

Stakeholder Confidence in Effective Safety Regulation:

A Regulator's View on the Role of Independent Research Capability

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Stakeholder Confidence**

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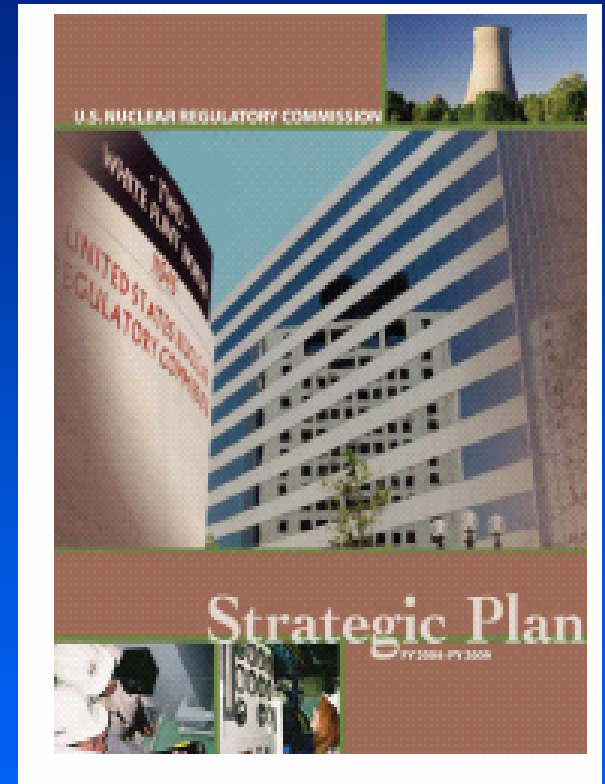
Paris, France

Outline of Presentation

- ◆ NRC's Openness Goal
- ◆ Openness in HLW Regulation
- ◆ Role of Independent Scientific and Engineering Analyses
- ◆ The Center for Nuclear Waste Regulatory Analyses (CNWRA)
- ◆ Conclusions

Openness: Part of NRC's Strategic Plan

- ◆ **MISSION:** License and regulate radioactive materials to protect public health and safety, promote security, and protect the environment
- ◆ **VISION:** Excellence in regulating safe and secure use of radioactive materials for the public good
- ◆ **STRATEGIC OBJECTIVE:** Realize this vision using regulatory actions that are open, effective, efficient, realistic and timely.



Strategies for Achieving Openness

- ◆ Public access to information about risks, safety and licensee performance that is accurate and timely
- ◆ Enhanced awareness of NRC as an independent regulator
- ◆ Fair and timely process for public involvement in NRC's decision-making
- ◆ Early public involvement and two-way communication to enhance public confidence in NRC's regulatory process

NRC's Role at Yucca Mountain

- ◆ Independent regulator
- ◆ Primary mission is to protect public health and safety and the environment
- ◆ Must decide whether to authorize U.S. Department of Energy (DOE) to construct the proposed repository
- ◆ If authorization is granted, must assure DOE complies with NRC regulations

To Do So in a Way That Inspires Confidence, NRC Must...

- ◆ Review all information objectively
- ◆ Make open decisions based on sound, scientific judgments about the facts
- ◆ Maintain an open and fair public process
- ◆ Ensure availability of documents
- ◆ Keep State, Counties, Tribes and public informed

On What Basis Will NRC Decide?

- ◆ Any NRC decision on a potential license application for a repository will:
 - be based on NRC staff's comprehensive, independent safety review
 - include a full and fair public hearing that follows formal, well-established rules to ensure, and document, an open, objective decision

NRC Staff Safety Review

- ◆ Review license application
- ◆ Request more information from DOE, if needed
- ◆ Conduct independent confirmatory analyses
- ◆ Document results in a Safety Evaluation Report



Public Licensing Hearing

If DOE submits a license application...

- ◆ Any NRC decision will be based on a full and fair public hearing before an independent panel of judges
- ◆ Hearing will follow formal, well-established rules, and will result in findings of fact and conclusions of law that are based on the record of the proceeding

Formal Evidentiary Hearing

- ◆ DOE has burden of proof
- ◆ State, Counties, Tribes, and other parties must present evidence to support their issues or contentions
- ◆ NRC staff will testify on the basis and conclusions of its independent safety evaluation report

Openness Challenges at Yucca Mountain

- ◆ Highly controversial, licensing decision for a first-of-its-kind facility
- ◆ Safety review will require extensive technical and scientific analyses, evaluation of expert judgment, and long-range modeling assessments of expected repository performance
- ◆ Formal, trial-type proceeding
- ◆ Law provides limited time to decide

NRC Needs Independent Scientific and Engineering Analyses to:

- ◆ Develop technical bases for regulations & guidance
- ◆ Evaluate adequacy of DOE's safety case for a potential repository at Yucca Mountain
- ◆ Assist preparation of NRC Safety Evaluation Report
- ◆ Provide technical support for NRC testimony during the licensing hearing
- ◆ Develop effective outreach and communication tools

Confidence in Regulatory Applications of Science and Engineering

- ◆ Confidence in NRC's use of science and engineering to formulate realistic regulatory requirements and make sound regulatory judgments depends on
 - Competence
 - Independence
 - Open and fair process
 - Regulatory outcomes that are subject to verification and monitoring

Formation of the CNWRA

- ◆ NRC established the Center for Nuclear Waste Regulatory Analyses (CNWRA), in 1987, to assist NRC in making independent judgments about the safety of the nation's first geological repository for high-level radioactive waste
- ◆ Creation of the CNWRA resulted from NRC's long-term, strategic preparation for the review of a license application for a potential license application for the proposed HLW repository at Yucca Mountain.
- ◆ CNWRA was chartered with clear goals and guidelines consistent with U.S. law governing Federally-Funded Research and Development Corporations

Formation of the CNWRA (cont'd)

- ◆ NRC sought to create a research and development center to provide expertise that
 - is competent — employing recognized experts, scientists and engineers, with in-depth knowledge of the scientific and technical issues related to the potential repository at Yucca Mountain
 - is independent of DOE — free from any potential conflict of interest, or the appearance of such conflicts
 - assures long-term continuity of focused support in technical areas, and maintenance of “corporate memory” of the evolution of repository safety and regulatory issues
 - complements NRC’s skill set — avoiding gaps and overlaps in expertise between NRC and CNWRA

Center for Nuclear Waste Regulatory Analyses

- ◆ Supports NRC's regulatory mission with expertise, computers, laboratories, and field research
- ◆ 66 technical and 20 support staff members
- ◆ Part of Southwest Research Institute™ (SWRI), San Antonio, Texas
- ◆ SWRI is an independent, nonprofit, applied engineering and physical sciences research and development organization
- ◆ SWRI occupies 1,200 acres, with ~2,000,000 ft² of laboratories, test facilities, workshops, and offices for more than 2,900 employees



Roles and Responsibilities of CNWRA

- ◆ Research and technical assistance
- ◆ Technical bases for regulations and guidance
- ◆ Assist review of license application
- ◆ Hearing support to NRC staff
- ◆ Support NRC outreach and communications

CNWRA Technical Expertise

- ◆ Hydrology/Climatology
- ◆ Material Sciences
- ◆ Mechanical Engineering
- ◆ Geochemistry/Radiochemistry
- ◆ Rock Mechanics
- ◆ Mining Engineering
- ◆ Structural Geology
- ◆ Health Physics
- ◆ Nuclear Engineering
- ◆ Volcanology
- ◆ Computer Sciences
- ◆ Performance Assessment

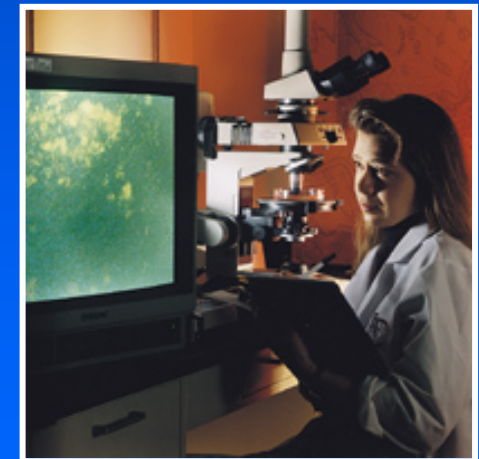
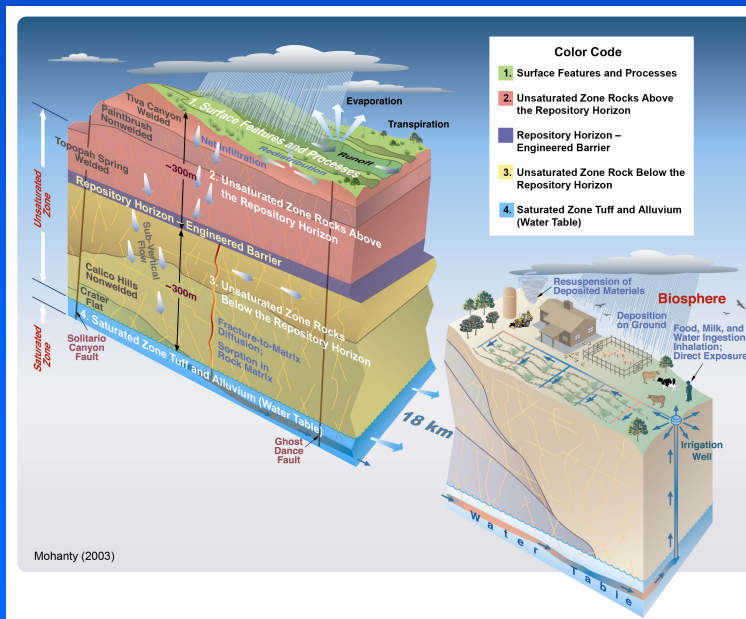
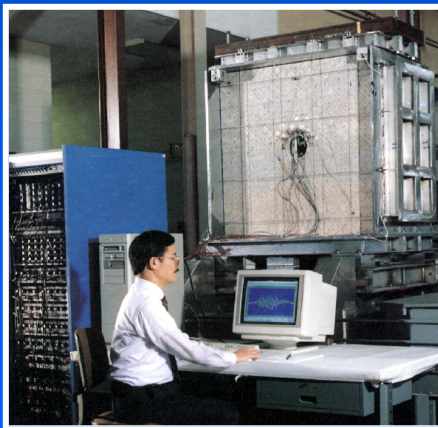
Joint NRC and CNWRA Analyses

