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

PRESENTATION TO THE NUCLEAR WASTE TECHNICAL REVIEW BOARD

SUBJECT: ENGINEERED BARRIER SYSTEM/ WASTE PACKAGE STRATEGY OVERVIEW

PRESENTER: MICHAEL O. CLONINGER

PRESENTER'S TITLE AND ORGANIZATION: CHIEF, FIELD ENGINEERING BRANCH
YUCCA MOUNTAIN PROJECT
U.S. DEPARTMENT OF ENERGY
LAS VEGAS, NEVADA

PRESENTER'S TELEPHONE NUMBER: (702) 794-7847

AUGUST 28-29, 1990

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OUTLINE

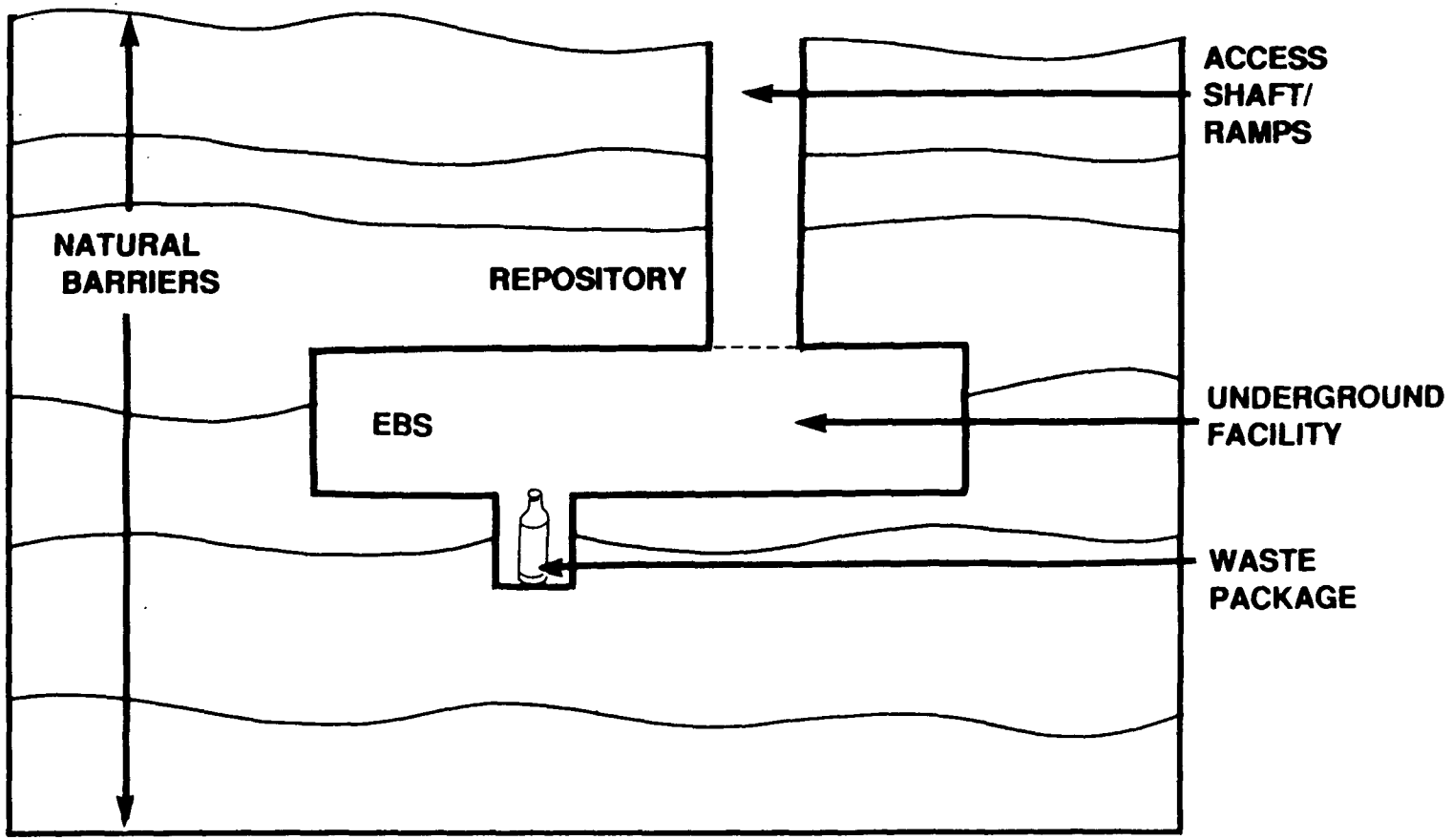
- ENGINEERED BARRIER SYSTEM (EBS) DESCRIPTION AND GOALS
- WASTE PACKAGE COMPLIANCE STRATEGY
- STRATEGY IMPLEMENTATION

