

**U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**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**

**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

- 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**

NUCLEAR REGULATORY COMMISSION

10 CFR 60

Overall System Performance Objective

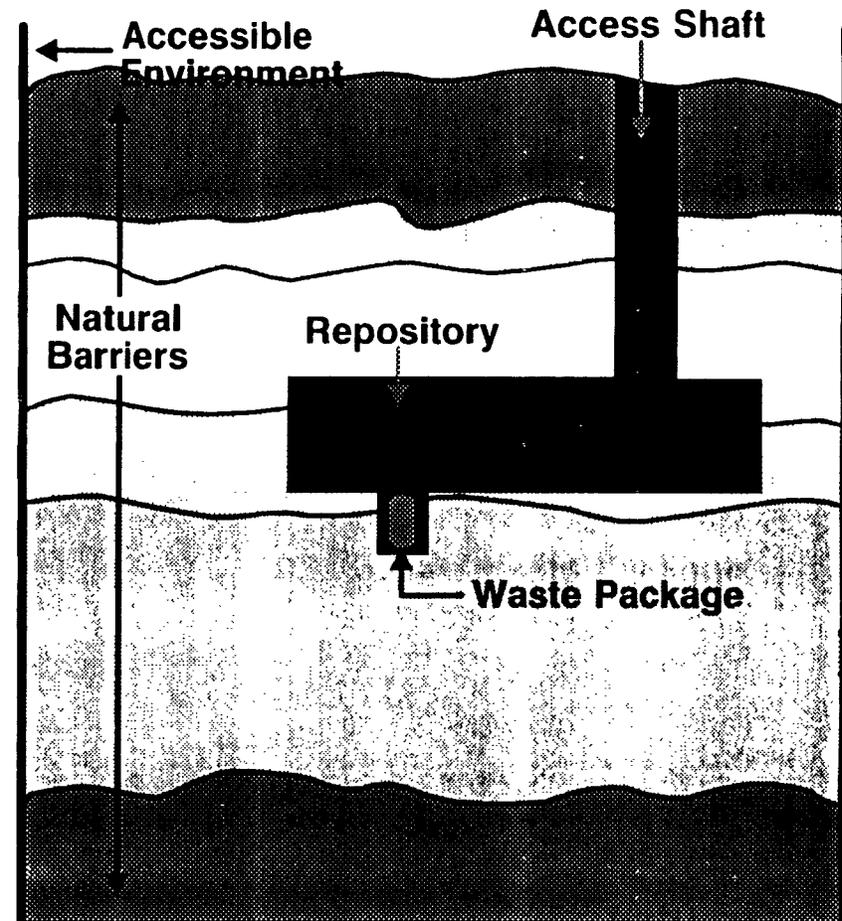
- Conformance with EPA Standard

Subsystem Performance Requirements

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

Siting Criteria

- Favorable Conditions
- Potentially Adverse Conditions



RW42387T.015

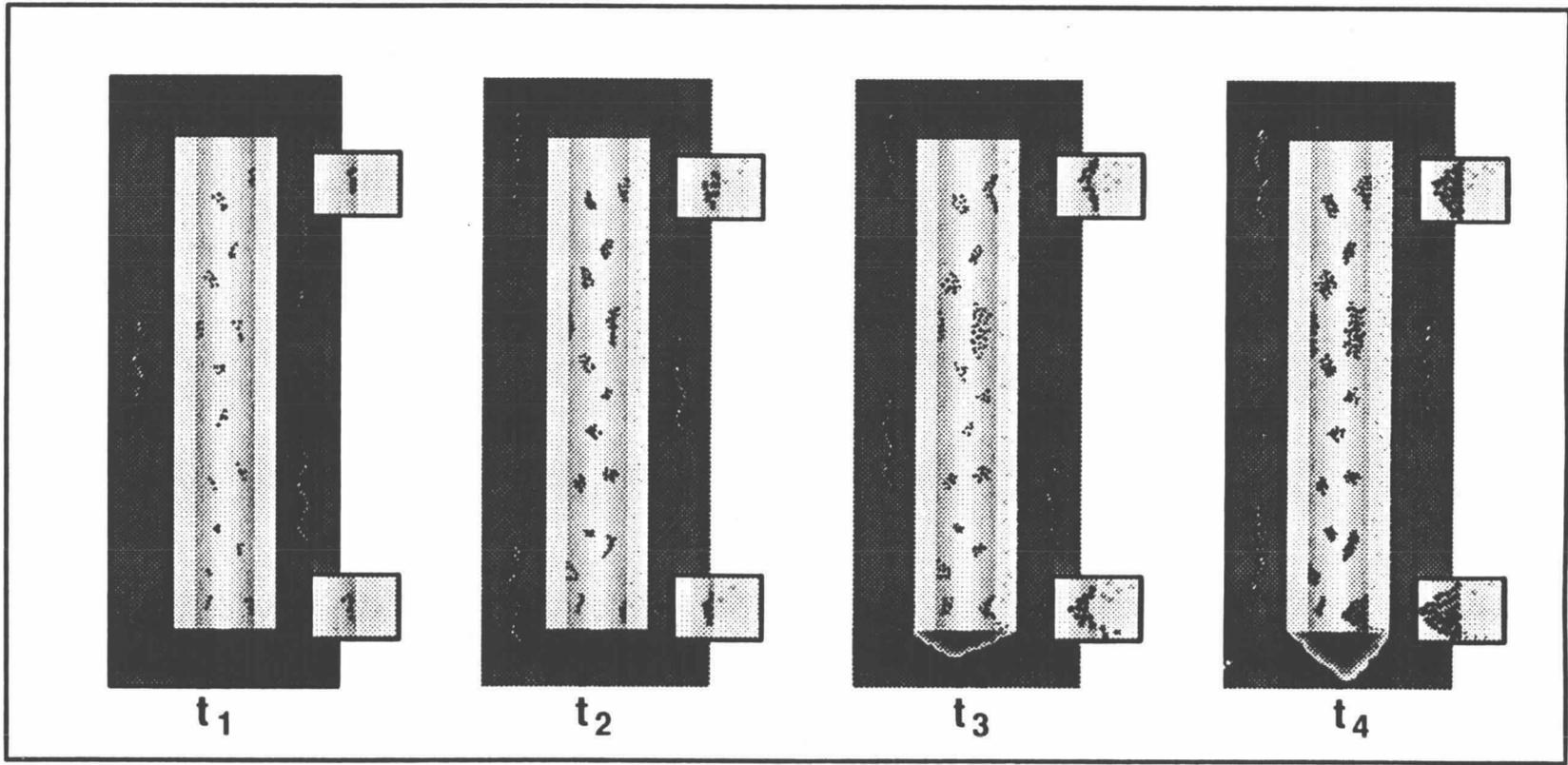
SCHEMATIC OF CONTAINER FUNCTIONS

Containment