- ◆ Comprehensive understanding of repository system
- ◆ Independent performance assessment model and codes
- ◆ Evaluation of technical uncertainties
- ◆ Risk significance of repository safety issues
- ◆ Documented bases for regulatory decisions

CNWRA Provides a Wide Range of Independent Technical Support to NRC



- *Technical Experts*
- *Computer Modeling*
- *Laboratory Investigations*
- *Field Studies*
- *Safety Assessment*



NRC Relies on CNWRA for Broad Technical Support

- ◆ Primary area of support is to NRC's high-level waste repository safety program
- ◆ CNWRA also performs scientific and engineering analyses for other NRC regulatory applications
 - Uranium mining and mill tailings
 - Waste reprocessing
 - Site decommissioning
 - Spent fuel storage
- ◆ Example: Aircraft crash probability
 - Issue of contention in hearing for an interim storage facility
 - Independent CNWRA analyses used to support NRC testimony

Technical Support for Public Outreach

- ◆ CNWRA experts support NRC public meetings, open houses and conference exhibits
- ◆ Help NRC staff identify key technical concepts and defining science-based messages
- ◆ Aid NRC in translating key messages into plain language



FEDERAL AGENCIES INVOLVED IN EVALUATING YUCCA MOUNTAIN

WHAT IS THE NRC'S MISSION?
 The NRC is an independent regulatory agency whose mission is to ensure protection of health and safety, promote the common defense and security, and protect the waste.

WHY IS THE FEDERAL GOVERNMENT STUDYING YUCCA MOUNTAIN?
 The Nuclear Waste Policy Act of 1982 as amended (the Act) specifies that high-level waste will be disposed of underground in a deep geologic repository and that Yucca Nevada will be the single candidate site for characterization as a potential geologic repository.

On February 15, 2002, after receiving a recommendation from the Secretary of Energy, President Bush directed the NRC to study the Yucca Mountain site for disposal of high-level waste. Congress approved the recommendation, and on July 23, 2002, President Bush signed House Joint Resolution 84 directing the DOE to prepare an application for a geologic repository at Yucca Mountain, Nevada.

WHICH FEDERAL AGENCIES ARE INVOLVED IN EVALUATING YUCCA MOUNTAIN?

- DOE** (<http://www.eis.doe.gov/>)
 - DOES the geology, geochemistry, and hydrology at the site.
 - DOE prepares an application to submit to the NRC for construction of a repository.
 - DOE is developing a transportation plan for shipment of waste to the repository.
 - DOE is responsible for designing and/or authorizing building, operating, and closing.
- Environmental Protection Agency (EPA)** (<http://www.epa.gov/adultion/yucca/>)
 - DOES environmental standards for evaluating the safety of a geologic repository.
- NRC** (http://www.nrc.gov/waste/how_disposal.html)
 - DOES develop and enforce regulations to implement the EPA safety standards.
 - DOE will evaluate the DOE prospective license application.
 - DOE may grant or deny DOE applications for a geologic repository.
 - DOE certifies casks used to ship commercial nuclear fuel waste.
- Department of Transportation (DOT)** (<http://www.dot.gov/>)
 - DOES regulate transportation of waste to the repository.
 - DOE enforces requirements on shippers, loaders, and vehicles.