ENGINEERED BARRIER SYSTEM DESCRIPTION

- **DEFINITION (10 CFR 60.2)**
  - THE WASTE PACKAGES AND UNDERGROUND FACILITY*
- **FOCUS OF THIS BRIEFING IS ON THE WASTE PACKAGES AND NOT ON THE UNDERGROUND FACILITIES**

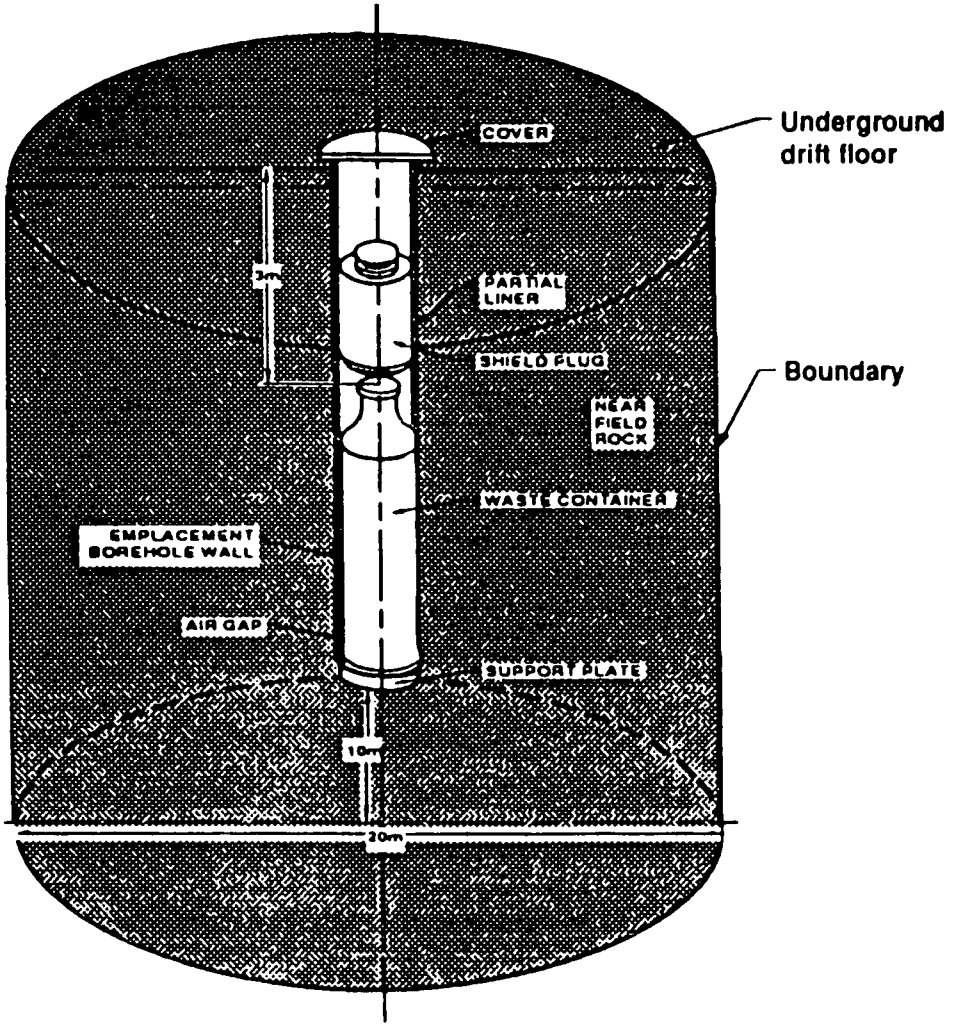
*UNDERGROUND FACILITY - THE UNDERGROUND STRUCTURE, INCLUDING OPENINGS AND BACKFILL MATERIALS, BUT EXCLUDING SHAFTS, BOREHOLES, AND THEIR SEALS