Period

Loss of
Containment

Beginning of
Liquid Release

Controlled
Release Period



Gaseous Releases



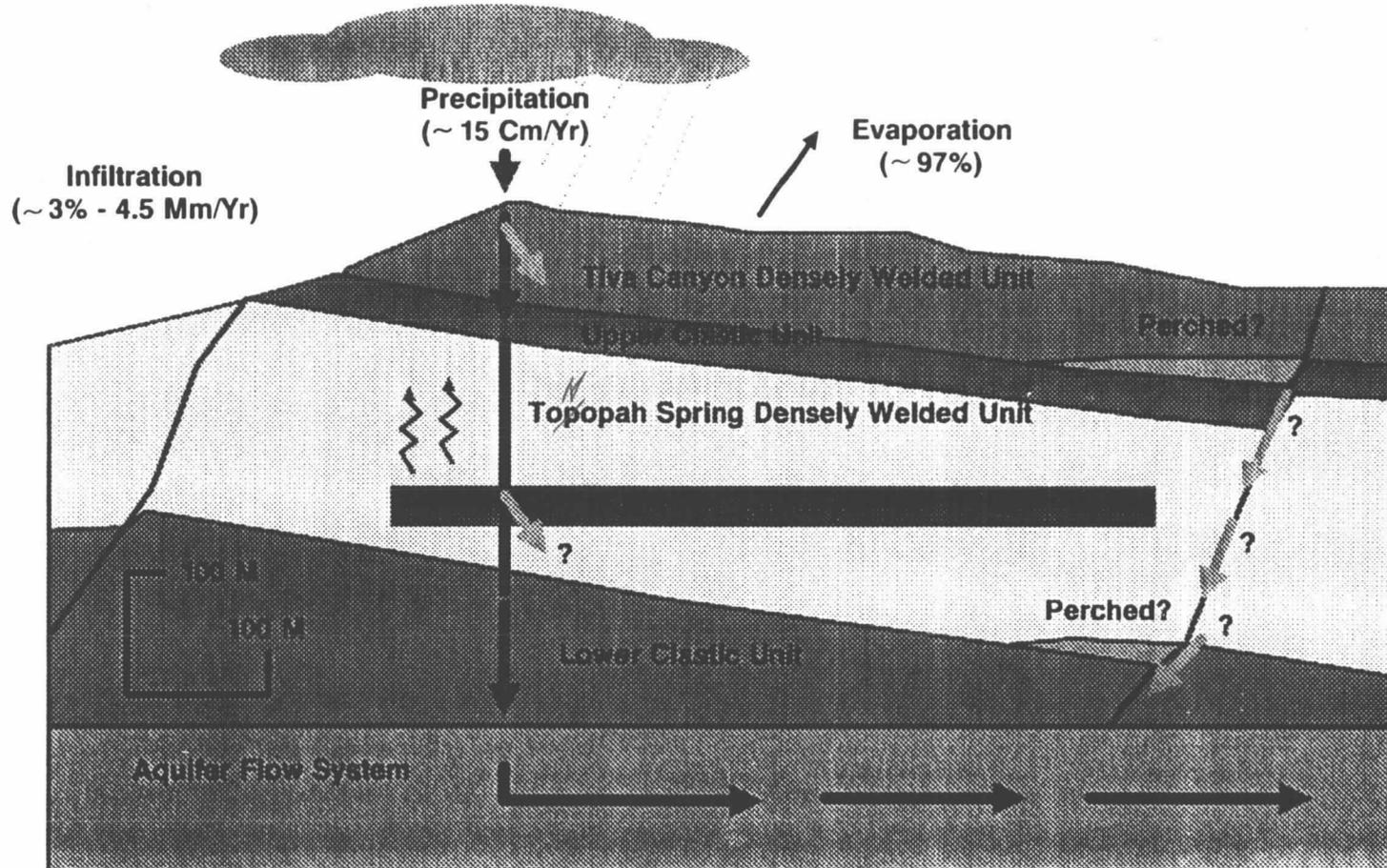
Dissolved Waste

RW21675.006

UNSATURATED-ZONE SECTION YUCCA MOUNTAIN

W

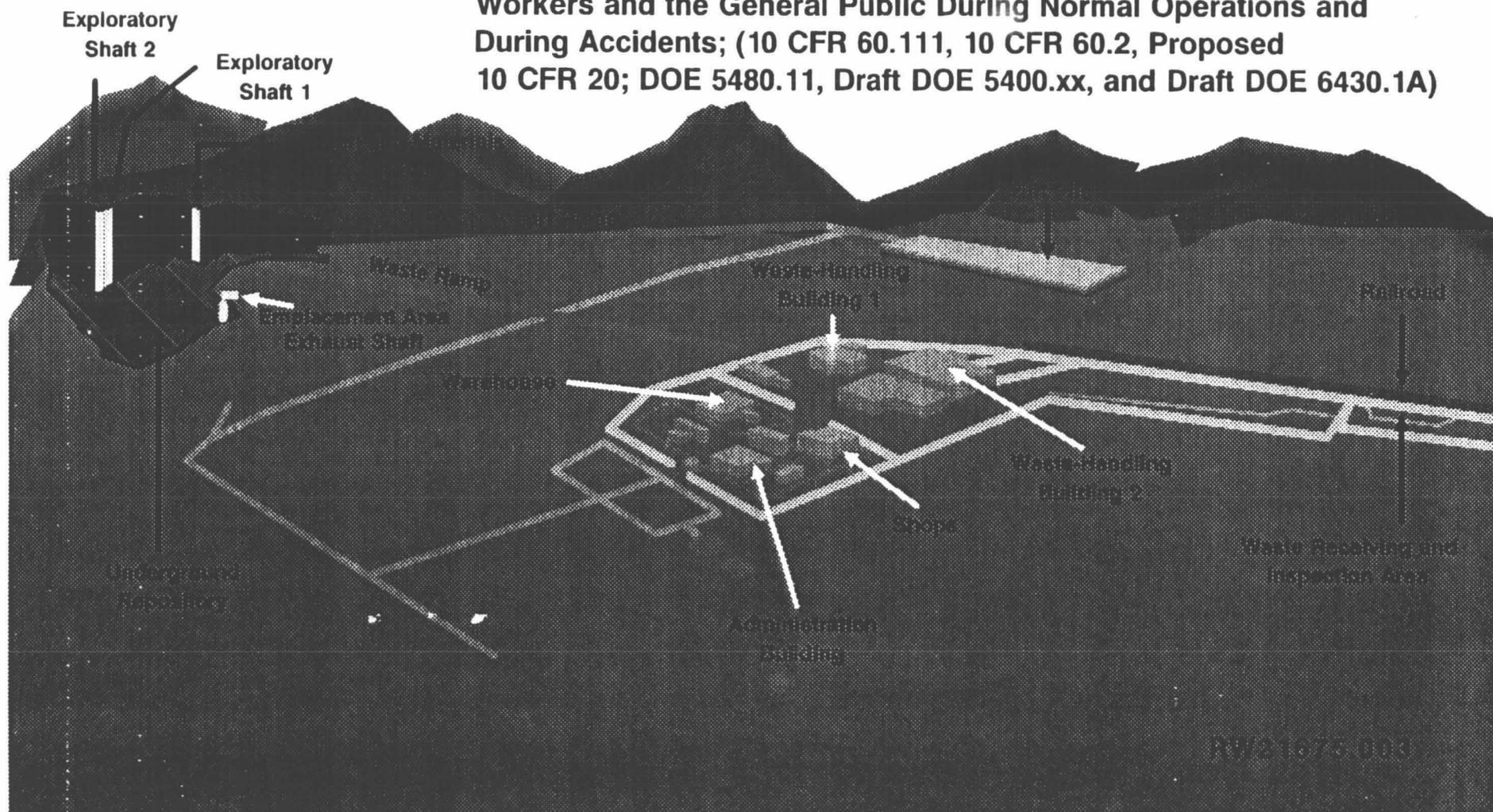
E



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)