May 2004-INTERACT

KEY TECHNICAL ISSUES
 Keys to Judging the Safety of a Proposed Repository at Yucca Mountain

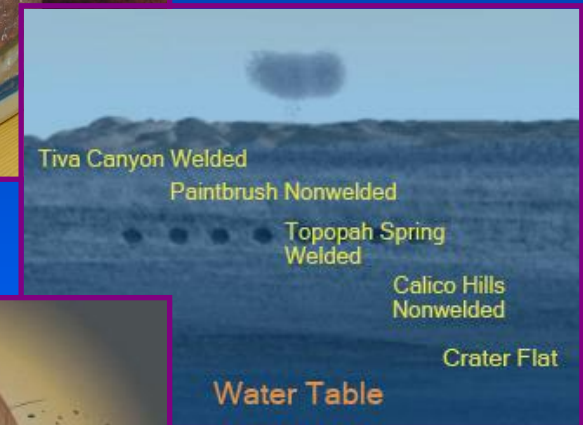
The staff of the U.S. Nuclear Regulatory Commission (NRC) identified nine key technical issues to organize its review of the U.S. Department of Energy (DOE) site characterization program at Yucca Mountain. These topics, posed as questions below, are the issues most important to understanding the long-term capability of a repository at Yucca Mountain to protect public health, safety, and the environment. These key technical issues, or KTI's, are organized in the NRC's standards and requirements applicable to Yucca Mountain. The KTI's also form the basis for the NRC's draft Safety Licensing Guide referenced in the Yucca Mountain Review Plan. If the DOE applies to the NRC for a license to construct a repository at Yucca Mountain, the DOE will need to show that the repository complies with NRC's regulations and it will have to address these issues:

- (1) UNSATURATED AND SATURATED ZONE FLOW UNDER ISOTHERMAL CONDITIONS R**
 How does water move above and below a potential repository at Yucca Mountain?
- (2) THE BIHAL EFFECTS ON FLOW R**
 How does temperature affect the movement of water in the immediate area of the potential repository?
- (3) CONTAINER LIFE AND SOURCE TERM R**
 How long do we expect the containers and waste forms to last and what will happen to the waste as the containers and waste forms wear away and break?
- (4) EVOLUTION OF THE NEAR FIELD ENVIRONMENT R**
 How do water and heat affect the chemical environment of the containers, waste forms, and the immediate area around the repository?
- (5) RADIONUCLIDE TRANSPORT R**
 How do radioactive elements released from degraded waste move away from the repository?
- (6) REPOSITORY DESIGN AND THE MECHANICAL EFFECTS R**
 How do engineering design, construction, and operation of a repository affect short- and long-term repository safety?
- (7) STRUCTURAL DEFORMATION AND SEISMICITY R**
 How do geologic features and events, such as fractures and earthquakes, affect repository safety?
- (8) IGNEOUS ACTIVITY R**
 How likely is it that volcanic eruptions or igneous intrusions will disrupt the repository and what would be the potential consequences to people and the environment?
- (9) TOTAL SYSTEM PERFORMANCE ASSESSMENT AND INTEGRATION R**
 How will the various engineered and natural barriers work together to isolate waste, so that the proposed repository at Yucca Mountain will comply with safety and environmental standards?

April 2004 KTI

Technical Support for Public Outreach (cont.)

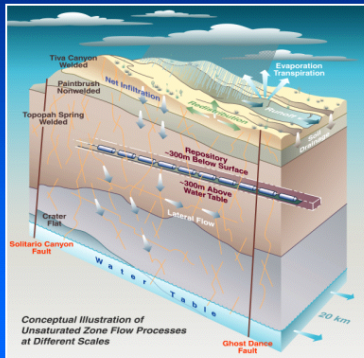
- ◆ CNWRA and NRC Staff strive to publish research findings and limitations in plain language
- ◆ CNWRA is working to develop physical models, computer visualization, and animations to illustrate regulatory requirements for repository performance



Explaining the Importance of the CNWRA

9 Total System Performance Assessment and Integration

How will the entire system of engineered and natural barriers work together to retain waste, so that the potential repository at Yucca Mountain will comply with safety and environmental standards?



CNWRA scientists and engineers study how the natural and engineered systems at Yucca Mountain would work together.

We use field studies to evaluate the safety of a potential repository.



Field sensors help locate and identify geologic structures beneath the ground surface that may affect the movement of groundwater.

◆ Presentation at NRC Open House



Conclusions

- ◆ NRC is committed to regulatory openness
- ◆ Independent research and development is necessary to support NRC regulatory actions and decisions regarding a proposed HLW repository at Yucca Mountain
- ◆ NRC established the CNWRA as a conflict-free body of experts to support NRC's HLW regulatory program
- ◆ NRC's reliance on independent expertise conveys to stakeholders that NRC is able to challenge DOE's assumptions and assertions and arrive at objective conclusions about the safety of the potential repository