Experience Gained on the Management and Disposition of High-Activity Waste

Presented to:
The Blue Ribbon Commission on America's Nuclear Future

Presented By:
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U.S. Nuclear Waste Technical Review Board

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About the Board

- An independent federal agency composed of 11 technical and scientific experts, who are appointed by the President from a list of nominees submitted by the National Academy of Sciences
- Created by the 1987 amendments to the Nuclear Waste Policy Act (NWPA)
- Evaluates the technical and scientific validity of DOE's management and disposition of commercial spent nuclear fuel and government-owned spent nuclear fuel and HLW
- Required by the NWPA to report its findings, conclusions, and recommendations at least twice a year to Congress and the Secretary of Energy

About the Board (cont.)

- The Board's peer review continues but its priorities have changed to reflect DOE's consideration of fuel cycle alternatives to direct disposal of spent fuel
- The Board reviews all DOE activities related to implementation of the NWPA *regardless of where inside DOE those activities are undertaken*

Board Priority Tasks

- Identify technical gaps related to very long term storage
- Develop capability to perform analyses of the back end of the fuel cycle with an emphasis on waste management and disposal (NUWASTE)
- Consider technical issues associated with “stranded” government-owned SNF & HLW
- Extend the Board’s *Survey* report to add assessment of how other countries have developed their repository programs
- Derive technical lessons-learned based on high-activity waste management and disposal experiences in the U.S. and abroad (Today’s focus)

Permanent Disposition

- A repository for the permanent disposal of high-activity waste will be needed, regardless of the nuclear fuel-cycle adopted
- An agreed-upon plan for permanent disposition of the waste is essential for public confidence and as an integral part of any fuel-cycle adopted in the future

Defining the Problem and Finding a Solution

- The Problem –

  High-activity waste is being temporarily stored at federal facilities and commercial nuclear power reactors across the country. The current inventory of waste in storage is more than 60,000 MTU and is being added to at the rate of 2,000 MTU per year.

- The Solution –

  Deep-geologic disposal should be part of the solution

Geologic Disposal – Technical Challenges

- Waste isolation is challenging because inventories and properties of the waste vary widely
- Heat generated by the waste affects geochemical processes and the rates of degradation of engineered barriers
- Result is a dynamic and complex repository system
- Extensive modeling is necessary to predict repository performance

Technical Lessons Learned

- Deep geologic repositories are feasible
- Expect surprises underground
- Engineered barriers can complement natural barriers and may be more predictable in the “near” term
- Analyzing the overall risk of different waste forms is very important
- Prototyping of first-of-a-kind system and subsystem components in the expected environments increases understanding and enhances performance estimates
- Reducing waste handling should be a priority; a repository design that accommodates the direct disposal of a variety of canister types should be considered

Technical Lessons Learned (cont.)

- Major advances have been made on quantifying the risk of geologic repositories that also enhance the efficiency of site characterization
- A transparent rigorous and integrated total systems approach to all elements of the project is essential
- Science and engineering should be well integrated, and the transition to an engineering program should occur at the right time
- It is possible to develop a license application that meets NRC requirements for accepting a license application for review

Experience in Other Countries

- Repository systems can be developed in a variety of geologic environments
- Most proposed disposal concepts rely on both natural and engineered barriers, although the degree of reliance on one or the other varies considerably
- Research carried out at-depth in underground research laboratories has been extremely valuable

Moving Forward

A permanent solution is essential for the following reasons:

- It is critical for building public confidence
- Institutional changes could bring instability over time
- An international scientific consensus exists that a permanent geologic repository is the preferred disposal option and that it is technically feasible

Moving Forward

The following appear to be necessary to move forward:

- A baseline founded on worldwide experience to date
- The most strategic method of disposing of different waste forms should be addressed
- At the point that a site is found suitable for repository development, an engineering-oriented project plan should be developed. An appropriate level of scientific activities should support the engineering program.