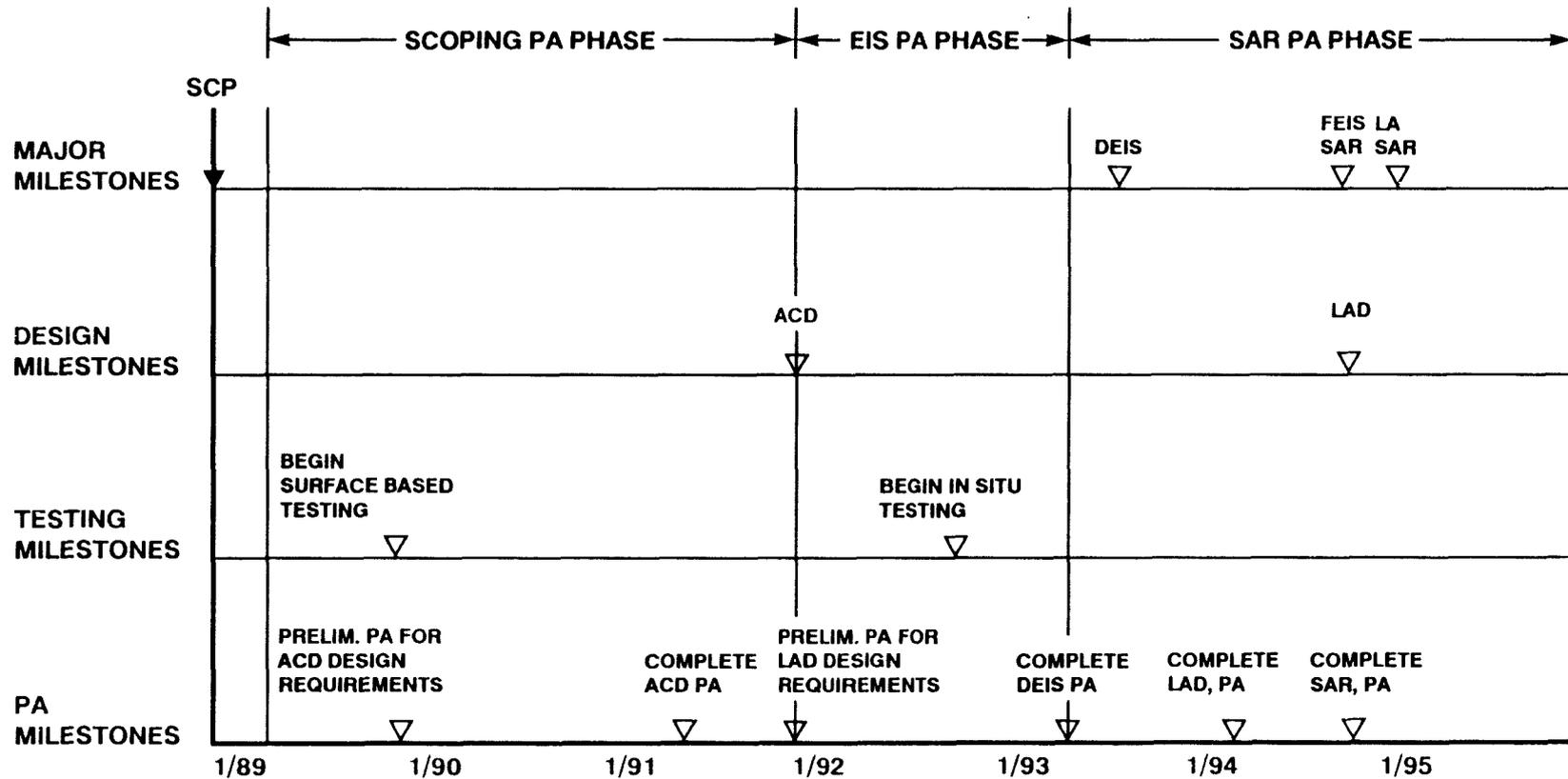


RW/21075-003

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

PERFORMANCE ASSESSMENT TARGETS



Handwritten notes:
 1/89
 1/90
 1/91
 1/92
 1/93
 1/94
 1/95

Handwritten notes:
 1/92
 1/93
 1/94
 1/95

MAJOR PHASES OF THE OCRWM PERFORMANCE ASSESMENT PROGRAM

12/88

10/89

10/90

10/91

10/92

10/93

1/95

..Complete SCP

.....DEIS Assessments

.....Complete PA Work Plans

.....Write DEIS.....Complete DEIS

.....Sensitivity Studies.....

.....SAR Assessments.....

.....Benchmarking.....

.....Write SAR.....Complete SAR

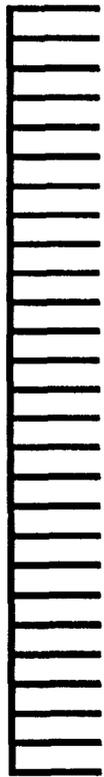
.....Verification/Validation.....

.....Code Selection.....

