



# **1996 OCRWM Draft Program Plan: Background**

- **In 1995, the OCRWM Program adjusted its planning efforts to comply with Congressional direction**
  - **De-emphasis placed on interim storage**
  - **Focus YMSCO efforts on core science and ESF construction**
  - **Definition of an interim milestone for assessing the viability of Yucca Mountain in 1998**
  - **Deferral of licensing activities**
  - **Plan for significant budget reductions for FY96 and the out years**
    - » **Reduction in major Project activities**
    - » **Reduction in Contractor staff**

# **1996 OCRWM Draft Program Plan: Background**

(continued)

- **YMSCO initiated contingency planning to streamline the repository program under constrained budgets**
  - **Utilizes elements of the Waste Containment and Isolation Strategy to focus on key safety issues**
  - **Emphasizes integration and Project efficiency**
  - **Incorporates the Viability Assessment**
  - **Re-establishes milestones for site recommendation and license application**

# **1996 OCRWM Draft Program Plan: Rationale**

- **Refocusing the Yucca Mountain Project**
  - **Technical rationale**
    - » Existing data and progress in data syntheses allow for a reduction in the overall scope
    - » Better understanding exists for what information is necessary to meet objectives
  - **Regulatory initiatives**
    - » Need to update regulatory framework to reflect current understanding and Congressional intent
  - **Project efficiency initiatives**
    - » Improve efficiency and achieve program objectives
    - » Improved planning process
    - » Emphasis on data management and accessibility
    - » Use PA as integrating tool

# Draft Project Summary Schedule Key Milestones

## FY1997

Complete Ghost Dance Fault I

Daylight TBM

Complete Ghost Dance Fault II

Initiate *In Situ* Thermal Tests

Complete Phase I Design

## FY1998

Publish Final Rule 10CFR960

License Application Plan

Site Process Models Completed

Complete TSPA - VA

Viability Assessment

## Rev 1 Draft Program Plan 1994 Program Plan

Mar. 97

Mar. 97

Mar. 97

Aug. 97

Sept. 97

Oct. 97

Oct. 97

Nov. 97

Aug. 98

Sept. 98

July 96

Apr. 97

Nov. 96

Feb. 97

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Sept. 00

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# Draft Project Summary Schedule Key Milestones

(Continued)

<u>FY1999</u>	<u>Rev 1 Draft Program Plan</u>	<u>1994 Program Plan</u>
Complete Phase II Design	July 99	--
Publish Draft EIS	July 99	Aug. 98
<u>FY2000</u>		
NRC Certification	Dec. 99	--
Drift-Scale Heater Test Summary Report	Mar. 00	--
Publish FEIS	Aug. 00	Aug. 00
<u>FY2001</u>		
DOE Recommends Site to President	July 01	Sept. 99
<u>FY2002</u>		
Submit LA to NRC	Mar. 02	June 01
Complete Phase III Design	Mar. 02	--

# **Status of Waste Containment and Isolation Strategy**

# Background

- **1988 Site Characterization Plan (SCP) presented a top-level strategy for Yucca Mountain**
- **This update to the strategy maintains the core of the SCP strategy**
  - **Protection against corrosion of waste packages is provided by emplacement in the unsaturated zone**
  - **Rock units along potential flowpaths offer potential for considerable radionuclide retardation**

# Basis for Updating Strategy

- **Improved understanding of site conditions and processes**
- **New repository and waste package designs**
  - **Larger more robust waste packages**
  - **Increased attention to effects of thermal loading**
- **More realistic performance predictions for the combined natural and engineered systems**
- **Changing regulatory considerations**
  - **Dose- or risk-based standard**

# Status

- **Updated top-level strategy is contained in the June 1996 Program Plan**
- **“Highlights of the Updated Waste Containment and Isolation Strategy” is available today**
- **Two-part comprehensive strategy is in preparation**
  - **Part 1: Technical Basis**
  - **Part 2: Priorities for Testing and Analysis**
- **Goal is to complete comprehensive strategy in early FY97**
- **Early versions of the strategy were used to support development of the Project Long-Range Plan and the FY97 Annual Plan**

# Highlights of the Updated Strategy

- **Takes credit for the more robust waste package design and other changes in repository design that may enhance performance**
- **Explicitly considers the potential for enhanced engineered barriers to prevent or delay transport**
- **Continues to rely on multiple natural barriers to limit radionuclide movement and to reduce concentrations**
- **Relies on dilution offered by saturated zone flowpaths as an important element of the strategy for a dose-based standard**

