



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



Making the Postclosure Safety Case for the Proposed Yucca Mountain Repository

Presented to:

NEA/IAEA Symposium: Safety Cases for the Deep Disposal of Radioactive Waste: Where do We Stand

Presented by:

Dr. Peter Swift

Sandia National Laboratories

Dr. Abe van Luik

Office of Civilian Radioactive Waste Management

United States Department of Energy

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Presentation Outline

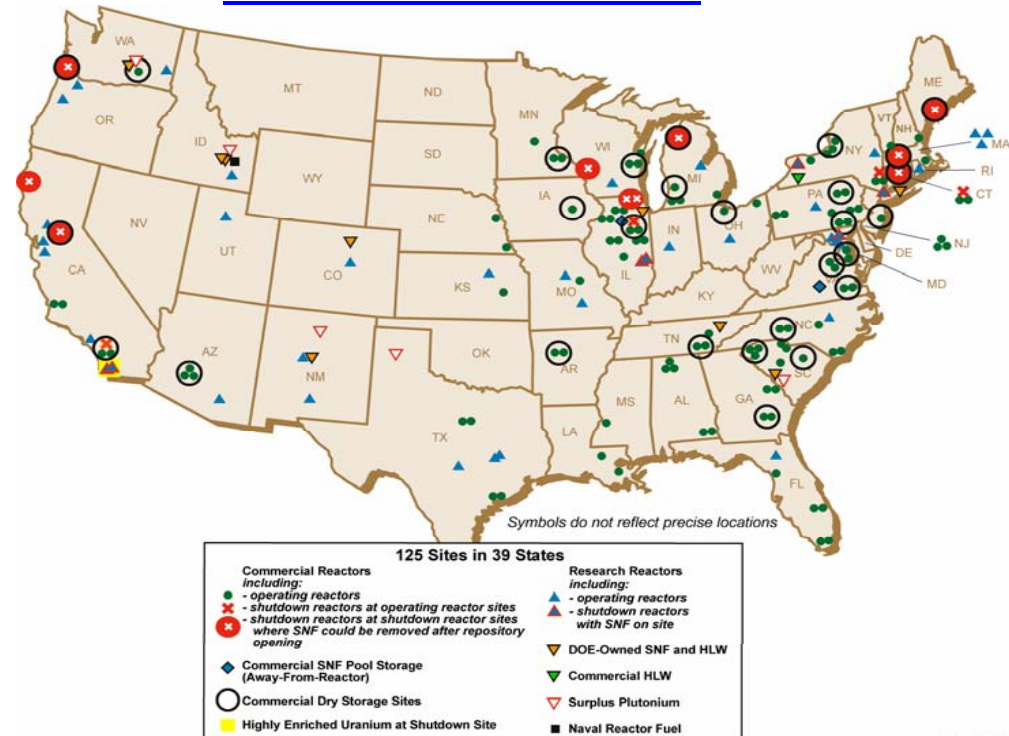
- **Mission and current status of the proposed Yucca Mountain repository**
- **The role of the safety case in licensing**
- **The technical bases for confidence**
- **Institutional bases for confidence**
- **Conclusions**