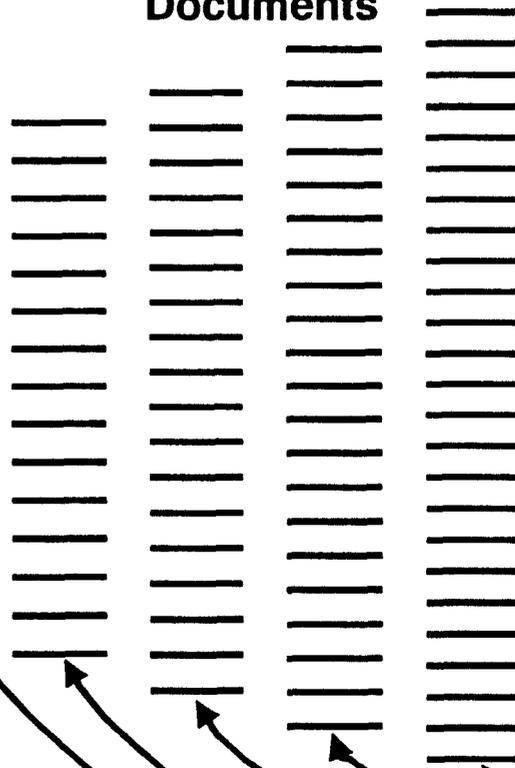
.....Code Documentation.....

