

YUCCA  
MOUNTAIN  
PROJECT

Studies

Objectives and Structure:  
Unsaturated Zone Flow Model Expert Elicitation  
(UZFMEE) Project

Presented to:  
Nuclear Waste Technical Review Board

Presented by:  
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June 25-26, 1997



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

# Objective of Study

- **The objective of the UZFMEE project was to identify and assess the uncertainties associated with certain key components of the unsaturated zone flow system at Yucca Mountain**
- **The assessment reviewed the data inputs, modeling approaches, and results of the unsaturated zone flow model being developed by Lawrence Berkeley National Laboratory (LBNL)**

# **Objective of Study**

(Continued)

- **Focused on percolation flux (volumetric flow rate per unit cross-sectional area) at the potential repository horizon**
- **Two users of results: site-scale unsaturated zone flow model and Total System Performance Assessment**

# Uncertainty Treatment

- **Major goal to capture the uncertainties in assessing unsaturated flow processes, including modeling and parameter uncertainties**
- **To ensure a range of perspectives, multiple individual judgments were elicited from seven members of an expert panel**
- **Panel members from within and outside the Yucca Mountain project represented a range of experience and expertise**

# Uncertainty Treatment

(Continued)

- **Deliberate process followed in facilitating interactions among the experts, training them to express their uncertainties, and eliciting their interpretations**
- **Expert elicitation processes consistent with recent NRC and DOE guidance**
- **Resulting assessments and probability distributions provide a reasonable representation of the knowledge and uncertainties about key Yucca Mountain unsaturated zone issues**

# **Steps in the UZFMEE Methodology**

- **Development of project plan**
- **Selection of the expert panel**
- **Data compilation and dissemination**
- **Meetings of the expert panel**
- **Elicitation of experts**
- **Feedback of preliminary results**
- **Finalization of expert assessments**
- **Preparation of project report**

# UZFMEE Panel Members

<b>Expert</b>	<b>Affiliation</b>
<b>Gaylon S. Campbell</b>	<b>Washington State University</b>
<b>Glendon W. Gee</b>	<b>Battelle, Pacific Northwest National Laboratory</b>
<b>James W. Mercer</b>	<b>Geotrans, Inc.</b>
<b>Shlomo P. Neuman</b>	<b>University of Arizona</b>
<b>Karsten Pruess</b>	<b>Lawrence Berkeley National Laboratory</b>
<b>Daniel B. Stephens</b>	<b>Daniel B. Stephens &amp; Associates</b>
<b>Edwin P. Weeks</b>	<b>U.S. Geological Survey</b>

# **Meetings and Other Key Steps of the UZFMEE Project**

## **Workshop #1 Significant Issues and Available Data (November 14-15, 1996)**

- **Identified issues important to TSPA-VA and for UZ site-scale model**
- **Summaries by PIs of data collected for Yucca Mountain**

## **Workshop #2 Alternative Models and Interpretations (December 18-20, 1996)**

- **Summary of key components of UZ site-scale model**
- **Alternative conceptual models of fracture-matrix interaction, temporal models**
- **Net infiltration modeling**
- **Calibration**



# **Meeting and Other Key Steps of the UZFMEE Project**

(Continued)

## **Field trip to ESF and Yucca Mountain Vicinity**

- **Workshop #3 Preliminary Interpretations (February 4-5, 1997)**
- **Presentations by experts of preliminary interpretations: net infiltration, rock properties, major pathways, calibration uncertainties, and alternative conceptual models**
- **Discussion of uncertainties**

# **Meetings and Other Key Steps of the UZFMEE Project**

(Continued)

## **Elicitation Interviews (February 6-21, 1997)**

- **One-day sessions with each expert**
- **Interpretations documented**

## **Feedback**

- **Following elicitations, feedback package prepared consisting of elicitation summaries, summary of key assessments across panel, and sensitivity analyses conducted based on expert requests**

# **Meetings and Other Key Steps of the UZFMEE Project**

(Continued)

## **Finalization and Documentation of Interpretations by Experts**

- **Multiple refinements of elicitation summaries**
- **Elicitation summaries describe unsaturated zone flow processes, alternative approaches to percolation flux estimation, flux estimates, seepage into drifts, etc.**

## **Documentation of procedures, assessments, and results**

# **Key Issues Addressed By UZFMEE Panel**

- **Conceptual model of unsaturated zone flow system**
- **Net infiltration (surface water balance)**
  - +**Temporal issues**
  - +**Spatial issues**
  - +**Temporal and spatial average over YM block**
- **Lateral diversion at top of Ptn and other interfaces**
- **Temporal behavior of UZ flow system**
- **Methods used to estimate percolation flux at potential repository horizon**

# **Key Issues Addressed By UZFMEE Panel**

(Continued)

- **Percolation flux**
  - +**Spatial and temporal average over YM block**
  - +**Spatial distribution**
- **Components of flux in fractures and matrix**
- **Fast-flow component of total flux**
- **Seepage into drifts**
- **Modeling issues**
- **Additional data collection to reduce uncertainties**