"ENGINEERED BARRIER SYSTEM" SCHEMATIC

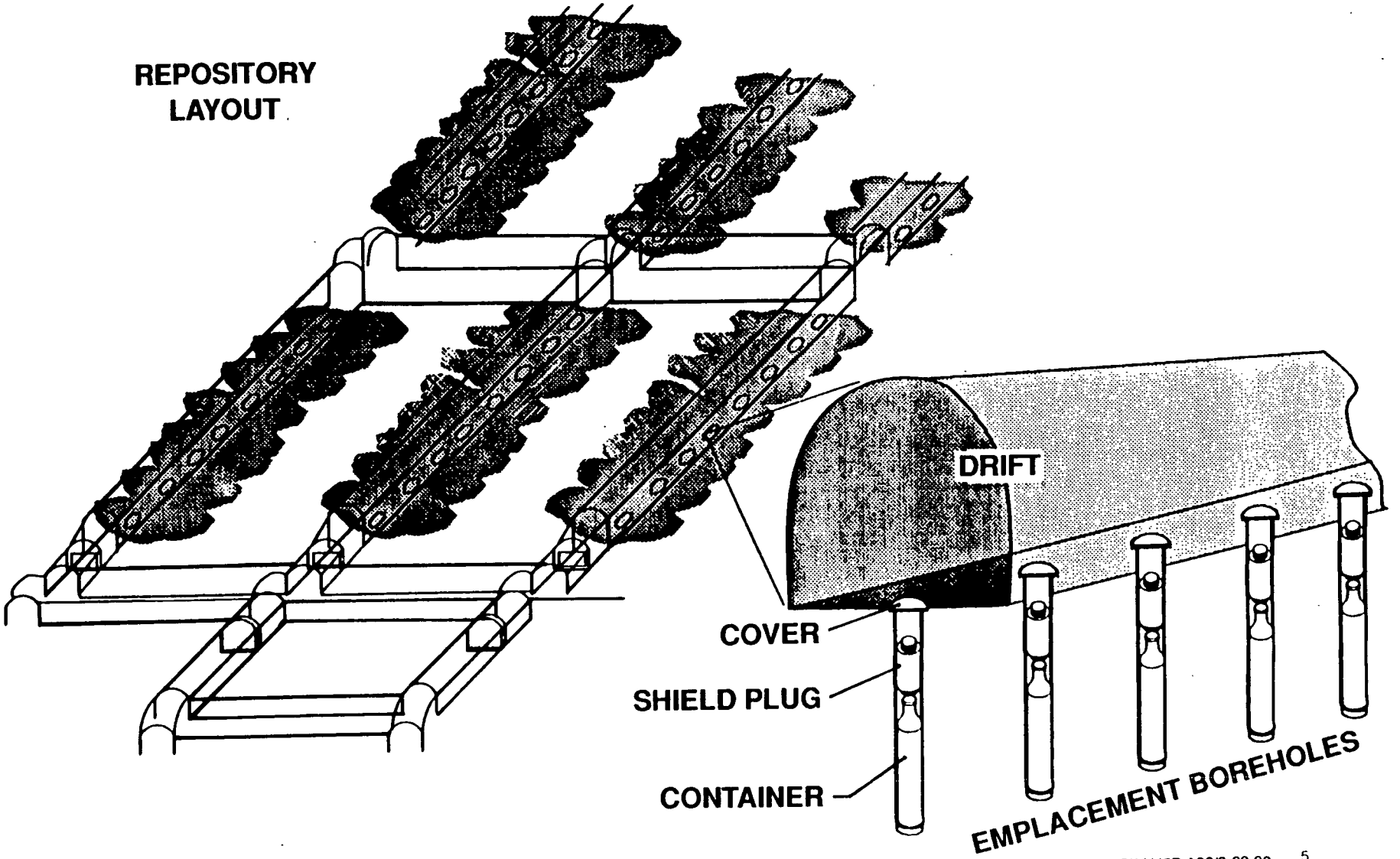


BOUNDARY FOR WASTE PACKAGE PROGRAM

ILLUSTRATION OF CONCEPTUAL WASTE PACKAGE AND PORTIONS OF THE EBS



THE NEAR-FIELD ENVIRONMENT IS A LARGE FRACTION OF THE UNDERGROUND REPOSITORY



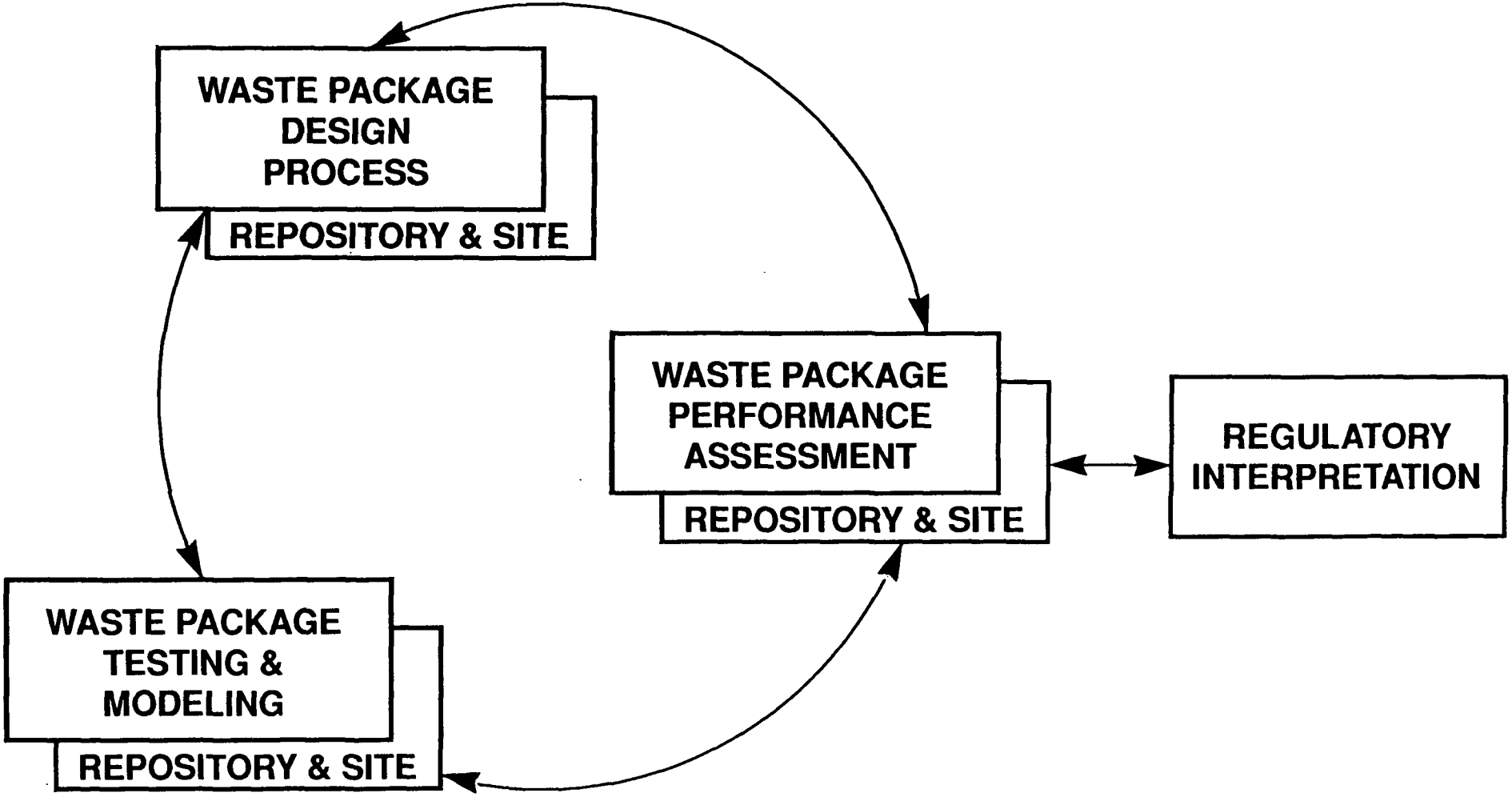