The Yucca Mountain Mission

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

125 sites in 39 states



As of July 2004

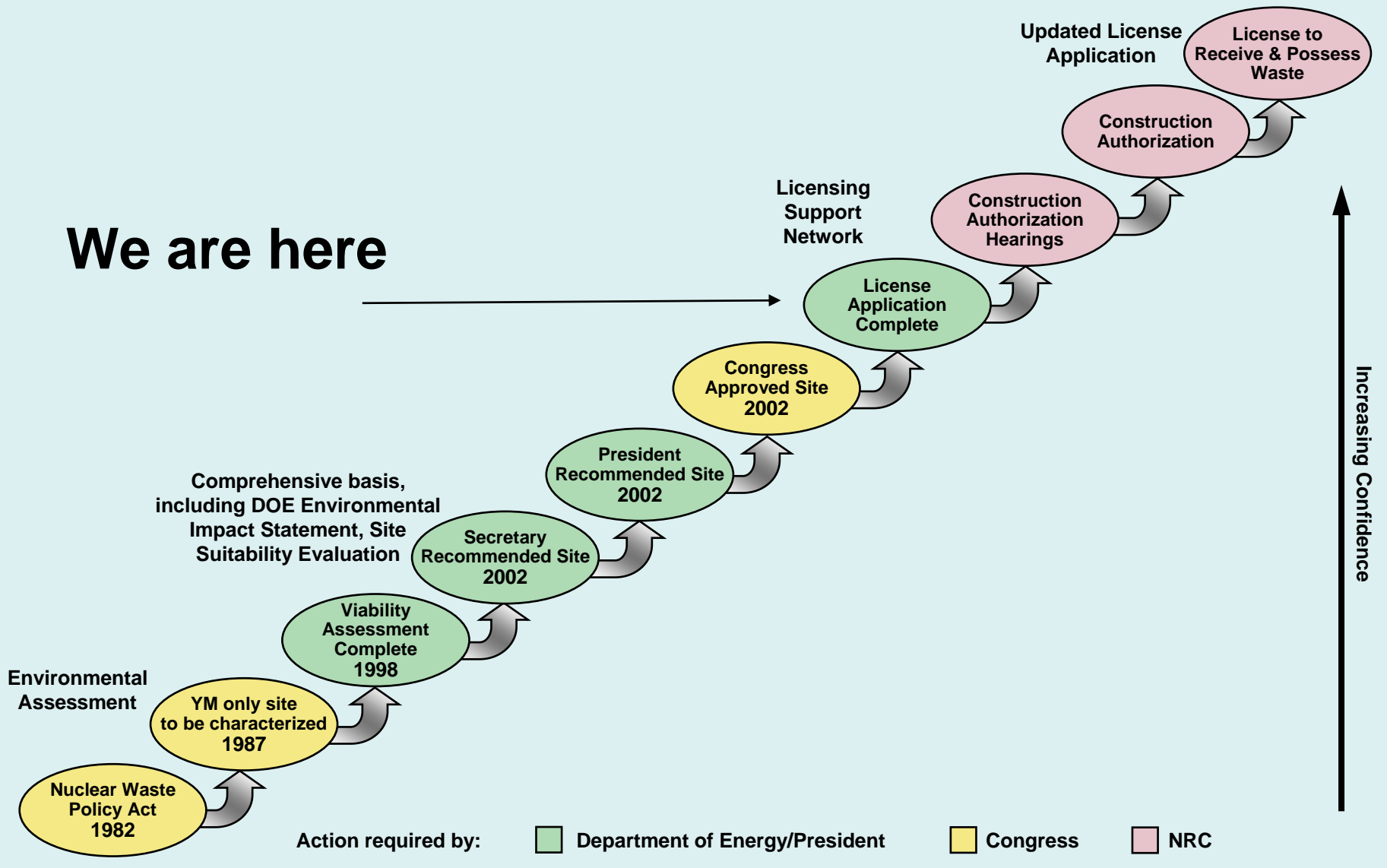
United States Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM)

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.