PERFORMANCE ASSESSMENT CYCLES

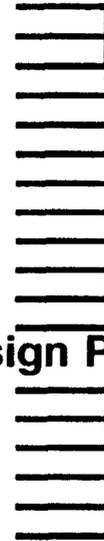
Safety Analysis Report



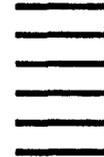
Technical Support Documents



Site Characterization Plan

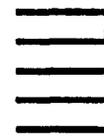


Design Plans



Activities Conducted

Performance Assessment Plans

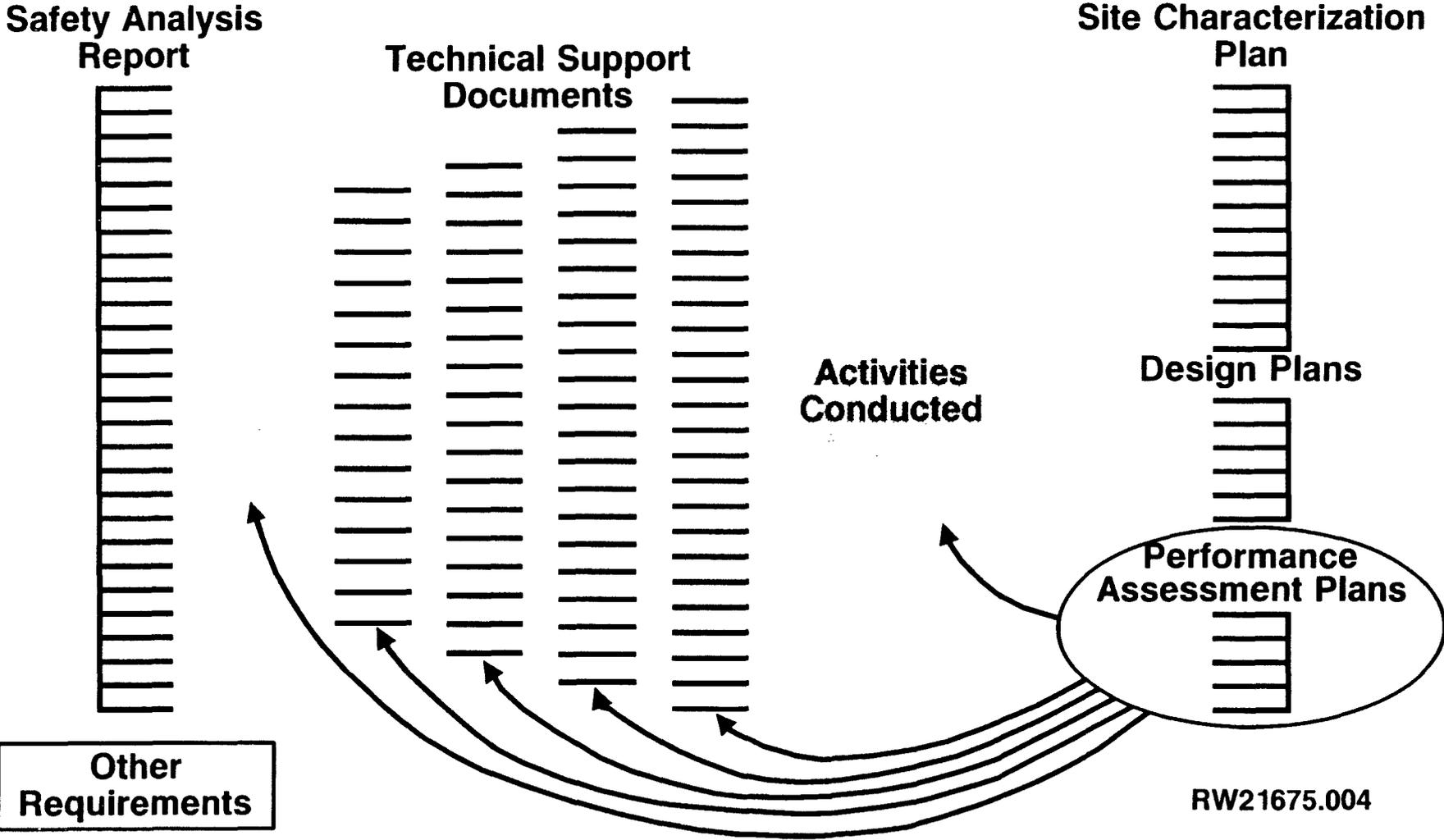


Other Requirements

SRP
SAD

RW21675.004

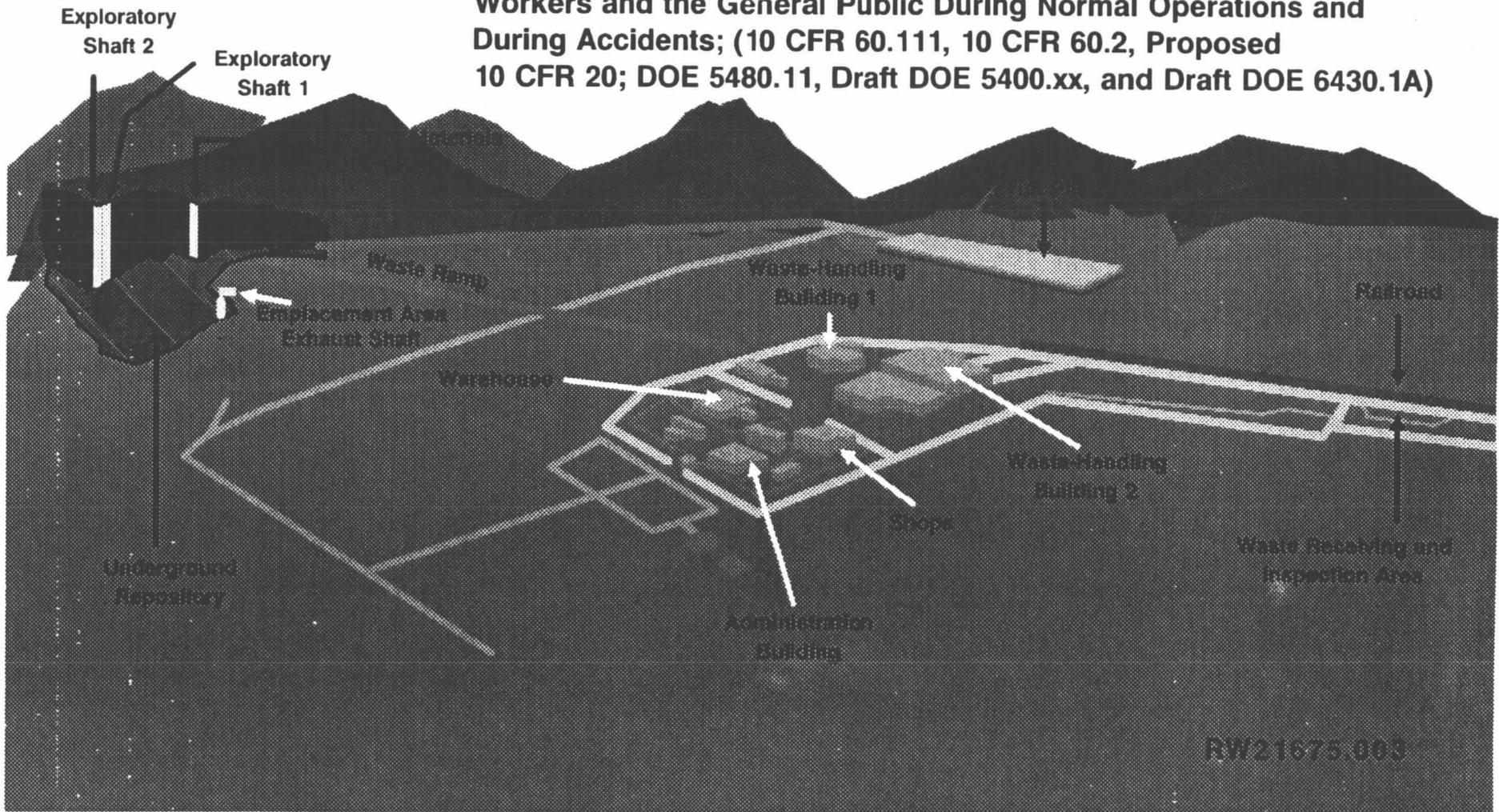
PERFORMANCE ASSESSMENT CYCLES



Larry Dickerson

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)