WASTE PACKAGE GOAL

THE DEVELOPMENT AND DEMONSTRATION OF A CONSERVATIVE DESIGN THAT WILL MEET THE CONTENT AND INTENT OF THE REGULATORY REQUIREMENTS WITH SUFFICIENT MARGIN FOR UNCERTAINTY

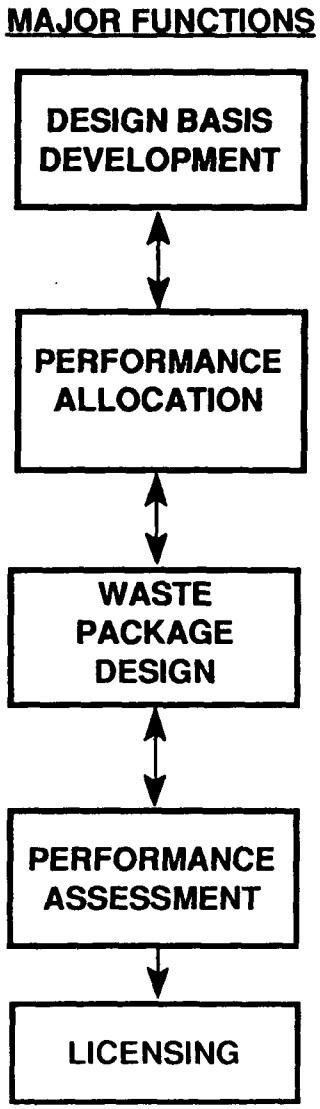
WASTE PACKAGE STRATEGY

- **THE ATTAINMENT OF THE GOAL USING AN ITERATIVE SYSTEMS ENGINEERING APPROACH THAT RELIES ON:**
  - **A MULTI-BARRIER APPROACH**
  - **THE UNSATURATED NATURE OF THE YUCCA MOUNTAIN SITE**
  - **CONSIDERATION OF TECHNICAL ALTERNATIVES**
  - **SUFFICIENT RESOLUTION OF TECHNICAL AND REGULATORY UNCERTAINTIES**

