PRESENTATION TO
THE NUCLEAR WASTE TECHNICAL REVIEW BOARD

SUBJECT: OVERVIEW OF PERFORMANCE ASSESSMENTS

PRESENTER: DR. DONALD H. ALEXANDER

PRESENTER'S TITLE AND ORGANIZATION:
CHIEF
REGULATORY COMPLIANCE BRANCH
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

PRESENTER'S TELEPHONE NUMBER: (202) 586-4889

MAY 16-17, 1989
U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

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MAY 16-17, 1989
1. OBJECTIVES OF THE BRIEFING

2. DEFINITION OF PERFORMANCE ASSESSMENT

3. OBJECTIVES OF PERFORMANCE ASSESSMENT

4. REQUIRED PERFORMANCE ASSESSMENTS

5. MAJOR TECHNICAL CONCERNS

6. PERFORMANCE ASSESSMENT ACTIVITIES
OBJECTIVES OF THE BRIEFING

SESSION I: OVERVIEW

- ESTABLISH THE REGULATORY BASIS FOR THE PERFORMANCE ASSESSMENT PROGRAM
- REVIEW THE ROLE OF PERFORMANCE ASSESSMENT IN THE REDUCTION OF UNCERTAINTIES
- REVIEW THE APPROACH FOR THE TECHNICAL INTEGRATION OF PERFORMANCE ASSESSMENT ACTIVITIES
- REVIEW THE TIMING AND SEQUENCING OF PLANNED PERFORMANCE ASSESSMENT ACTIVITIES

SESSION II: SUMMARY OF MAJOR PERFORMANCE ASSESSMENT EFFORTS

- REVIEW PREVIOUS PERFORMANCE ASSESSMENT CALCULATIONS INCLUDING THOSE IN THE ENVIRONMENTAL ASSESSMENTS
- REVIEW DATA STATUS AND NEEDS
- IDENTIFY NEAR TERM ACTIVITIES
OBJECTIVES OF THE BRIEFING
DAY 2

SESSION III: INVESTIGATIVE APPROACH

- REVIEW APPROACH TO MODEL VALIDATION
- ESTABLISH ITERATIVE NATURE OF PERFORMANCE ASSESSMENT AND TESTING

SESSION IV: RECENT APPLICATIONS

- REVIEW OF PERFORMANCE ASSESSMENTS IN SUPPORT OF THE SCP
- REVIEW OF PERFORMANCE ASSESSMENTS IN THE COMPARATIVE SITE ANALYSIS
- REVIEW OF PERFORMANCE ASSESSMENTS CONDUCTED TO EVALUATE THE IMPACTS OF SITE CHARACTERIZATION ON LONG-TERM SITE PERFORMANCE

SESSION V: MODEL DEVELOPMENT

- PRESENT AN EXAMPLE OF PHYSICAL MODEL DEVELOPMENT
- PRESENT AN EXAMPLE OF SUBSYSTEM MODEL DEVELOPMENT
WHAT IS PERFORMANCE ASSESSMENT?

- PROCESS OF EVALUATING REPOSITORY SYSTEM, SUBSYSTEM, AND COMPONENT PERFORMANCE

- DEMONSTRATE COMPLIANCE WITH THE NUMERICAL CRITERIA OF THE REGULATIONS

- SUPPORT REPOSITORY DEVELOPMENT INCLUDING SITE CHARACTERIZATION AND DESIGN
OBJECTIVES OF PERFORMANCE ASSESSMENT

- EVALUATE SYSTEM AND SUBSYSTEM PERFORMANCE TO DEMONSTRATE COMPLIANCE WITH THE TECHNICAL CRITERIA OF 10 CFR PART 60 FOR THE LICENSE APPLICATION
- EVALUATE ENVIRONMENTAL IMPACTS FOR THE ENVIRONMENTAL IMPACT STATEMENT
- ASSESS SENSITIVITIES AND UNCERTAINTIES IN THE PERFORMANCE ASSESSMENT
- GUIDE DESIGN AND TESTING ACTIVITIES
REQUIRED PERFORMANCE ASSESSMENTS

