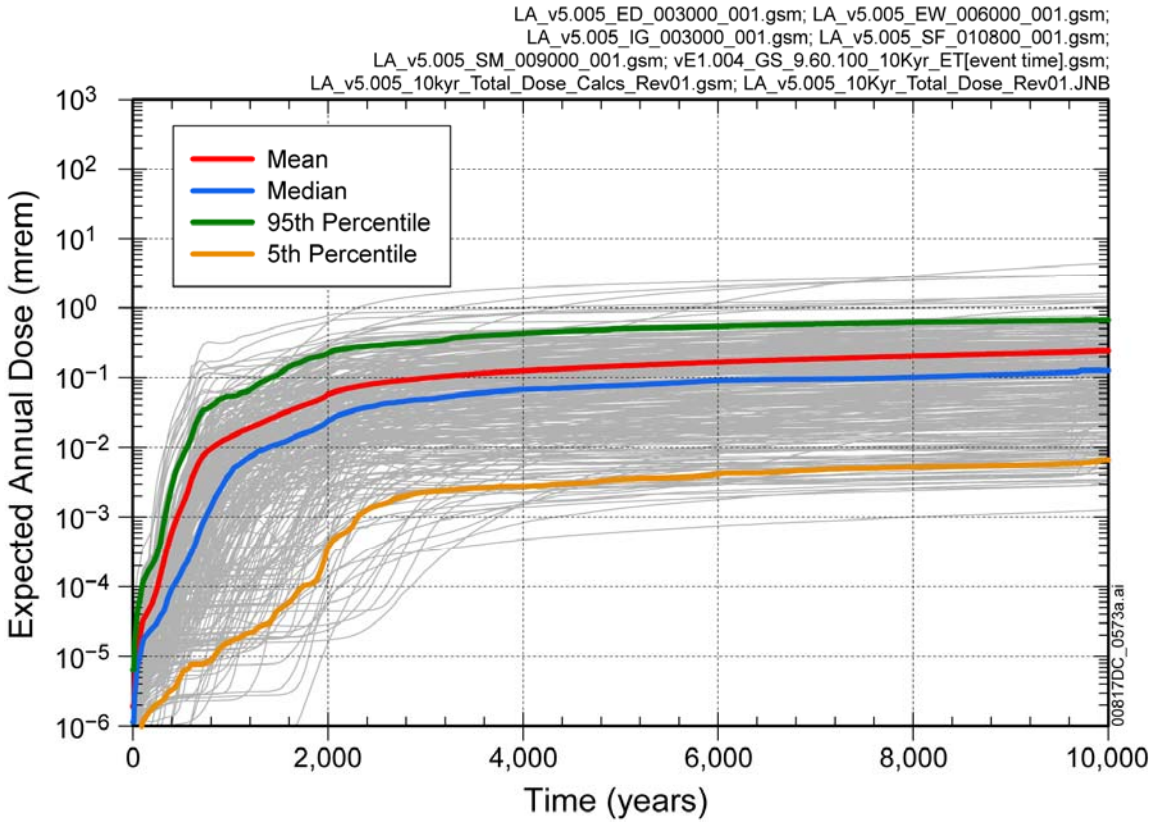
Total System Performance Assessment Architecture



f_S	Fraction of WPs with Seeps	q_p	Percolation Flux	q_I	Infiltration Flux	H	Hydrologic Properties
EBS	Engineered Barrier System	NO_3	Nitrate Concentration	DG	Drift Geometry	SP	Seepage Parameters
Q_S	Seep Flow Rate	T	Temperature	Cl	Chloride Concentration	RS	Rock Strength
Q	Evaporation Rate	RH	Relative Humidity	I	Ionic Strength	RF	Rockfall Size and Number
pH	pH	S_l	Liquid Saturation	t_{SZi}	Saturated Zone Transport Time		
ΣCO_3^{-2}	Carbonate Concentration	X_a	Air Mass Fraction	$BDCF_i$	Biosphere Dose Conversion Factor		
P_{CO_2}	Partial Pressure of CO_2	q_l	Liquid Flux	q_g	Gas Flux		

*Note: q_p derived from INFIL model

Total System Performance Assessment Results
Individual Protection Standard: 10,000 yr



MDL-WIS-PA-000005 REV 00 AD 01, Figure 8.1-1[a]