Repository Timeline

We are here

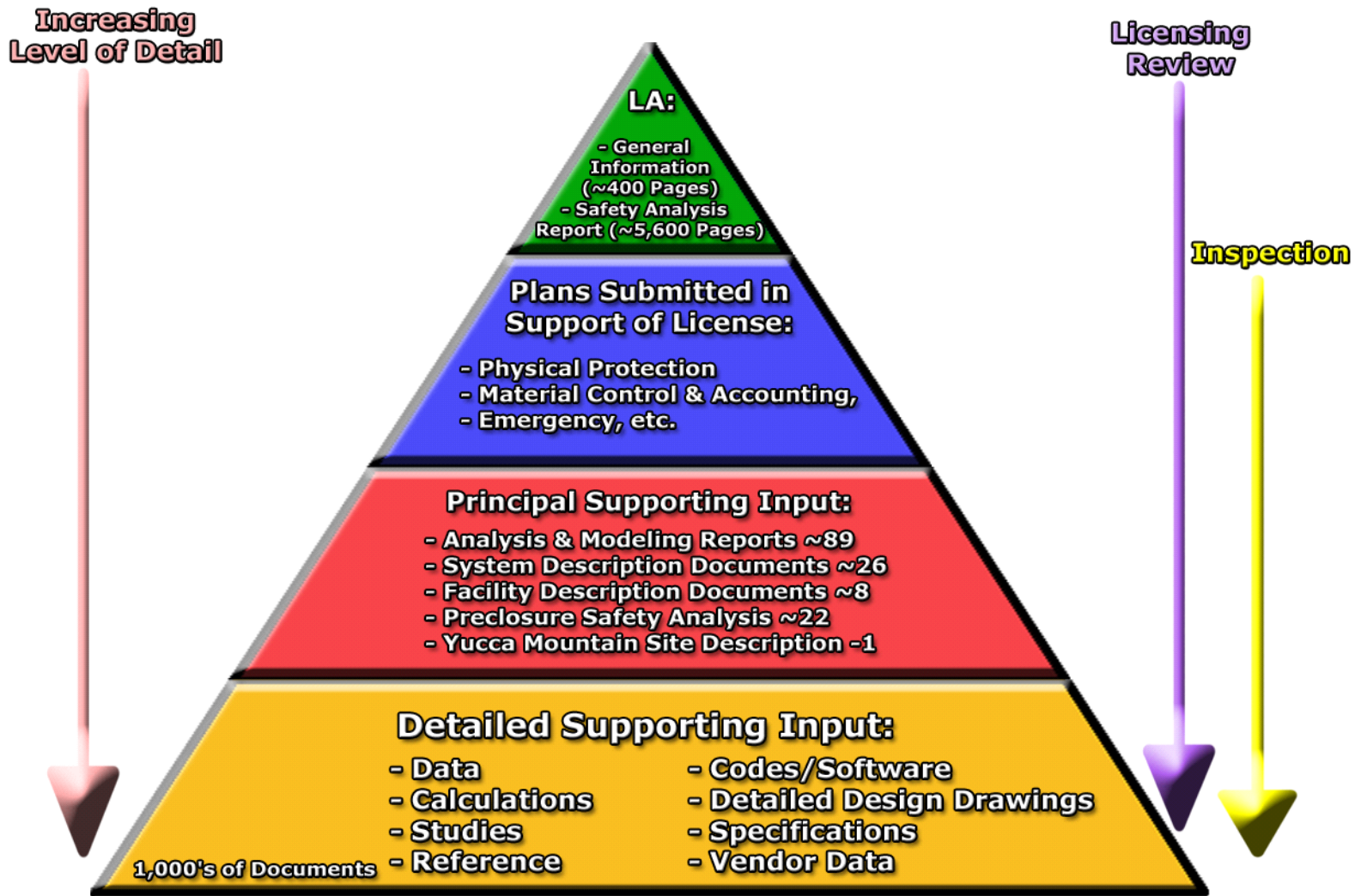


The Role of the Safety Case in Licensing

- **DOE concurs with the International Atomic Energy Agency (IAEA) definitions for safety assessment and safety case**
- **For Yucca Mountain, the license application is equivalent to the safety case**
 - **The Safety Analysis Report submitted to the Nuclear Regulatory Commission (NRC) will include the safety assessment and comprehensive documentation of the supporting technical basis**
 - ◆ **Systematic analysis of hazards associated with the facility**
 - ◆ **Integration of arguments and evidence that support the finding of safety**
 - ◆ **Evaluation of uncertainties and discussion of the basis for confidence to move forward acknowledging uncertainty**



Documentation Supporting the License Application



Outline of the License Application

- **General Information**
 - Site and facility description
 - Proposed schedules for construction, receipt and emplacement of waste
 - Physical protection plan
 - Material control and accounting
 - Site characterization
- **Safety Analysis Report**
 - Repository safety before permanent closure
 - Repository safety after permanent closure
 - Research and development program to resolve safety questions
 - Performance confirmation program
 - Administrative and programmatic requirements