KEY INTERNAL INTERFACES



WASTE PACKAGE STRATEGY



INPUTS AND INTERFACES

- REGULATORY REQUIREMENTS
- INTERPRETATION OF TERMS

- WASTE FORM CHARACTERIZATION
- MATERIALS COMPATIBILITY
- ENVIRONMENTAL CHARACTERISTICS
- SCENARIO DEVELOPMENT

- PERFORMANCE MEASURES
- PARAMETER GOALS
- TESTING AND MODELING

- MATERIALS SELECTION
- REPOSITORY DESIGN

- PERFORMANCE COMPLIANCE
- UNCERTAINTY
- ALTERNATE ACTIONS

REGULATORY REQUIREMENTS

- AS PART OF REPOSITORY LICENSING (10 CFR 60.113), WE NEED TO SHOW THROUGH TESTS AND CALCULATIONS FOR "ANTICIPATED PROCESSES AND EVENTS"
  - SUBSTANTIALLY COMPLETE CONTAINMENT WITHIN THE WASTE PACKAGES [10 CFR 60.113(a)(1)(i)(A)]
  - CONTROLLED RELEASE OF RADIONUCLIDES FROM THE EBS [10 CFR 60.113(a)(1)(ii)(B)]
- SPECIFIC DESIGN CONSIDERATIONS
  - RETRIEVABILITY (10 CFR 60.113)
  - ALTERNATIVES (10 CFR 60.21)
  - TOTAL SYSTEM PERFORMANCE (10 CFR 60.112)
  - DESIGN STANDARDS (10 CFR 60.135)

PERFORMANCE ALLOCATION AND DESIGN DEVELOPMENT

- USE REGULATORY AND ENGINEERING REQUIREMENTS AND AVAILABLE DATA BASE, IDENTIFY DESIGN CONCEPTS
- SELECT SYSTEM ELEMENTS AND IDENTIFY TOP-LEVEL FUNCTIONS FOR EACH WASTE PACKAGE ELEMENT
- ALLOCATE PERFORMANCE TO WASTE PACKAGE COMPONENTS
- DEMONSTRATE THAT THE PRODUCT OF THE ALLOCATIONS MEET THE REQUIREMENTS
- IDENTIFY TESTING AND MODELING NEEDS

WASTE PACKAGE PERFORMANCE ASSESSMENT (PA)

- CALCULATIONS TO PREDICT OR BOUND THE FUTURE PERFORMANCE OF THE WASTE PACKAGE AND COMPARE THAT PREDICTION TO THE REQUIRED PERFORMANCE

- INCLUDES CONSIDERATION OF SYSTEM VARIABILITY AND UNCERTAINTIES

WASTE PACKAGE PERFORMANCE ASSESSMENT (PA)
(CONTINUED)

- PRECLOSURE PA FAIRLY WELL ESTABLISHED
  - TECHNIQUES HAVE BEEN USED FOR DECADES
  - REAL-TIME DATA AND METHODS
- POSTCLOSURE PA IS FOCUS OF DEVELOPMENT
  - THE RELIABILITY PARADOX = UNCERTAINTY
  - UNPRECEDENTED TIME EXTRAPOLATIONS (100x to 1000x) = UNCERTAINTY
  - SEEKING "MECHANISTIC" UNDERSTANDING; APPLIED STATISTICALLY

WASTE PACKAGE PERFORMANCE ASSESSMENT (PA)

(CONTINUED)

- **CURRENT WASTE PACKAGE EFFORTS**
  - PROVIDE INPUT TO DESIGN BASIS DEVELOPMENT
  - PROVIDE BASES FOR PERFORMANCE ASSESSMENT SUBMODELS
  - PROVIDE DATA FOR USE IN SUCH MODELS
  - PROVIDE PARTIAL VALIDATION FOR SUCH MODELS