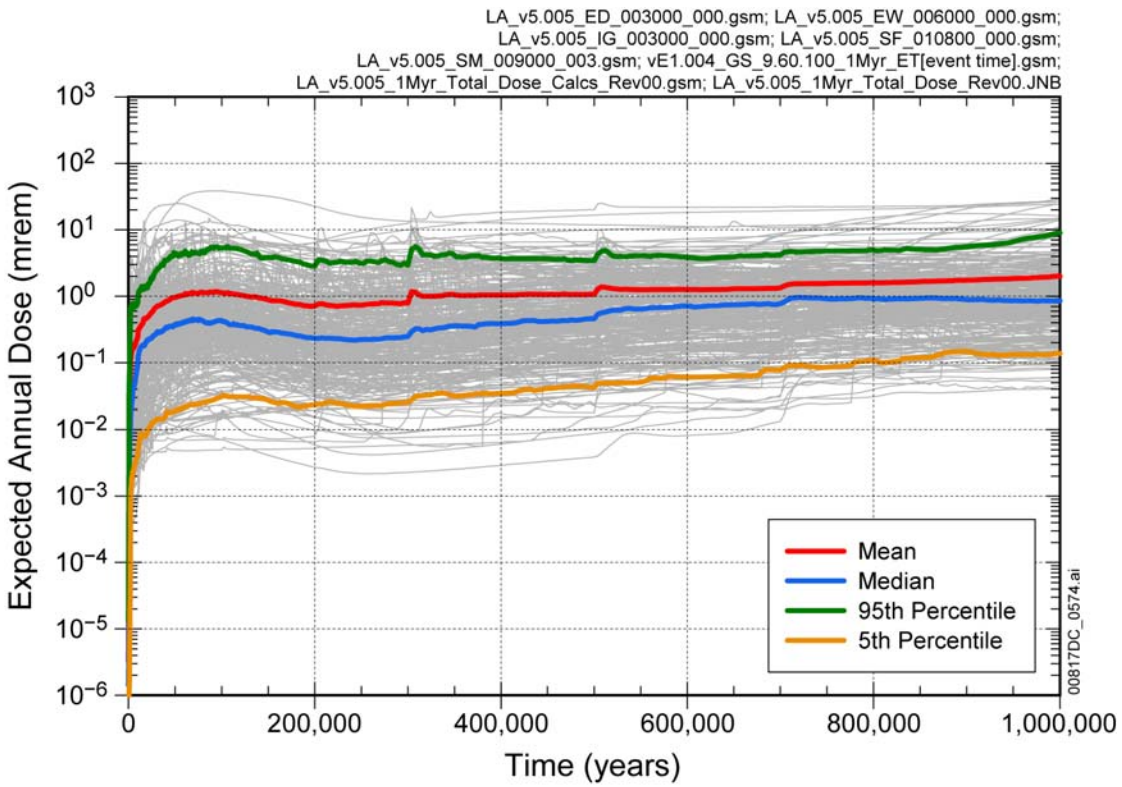
10,000-year Standard:

Mean annual dose no more than 15 mrem

TSPA-LA estimated 10,000 yr maximum mean annual dose:

0.24 mrem

Total System Performance Assessment Results
Individual Protection Standard: 1,000,000 yr



1,000,000-year Standard:

Mean annual dose no more than 100 mrem

TSPA-LA estimated 1,000,000- yr maximum mean annual dose:

2.0 mrem

MDL-WIS-PA-000005 REV 00 AD 01, Figure 8.1-2[a]