- PRECLOSURE PERFORMANCE ASSESSMENTS

- POSTCLOSURE PERFORMANCE ASSESSMENTS
  - TOTAL SYSTEM PERFORMANCE ASSESSMENT
  - ENGINEERED BARRIER SYSTEM PERFORMANCE ASSESSMENT
  - NATURAL BARRIERS PERFORMANCE ASSESSMENT
Overall System Performance Objective

- Conformance with EPA Standard

Subsystem Performance Requirements

- Waste Package Lifetime
- Annual Radionuclide Release Rate
- Pre-Emplacement Ground-Water Travel Time

Siting Criteria

- Favorable Conditions
- Potentially Adverse Conditions
SCHEMATIC OF CONTAINER FUNCTIONS

Containment Period | Loss of Containment | Beginning of Liquid Release | Controlled Release Period

\[ t_1 \quad t_2 \quad t_3 \quad t_4 \]

- Gaseous Releases
- Dissolved Waste
UNSATURATED-ZONE SECTION
YUCCA MOUNTAIN

Precipitation
(~ 15 Cm/Yr)

Evaporation
(~ 97%)

Infiltration
(~ 3% - 4.5 Mm/Yr)

Tite Canyon Densely Welded Unit

Upper Clastic Unit

Topopah Spring Densely Welded Unit

Lower Clastic Unit

Aquifer Flow System

RW21675.002
PRECLOSURE REQUIREMENTS

Both the DOE and the NRC Require Radiation Protection for Workers and the General Public During Normal Operations and During Accidents; (10 CFR 60.111, 10 CFR 60.2, Proposed 10 CFR 20; DOE 5480.11, Draft DOE 5400.xx, and Draft DOE 6430.1A)
MAJOR TECHNICAL CONCERNS

- INTEGRATION OF PERFORMANCE ASSESSMENT INTO TESTING PROGRAM TO EVALUATE ADEQUACY OF DATA

- UNCERTAINTIES IN SITE MODELS
  - ALTERNATE CONCEPTUAL MODELS
  - SCENARIO SELECTION
  - VALIDITY OF PROCESS AND CONSTITUTIVE MODELS
    (eg. FLOW MECHANISM IN UZ)
  - REPRESENTATIVENESS OF SITE DATA

- UNCERTAINTIES IN ENGINEERED BARRIER MODELS
  - PHYSICAL MODEL FOR CONTAINER DEGRADATION AND FAILURE
  - MASS TRANSFER FROM WASTE PACKAGE IN UNSATURATED MEDIA

- PRECLOSURE CONCERNS
  - SEISMIC ENVIRONMENT
  - ACCIDENT SOURCE TERM

- C-14 GASEOUS RELEASE IN THE UNSATURATED ZONE

- REGULATORY INTERPRETATION
  - GROUND-WATER TRAVEL TIME
  - SUBSTANTIALLY COMPLETE CONTAINMENT
  - ANTICIPATED PROCESS AND EVENTS
  - DISTURBED ZONE EXTENT
MAJOR PHASES OF THE OCRWM PERFORMANCE ASSESSMENT PROGRAM

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- Complete SCP
- Complete PA Work Plans
- Sensitivity Studies
- Benchmarking
- Verification/Validation
- Code Selection
- Code Documentation
- DEIS Assessments
- Write DEIS
- Complete DEIS
- SAR Assessments
- Write SAR
- Complete SAR
PERFORMANCE ASSESSMENT CYCLES

Safety Analysis Report

Technical Support Documents

Activities Conducted

Site Characterization Plan

Design Plans

Performance Assessment Plans

Other Requirements
PERFORMANCE ASSESSMENT CYCLES

- Safety Analysis Report
- Technical Support Documents
- Site Characterization Plan
- Design Plans

Activities Conducted

Other Requirements

Performance Assessment Plans

RW21675.004
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Lava Flow

Upper Clastic Unit

Perched?

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Aquifer Flow System

RW21675.002
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$\text{t}_1$ | $\text{t}_2$ | $\text{t}_3$ | $\text{t}_4$

조건: Gaseous Releases, Dissolved Waste

RW21675.006
Overall System Performance Objective
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