WASTE PACKAGE PERFORMANCE ASSESSMENT

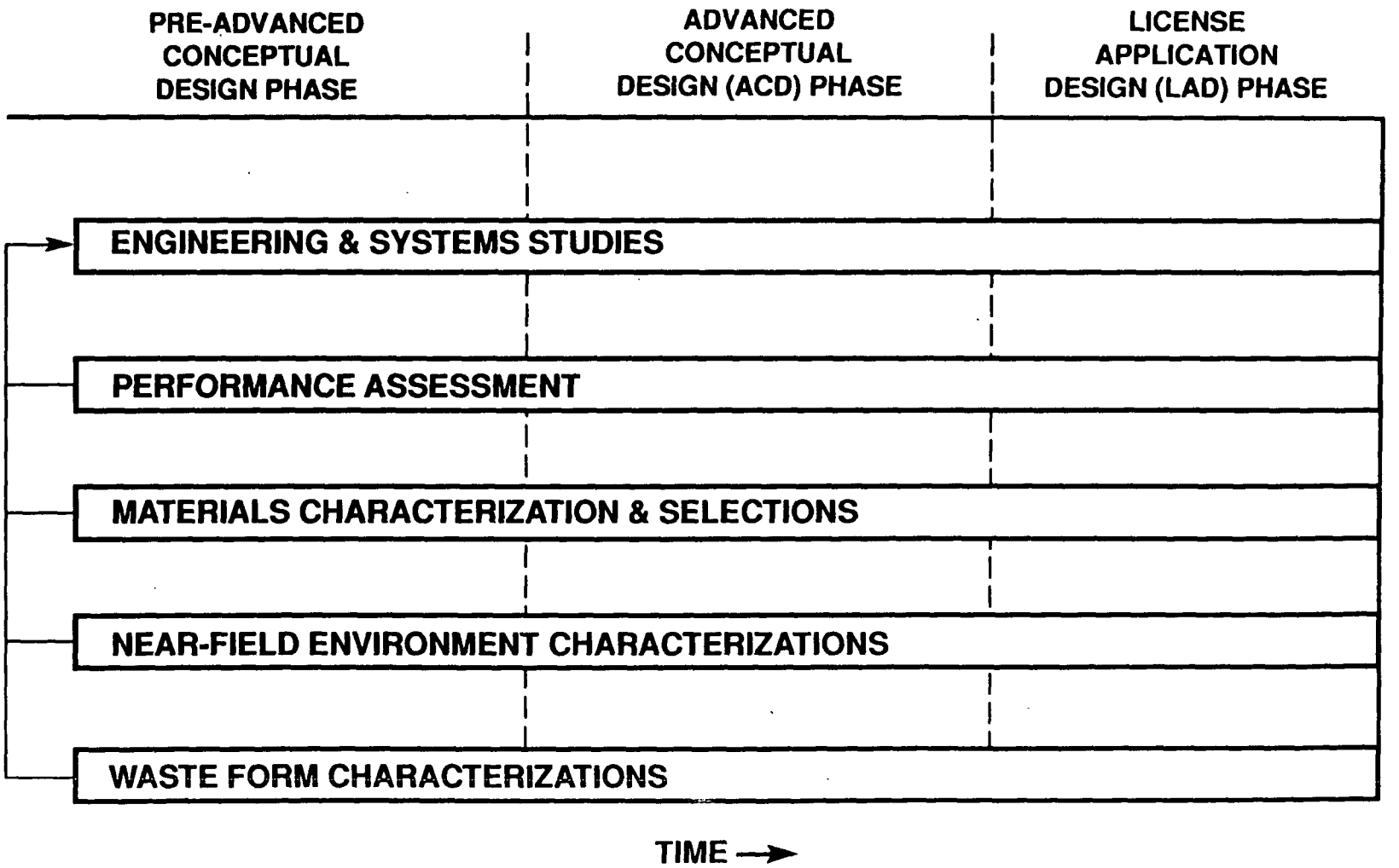
(CONTINUED)

- IF THE DESIGN MEETS THE REQUIREMENTS, THEN LICENSE APPLICATION ACTIVITIES CAN PROCEED (ISSUE IS RESOLVED)

- IF DESIGN DOES NOT MEET REQUIREMENTS, EVALUATE AND SELECT ALTERNATIVE ACTIONS

  - ASSIGN PERFORMANCE GOALS TO ADDITIONAL COMPONENTS
  - MODIFY THE COMPUTATIONAL MODELS
  - PERFORM MORE TESTS TO IMPROVE DATABASES
  - CHANGE WASTE PACKAGE DESIGN OR MATERIALS
  - REVISE THE REGULATORY DESIGN BASES AS PROVIDED IN 10 CFR 60.113 (b)

WASTE PACKAGE PLAN LOGIC AND TECHNICAL APPROACH DESIGN PHASES



FLOW DIAGRAM OF WASTE PACKAGE PROGRAM