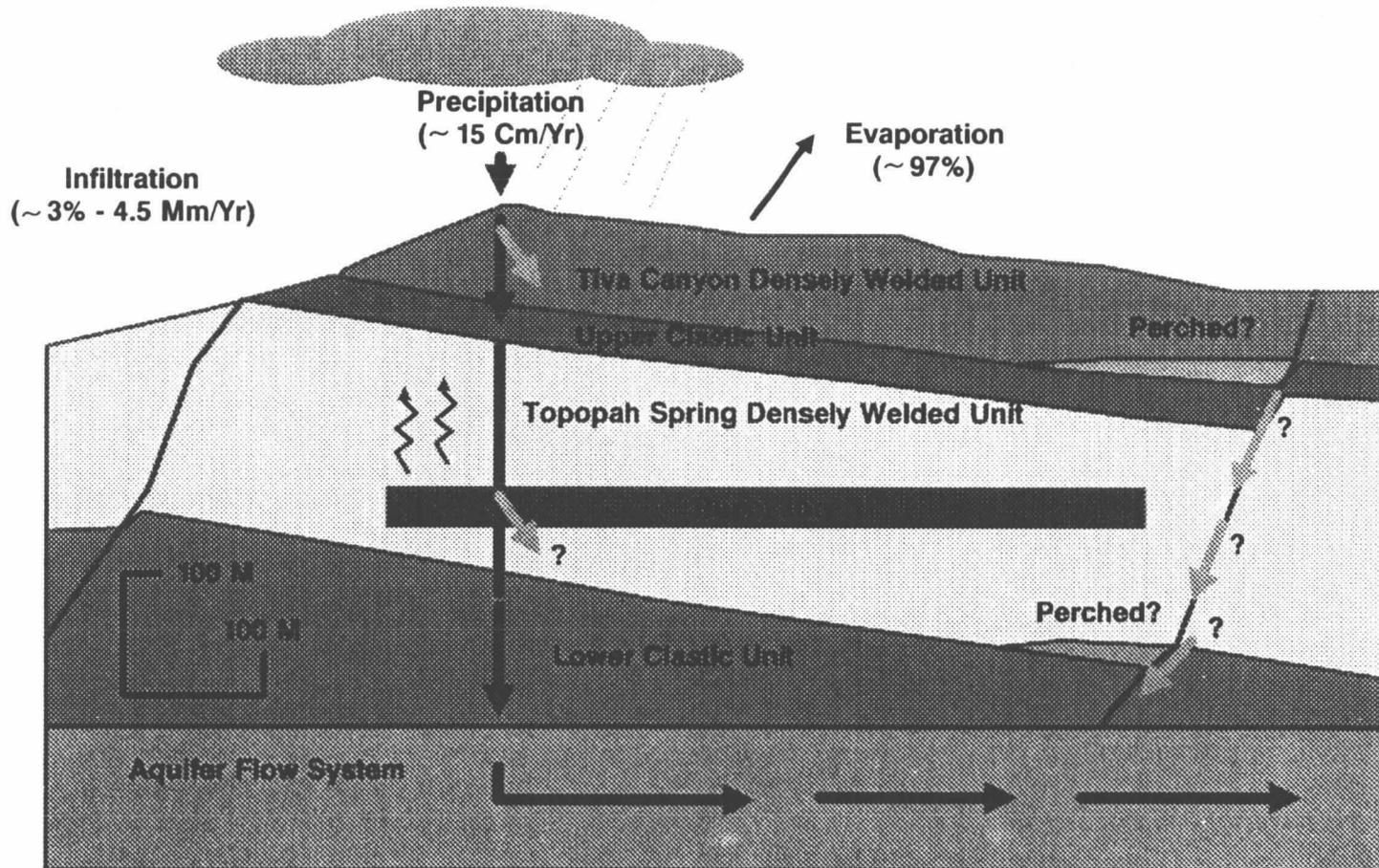


RW21675.003

UNSATURATED-ZONE SECTION YUCCA MOUNTAIN

W

E



RW21675.002

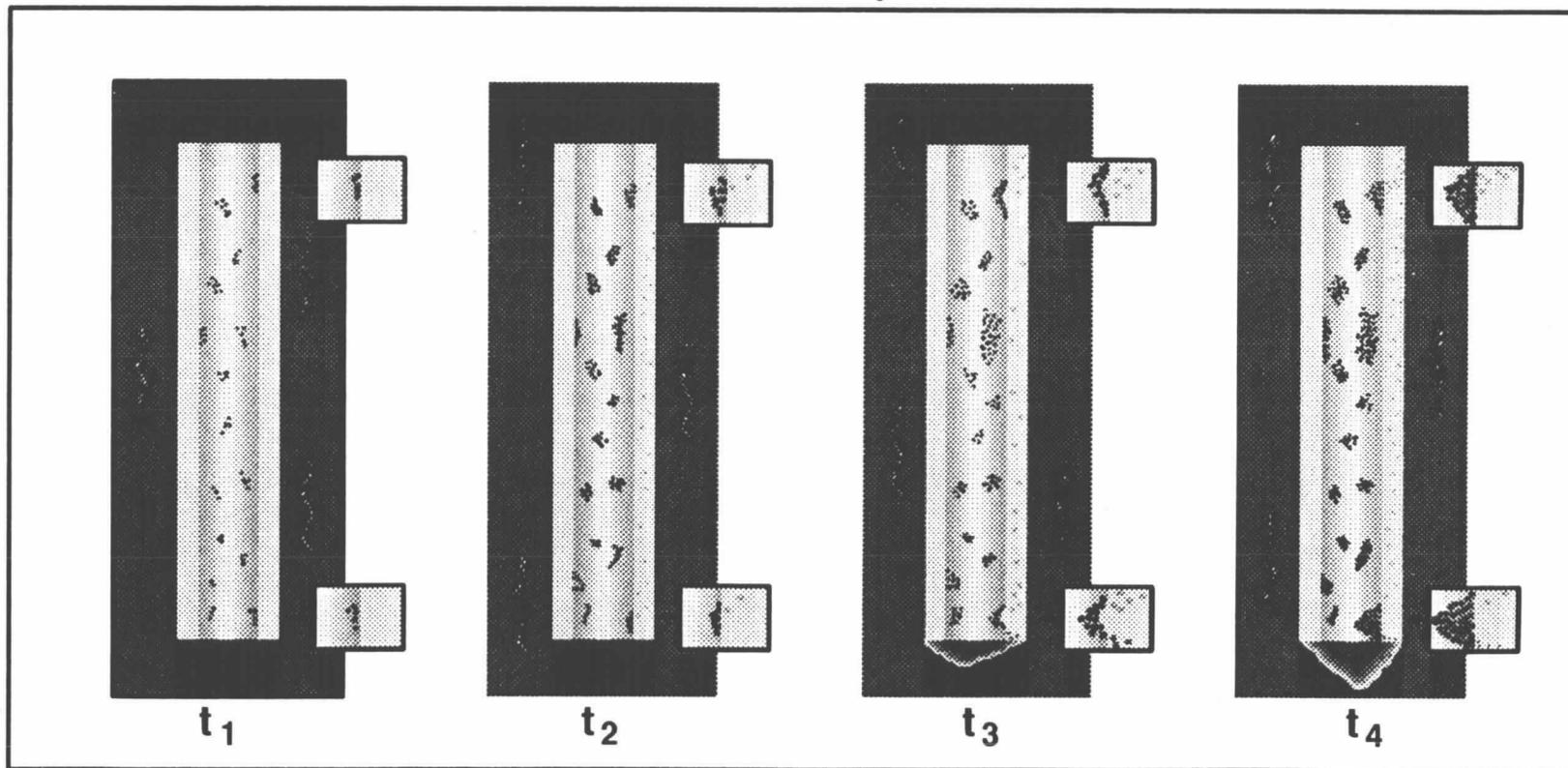
SCHEMATIC OF CONTAINER FUNCTIONS

Containment
Period

Loss of
Containment

Beginning of
Liquid Release

Controlled
Release Period



 Gaseous Releases

 Dissolved Waste

RW21675.006