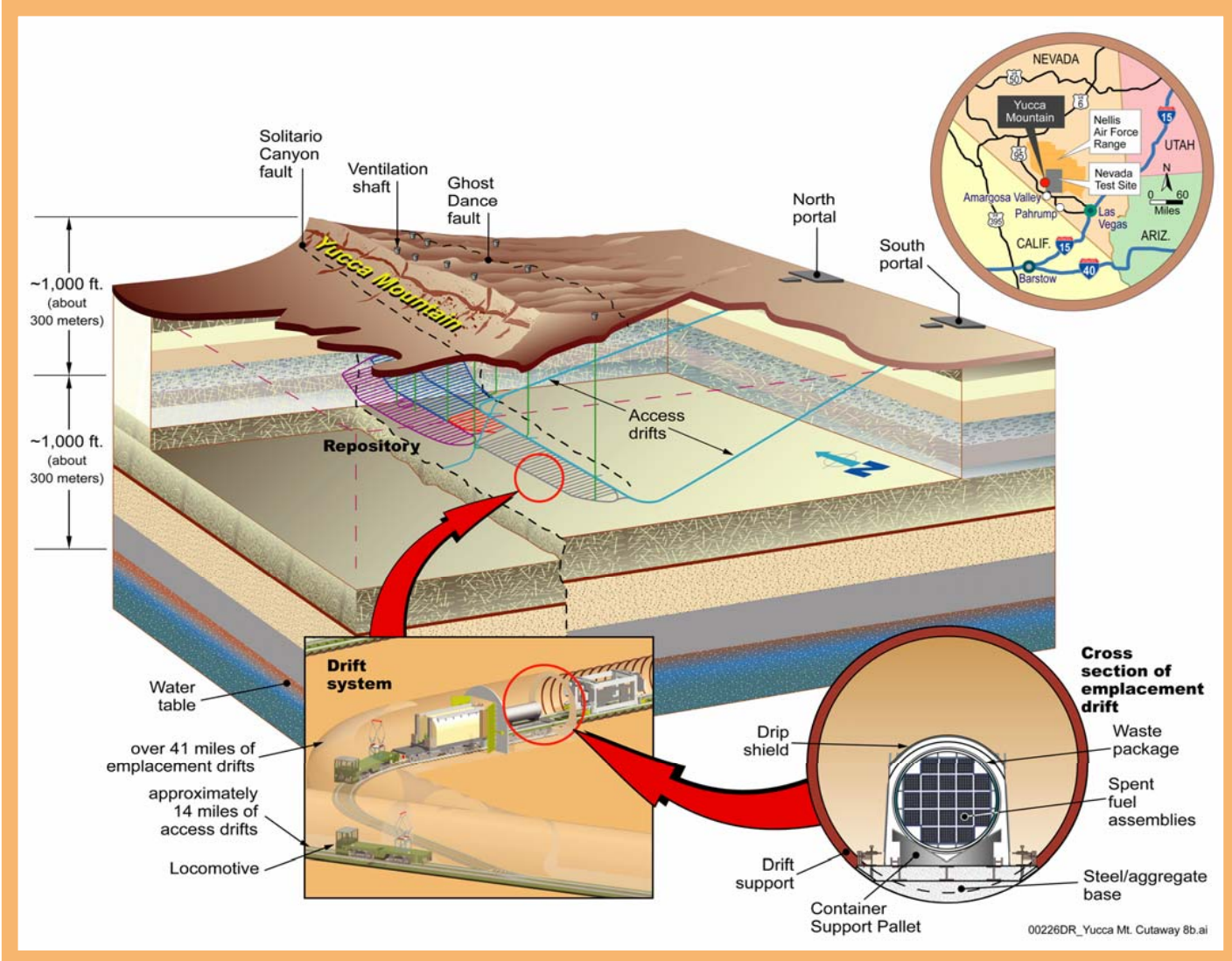


Technical Basis

- **Multiple barriers provide waste isolation**
 - Robust natural and engineered barriers limit radionuclide release and transport
- **Detailed characterization of natural and engineered systems**
 - Process-level modeling of future performance at the component level
- **System-level safety assessment modeling provides a full acknowledgement of uncertainty**
- **Confidence enhanced by**
 - Peer review
 - Corroboration with analogue information where available



