



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



The Safety Case for a Geologic Repository at Yucca Mountain, Nevada

Presented to:

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Safety Case & Safety Assessment

- **The International Atomic Energy Agency (IAEA) 2006 standard for geological repositories defines safety assessment and safety case :**

*3.41. **Safety assessment** is the process of systematically analysing the hazards associated with the facility and the ability of the site and the design of the facility to provide for the safety functions and to meet technical requirements. . . .*

*3.40. . . . **The safety case** substantiates the safety, and contributes to confidence in the safety, of the geological disposal facility. The safety case is an essential input to all the important decisions concerning the facility. It includes the output of safety assessments . . . , together with additional information, including supporting evidence and reasoning on the robustness and reliability of the facility, its design, the design logic, and the quality of safety assessments and underlying assumptions. . . .*



The Yucca Mountain Review Plan Mandates a Case for Safety

- Nevada petitioned for a rulemaking to revise the Nuclear Regulatory Commission's (NRC's) 10 CFR Part 63 to, in part, require "an affirmative safety case" for the repository
 - Nevada cited "An International Peer Review of the Yucca Mountain Project TSPA-SR, March 2002" for this concept
- The NRC denied this petition because Part 63 requires that NRC consider a broad range of information to support a licensing action, not just a judgment of whether or not numerical requirements are met
- The NRC's Yucca Mountain Review Plan (YMRP), which is based on Part 63, makes clear that compliance is more than just showing models and modeling results:
 - A comprehensive scientific basis is required in support of every important model, modeling assumption, and decision



The Safety Analysis Report will Make the Case for Yucca Mountain Repository Safety

- **The Safety Analysis Report (SAR) will comply with the requirements of Part 63 and demonstrate:**
 - **A systematic analysis of hazards associated with the facility and a robust repository system composed of multiple barriers**
 - **An integration of arguments and evidence that support the finding of likely safety**
 - **A discussion and evaluation of the uncertainties in the analyses and why, in the face of these uncertainties, the applicant has sufficient confidence in the postclosure assessment to allow it to petition to move into the next phase of the repository program's life-cycle: facility construction**



A Cautious, Step-Wise Decision Process Defined by Regulation is Part of the Case for Safety

- **The License Application and its SAR will provide the basis for NRC's issuance of authorization to construct the facility**
 - During the construction phase, scientific and safety evaluation work continues
- **An update to the SAR will be the basis for NRC to authorize implementation of the next phase in the repository life-cycle: the operations phase**
 - It is when actual radiological risks will first occur
 - It will last several decades, during which scientific work and safety evaluations continue
- **A final update to the SAR will be required to enter into the last phase in the repository life-cycle: permanent closure**



Confidence Arguments in Light of Uncertainty

- **By submitting a SAR, the DOE states it has confidence in system safety over the entire repository life-cycle**
- **Contributors to this confidence are:**
 - **Continued long-term testing, monitoring and regulatorily defined performance confirmation studies will challenge as well as confirm the basis of the safety case**
 - **The current science and technology program and performance confirmation demonstrate DOE's long-term plan to continually enhance system safety and efficiency (part of a viable 'safety culture')**



Confidence Arguments in Light of Uncertainty

- **Natural and other analogue studies have been important to both building and evaluating portions of the safety assessment**
 - **Climate and igneous events and processes rely on analogue insights**
 - **Analogue insights helped create the current colloid transport model**
 - **Analogue studies are helping provide a level of confidence in other process-level models, such as:**
 - ◆ **The model for source-term behavior**
 - ◆ **The unsaturated-saturated zone flow and transport models**



Structure of DOE Presentations

- **In the overall context of providing a case for postclosure-system safety, presentations will:**
 - **Illustrate the capabilities of barriers that give insight and understanding regarding system functioning**
 - ◆ **Upper natural barrier, engineered barrier, lower natural barrier**
 - **Illustrate the uses made of analogues**
 - ◆ **Natural analogues, anthropogenic analogues, industrial analogues, self-analogues**
 - **Discuss the long-term plan to continuing science and safety evaluation**
 - ◆ **Science and technology program**
 - ◆ **Long-term test and monitoring program**
 - ◆ **Performance confirmation program**