Long-Term Performance of Yucca Mountain

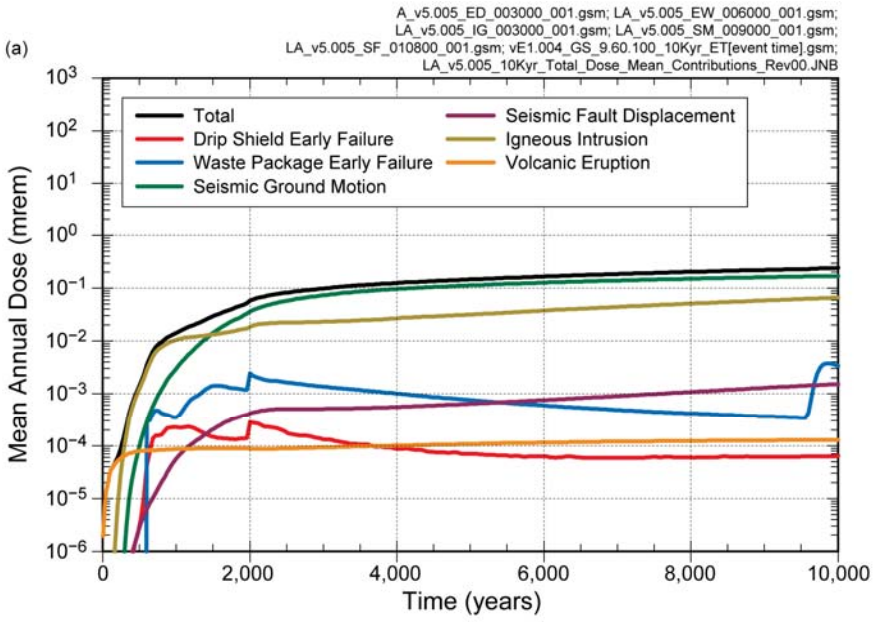
- **No significant releases for many tens of thousands of years if the site is undisturbed**
  - **Dry climate, little groundwater flow**
  - **Corrosion-resistant waste packages**
- **Over hundreds of thousands of years, estimated mean and median annual doses are well below natural background**
- **Disruption by unlikely geologic processes could cause releases and doses to humans; probability-weighted consequences are evaluated**
  - **Site geology indicates probability of volcanism is on the order of one chance in 10 million to one chance in 1 billion per year (mean 1.7×10^{-8}/yr)**
  - **Disruption by seismic activity is reasonably likely over very long time periods; consequences are not severe**
- **All estimated radiation doses are within regulatory limits**

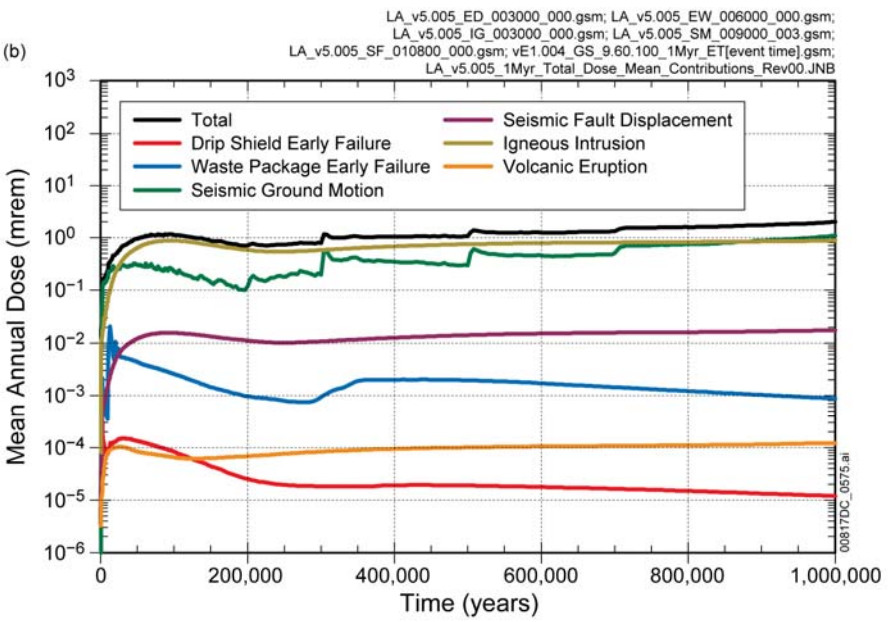
October 2008 Status of Yucca Mountain

- 3 June 2008: License Application (LA) for Construction Authorization submitted to US Nuclear Regulatory Commission
- 8 September 2008: NRC accepts LA for technical review, docketing initiates 3-4 year review and hearing process
- US EPA million year standard approved 30 September 2008
- Earliest possible decision on licensing September 2011
- Earliest possible receipt of waste: 2020
- Other potentially relevant topics
  - Nuclear renaissance in the U.S.
    - Several new reactor license applications submitted to NRC
  - Increasing Debate and Dialogue on Reprocessing
  - Evolution of the Global Nuclear Energy Partnership (GNEP) Initiative
    - Reprocessing, Advanced Reactors
  - Second repository
  - Presidential election
  - Nevada opposition