# Goals of the Strategy

- **Near complete containment of radionuclides within waste packages for several thousand years**
- **Acceptably low annual dose rates to a member of the public living near the site**

# System Attributes

- **The system attributes that have been recognized to be most important for predicting performance of engineered and natural barriers are**
  - **Rate of water seepage into the repository**
  - **Waste package lifetime (containment)**
  - **Rate of release of radionuclides from breached waste packages**
  - **Radionuclide transport through engineered and natural barriers**
  - **Dilution in the saturated zone below the repository**

# Outlook

- **Defining the key performance attributes provides the basis for focusing the testing and analyses program on the most important remaining issues about postclosure safety**
- **Evaluation of these attributes will aid us in confirming or revising the models that are used to predict performance**

# Development of Hypotheses

- **Working hypotheses have been developed to guide the testing of remaining issues related to each performance attribute**
- **The hypotheses provide a basis for organizing, managing, and explaining the rationale for testing and analyses related to total system performance**
- **Each hypothesis and attribute must be evaluated in the context of its relative contribution to the performance of the total system**

# Hypotheses

Attribute	Hypotheses to be evaluated
Seepage	<ol style="list-style-type: none"><li data-bbox="985 508 1649 654">1. Percolation flux at repository depth is significantly less than net infiltration</li><li data-bbox="985 690 1676 835">2. Fracture flow occurs within a limited volume of the repository host rock at any given time</li><li data-bbox="985 872 1734 1067">3. Seepage into emplacement drifts will be limited to a small fraction of the incident percolation flux due to capillary forces</li><li data-bbox="985 1103 1749 1199">4. Bounds can be placed on thermally induced changes in seepage rates</li><li data-bbox="985 1235 1672 1331">5. Impacts of climate change on seepage rates can be bounded</li></ol>

# Hypotheses

(Continued)

Attribute	Hypotheses to be evaluated
Containment	<ol style="list-style-type: none"><li data-bbox="981 678 1817 827">6. Heat produced by emplaced waste will reduce relative humidity in the vicinity of waste packages</li><li data-bbox="981 860 1817 1009">7. Corrosion rates are very low at low relative humidity, and corrosion of the inner barrier is slow</li><li data-bbox="981 1042 1817 1240">8. Double-walled waste packages will significantly increase containment times due to protection of the inner barrier by the outer barrier</li></ol>

# Hypotheses

(Continued)

Attribute	Hypotheses to be evaluated
Radionuclide Mobilization	9. Radionuclide release from waste forms due to surface area exposed, dissolution, colloid formation, and microbial will be low

# Hypotheses

(Continued)

Attribute	Hypotheses to be evaluated
Radionuclide Transport	10. Transport properties of both engineered and natural barriers significantly reduce radionuclide concentrations of key actinides through depletion and dispersion

# Hypotheses

(Continued)

Attribute	Hypotheses to be evaluated
Dilution	<ol style="list-style-type: none"><li data-bbox="968 667 1724 805">11. Flow in the saturated zone is much greater than the flow contacting the waste</li><li data-bbox="968 846 1724 1036">12. Water percolating down through the repository horizon to the water table mixes strongly with the flow in the aquifer</li></ol>

# Hypotheses (Disruptive Processes and Events)

Attribute	Hypotheses to be evaluated
Tectonics & Seismicity	<p>13. The amount of movement on faults through the repository horizon will be too small to bring waste to the surface and too small and infrequent to significantly impact containment during the next few thousand years</p> <p>14. The severity of ground motion expected in the repository horizon will be limited, and the consequences of ground motion will be minimal for tens of thousands of years, based on the Quaternary geologic record, the depth of the repository, and the low seismic vulnerability of the engineered barrier system</p>

# Hypotheses (Disruptive Processes and Events)

(Continued)

Attribute	Hypotheses to be evaluated
Volcanism	15. Volcanic events within the controlled area will be rare, and the consequences of volcanism will be acceptable

# Conclusion and Review

**Results of hypotheses evaluation may impact**

- **Waste package design and materials testing**
- **Decisions about the need for other engineered barriers**
- **Repository design, particularly the density of heat-generated waste in the repository or in individual waste packages**
- **Plans for acquisition of site information**

# **Conclusion and Review**

(Continued)

- **Strategy has served as an integrating tool for design, site, and performance assessment**
- **Refinements to the strategy are likely as new information becomes available**