Backup

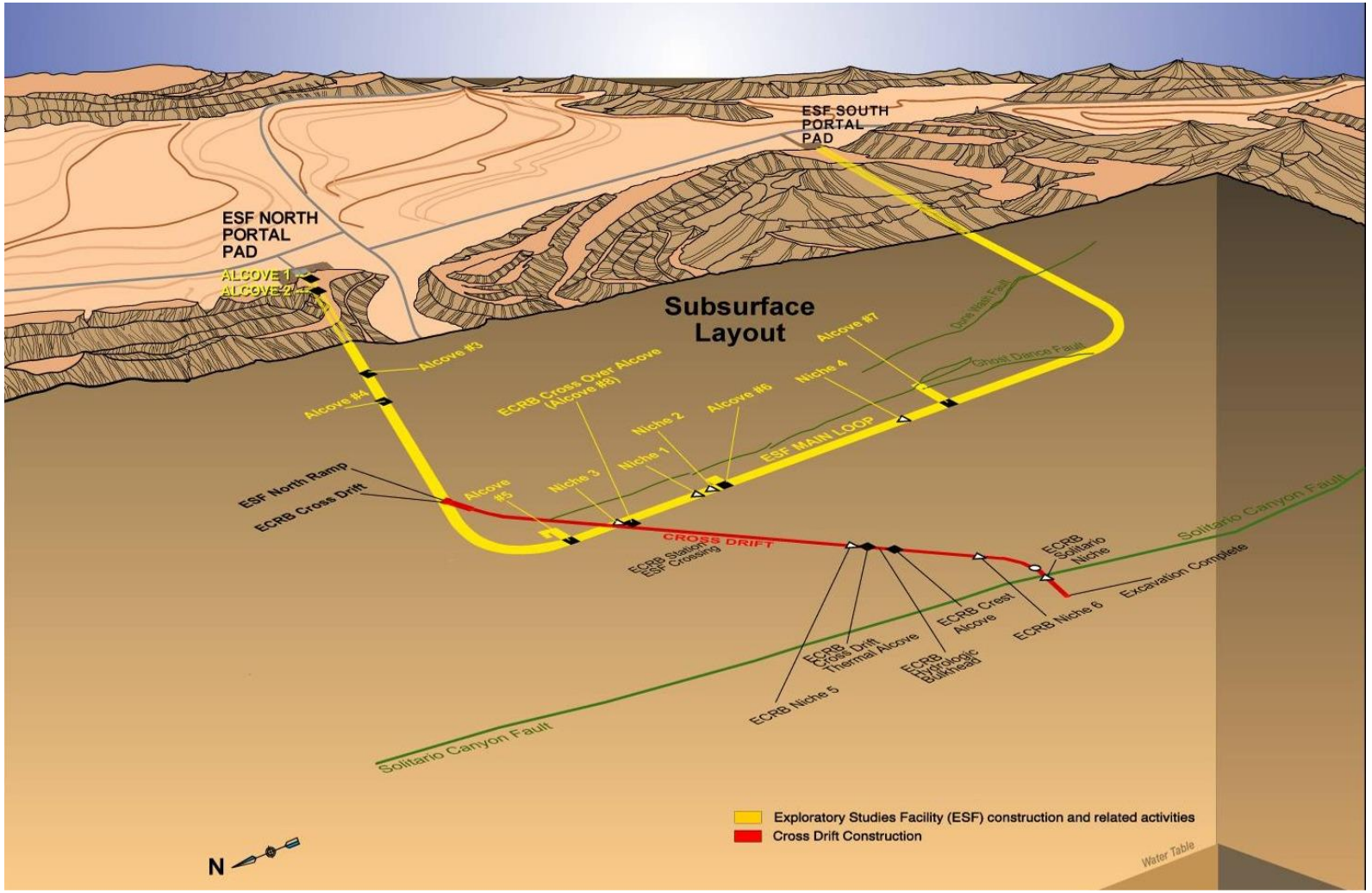
Meeting on Technical Lessons Learned

- October 26, 2010, at Dulles Marriott
- Three panels:
  - 4 senior DOE or M&O technical managers
  - 5 representatives of Nevada counties and the state of Nevada
  - 4 representatives from repository programs of other countries (France, Germany, Sweden, UK)

Meeting on Technical Lessons Learned (cont.)

- State and local oversight should be treated seriously
- Prototyping of novel equipment and components provides important data and builds public confidence
- A lead lab should be established as early as possible
- Making utilities responsible for waste disposal may have advantages

ESF and ECRB


ESF SOUTH PORTAL PAD
ESF NORTH PORTAL PAD
ALCOVE 1
ALCOVE 2
Subsurface Layout
Alcove #7
Ghost Dance Fault
Alcove #3
Alcove #4
ECRB Cross Over Alcove (Alcove #8)
Niche 2
Alcove #6
Niche 4
Niche 1
ESF MAIN LOOP
ESF North Ramp
ECRB Cross Drift
Alcove #5
Niche 3
CROSS DRIFT
ECRB Station ESF Crossing
ECRB Solitario Niche
Solitario Canyon Fault
Excavation Complete
ECRB Crest Alcove
ECRB Niche 6
ECRB Cross Drift Thermal Alcove
ECRB Hydrologic Bulkhead
ECRB Niche 5
Solitario Canyon Fault
Exploratory Studies Facility (ESF) construction and related activities
Cross Drift Construction
N
Water Table

NWTRB *Survey* Report