backup

TSPA Results: Modeling Cases Contributing to Total Mean Annual Dose



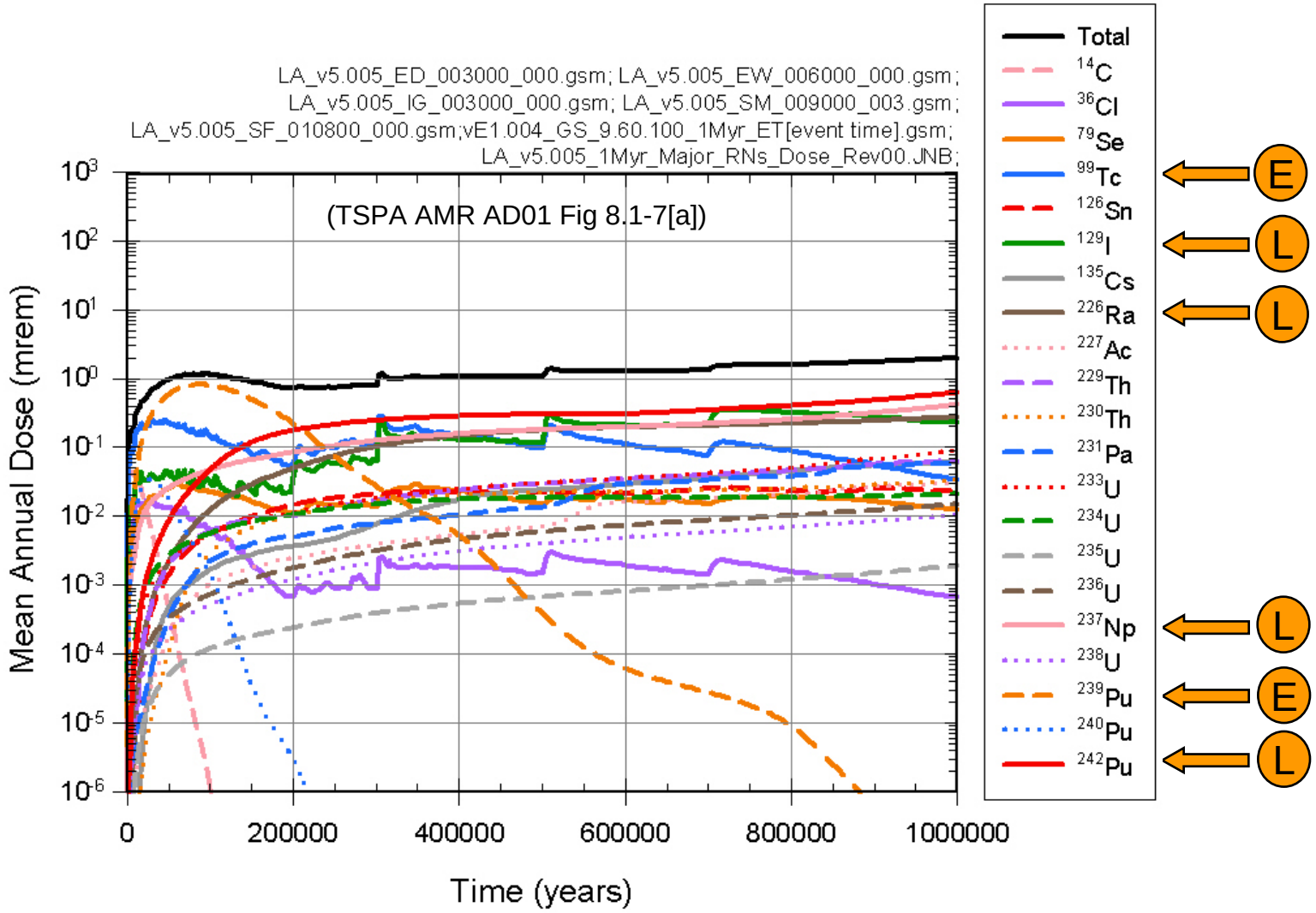


10,000 years

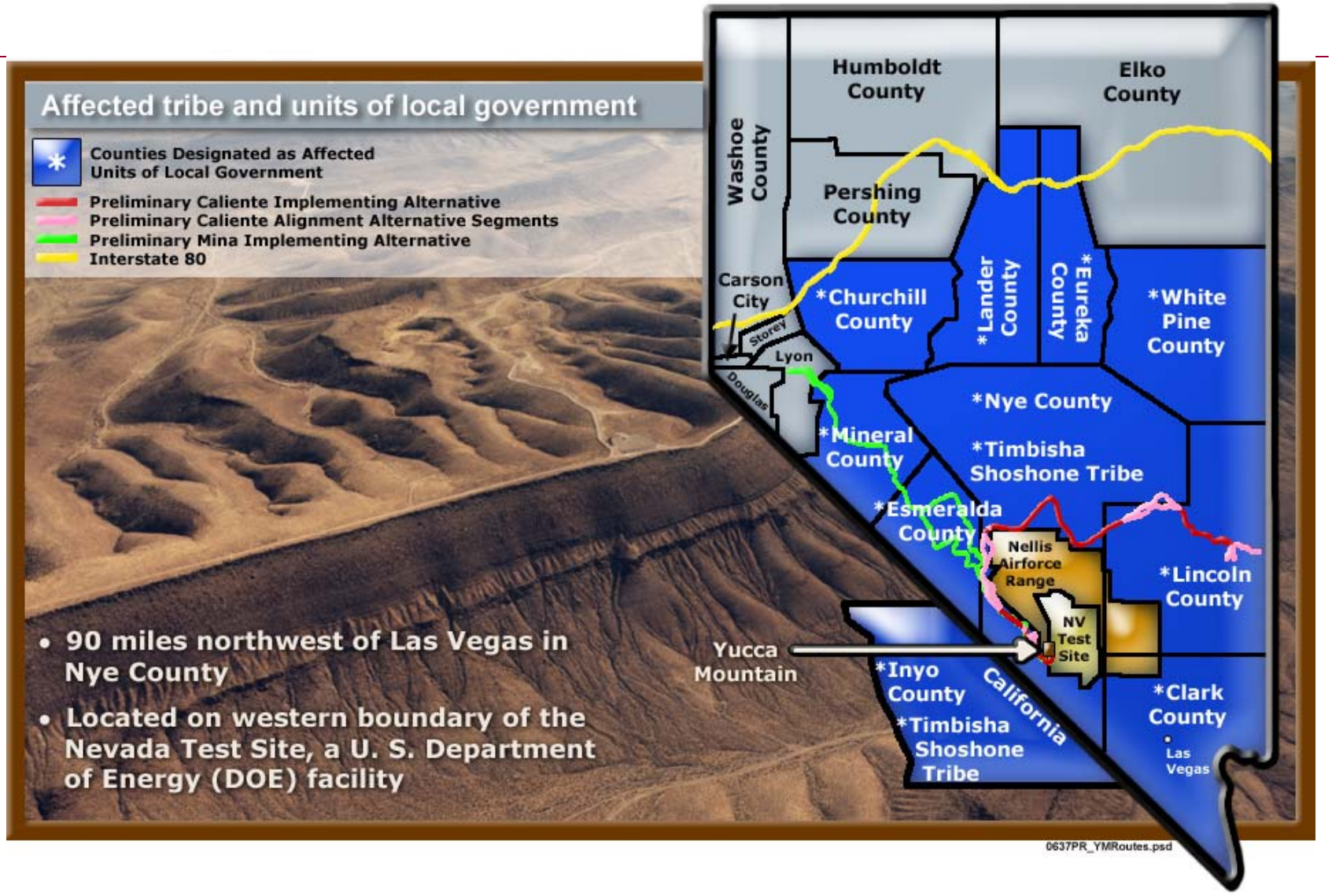
1,000,000 years

MDL-WIS-PA-000005 REV 00 AD 01, Figure 8.1-3[a].

Radionuclides Important to Mean Dose Early (E) and Late (L)



Yucca Mountain, Nevada



References

- US DOE (United States Department of Energy), *Yucca Mountain Repository License Application*, DOE/RW-0573, Rev. 0 (2008) (available at http://www.nrc.gov/waste/hlw-disposal/yucca-lic-app.html#appdocuments)
  - Documentation of the TSPA is provided in Section 2.4 of the Safety Analysis Report contained in the License Application
- See also summary documents available at http://ymp.gov/
  - *The Safety of a Repository at Yucca Mountain*
  - *The National Repository at Yucca Mountain*
- Supporting documents available at the Nuclear Regulatory Commission's Licensing Support Network (LSN) at http://www.lsnnet.gov/