NUCLEAR REGULATORY COMMISSION

10 CFR 60

Overall System Performance Objective

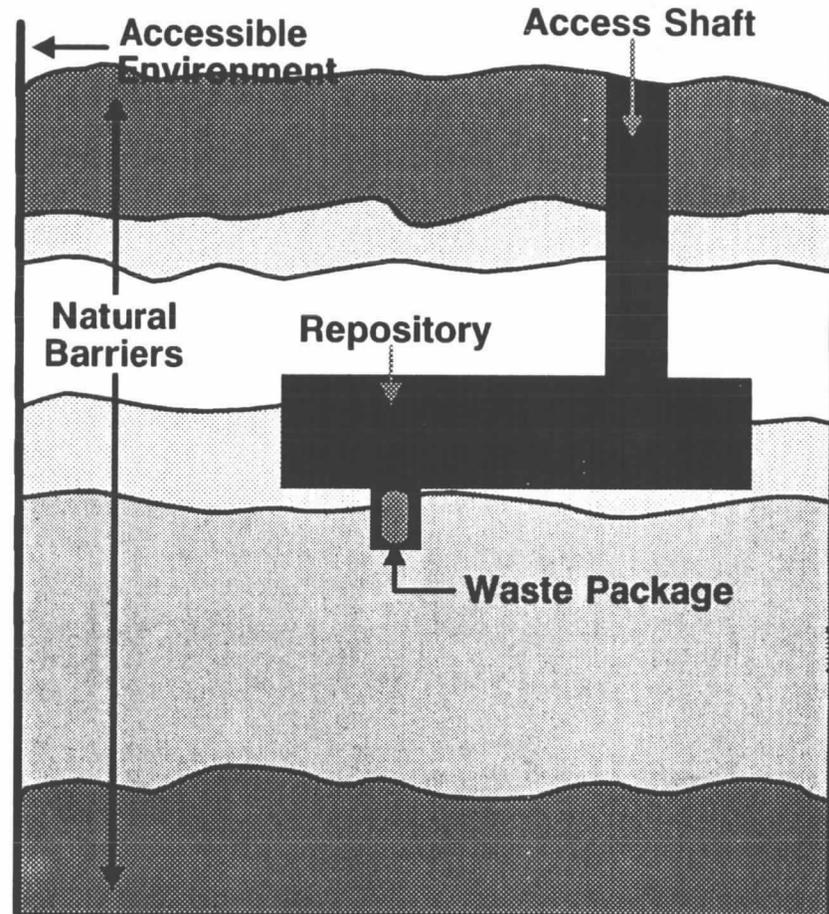
- Conformance with EPA Standard

Subsystem Performance Requirements

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

Siting Criteria

- Favorable Conditions
- Potentially Adverse Conditions



RW42387T.015