The Natural and Engineered Barrier System

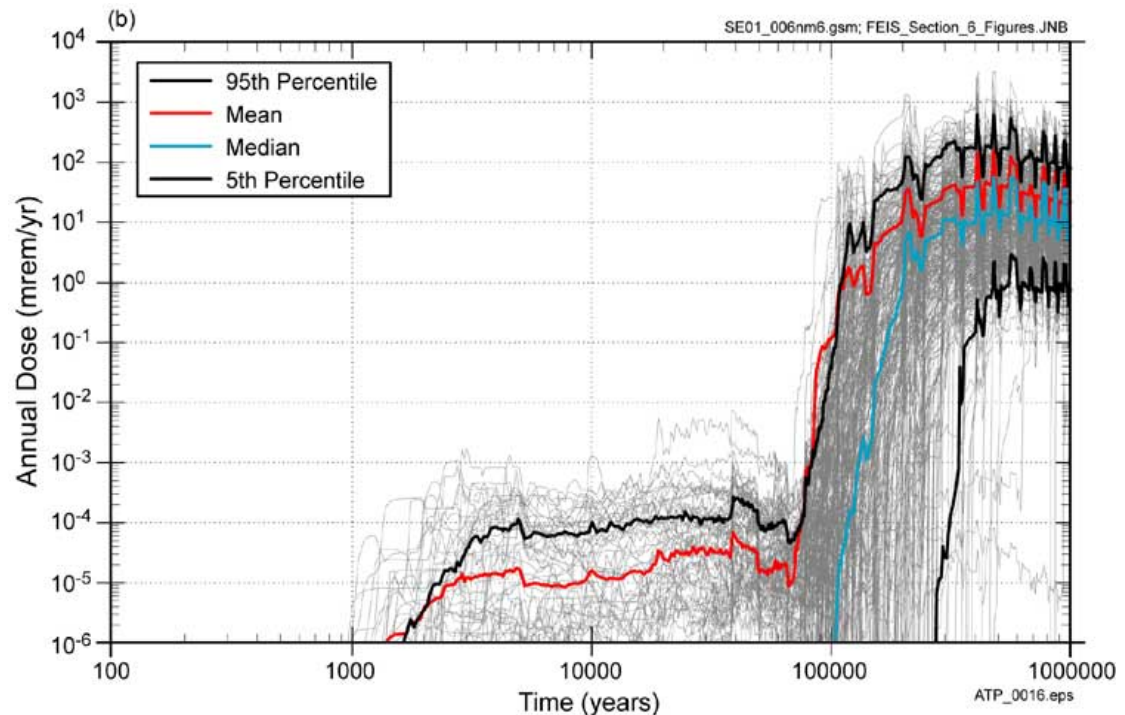


System-Level Safety Assessment Acknowledging Uncertainty

Monte Carlo Approach to Uncertainty Analysis

- Each curve is a dose history calculated using a single set of sampled input parameter values
- Summary statistical measures are derived from the distribution of model outcomes
- Stability of the mean (or other summary measure) is related to sample size
- Distribution of model results allows detailed sensitivity and uncertainty analysis of intermediate performance measures

Example Results from Work Supporting the 2002 Yucca Mountain Site Recommendation



300 Monte Carlo realizations, no disruptive events, ICRP 30 dose model; DOE/RW-0539-1, Figure 4-179; http://www.ocrwm.doe.gov/documents/ser_b/index.htm



Enhancing Confidence in the Safety Assessment

- **Thorough documentation of internal checking and analysis**
 - **Confirmation of stability of model results**
 - **System and subsystem uncertainty and sensitivity analysis**
 - **Corroboration of system model component results with underlying process models**
- **Peer Review**
 - **External peer reviews of past iterations (1999, 2002)**
- **Comparison to analogue systems where applicable**
 - **E.g., radionuclide mobilization and transport at Peña Blanca, Chihuahua, Mexico**



Building Confidence through Institutional Actions

- **Performance Confirmation**
 - NRC requires, and the DOE will implement, a testing program throughout the operational period that will challenge data and models underlying the safety assessment
- **Active and passive institutional controls at the site**
 - NRC requires, and the DOE will implement, active controls over the site during preclosure operations, and passive controls, including permanent markers, after closure
- **Quality Assurance**
 - NRC requires, and the DOE is implementing, a rigorous program to ensure the quality of work supporting the technical basis
- **Safety Conscious Work Environment**
 - NRC requires, and the DOE is implementing, a program to ensure an open work environment in which all concerns, safety-related or otherwise, are brought forward by employees without fear of retribution



Conclusions

- **The Safety Case for Yucca Mountain is based on**
 - A sound geologic site
 - A robust facility design
 - Thorough scientific investigation and analysis
 - A detailed quantitative safety assessment
 - ◆ Confidence enhanced by detailed confirmatory analysis, peer review, and comparison to analogue systems where appropriate
 - Strong institutional commitments and controls
- **The U.S. DOE plans to submit a license application to the U.S. NRC by June 30, 2008**
 - Final evaluations of the safety case will occur through the regulatory process

