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

NUCLEAR WASTE TECHNICAL REVIEW BOARD
EBS PANEL MEETING

SUBJECT: DESIGN-FOCUSED WASTE PACKAGE R&D NEEDS

PRESENTER: DR. DAVID STAHL

PRESENTER'S TITLE AND ORGANIZATION: MANAGER, WASTE PACKAGE MATERIALS AND PERFORMANCE ANALYSIS
CRWMS M&O, B&W FUEL COMPANY
LAS VEGAS, NEVADA

PRESENTER'S TELEPHONE NUMBER: (702) 794-7778

PLEASANTON, CALIFORNIA
MARCH 10-11, 1994

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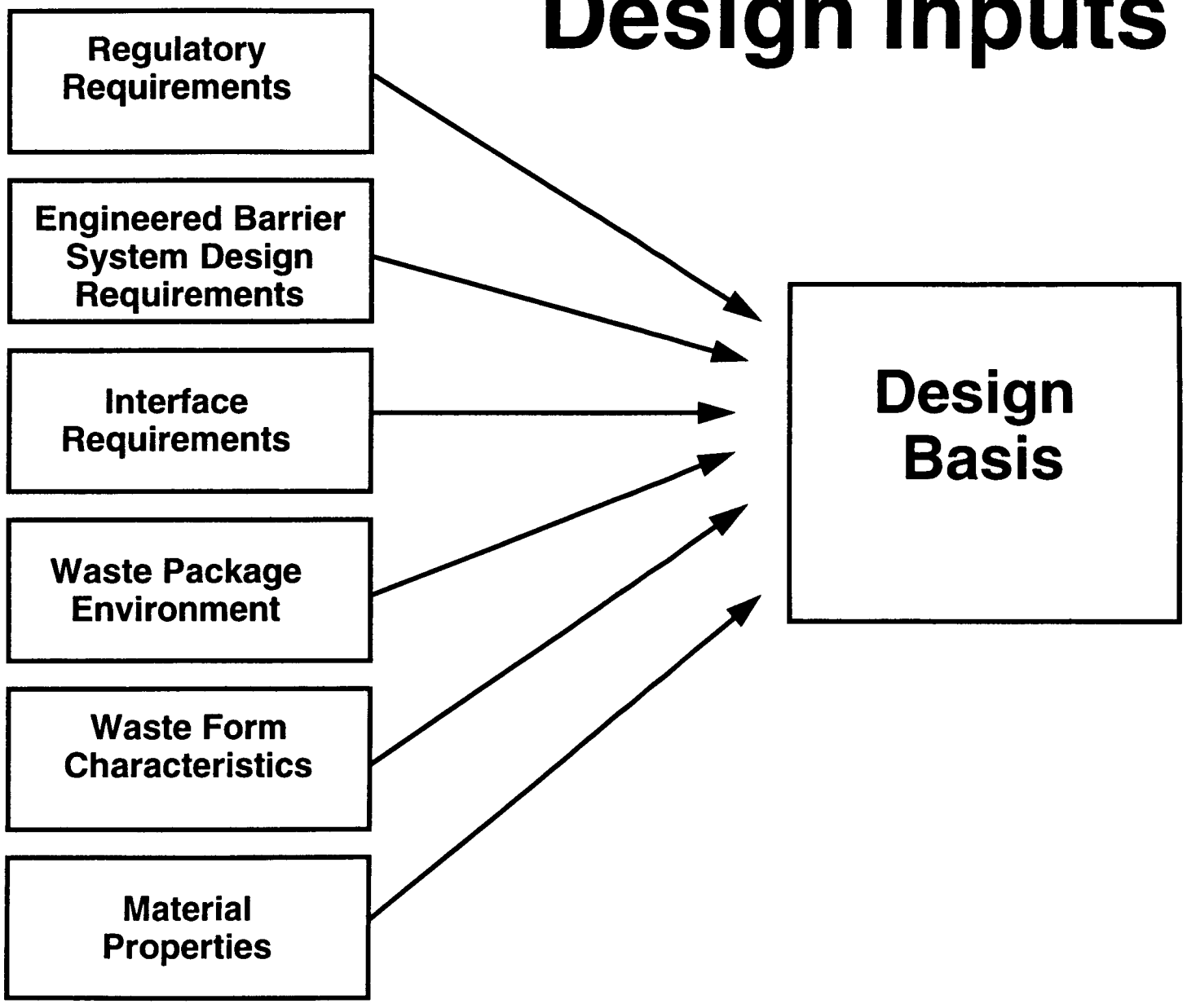
Design Inputs



Major Sources of Regulations/Requirements:

- **10 CFR Part 20 - Standards for Protection Against Radiation**
- **10 CFR Part 60 - Disposal of High-Level Radioactive Wastes in Geologic Repositories**
- **10 CFR Part 960 - General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories**
- **YMP/CM-0024 Engineered Barrier Design Requirements Document**

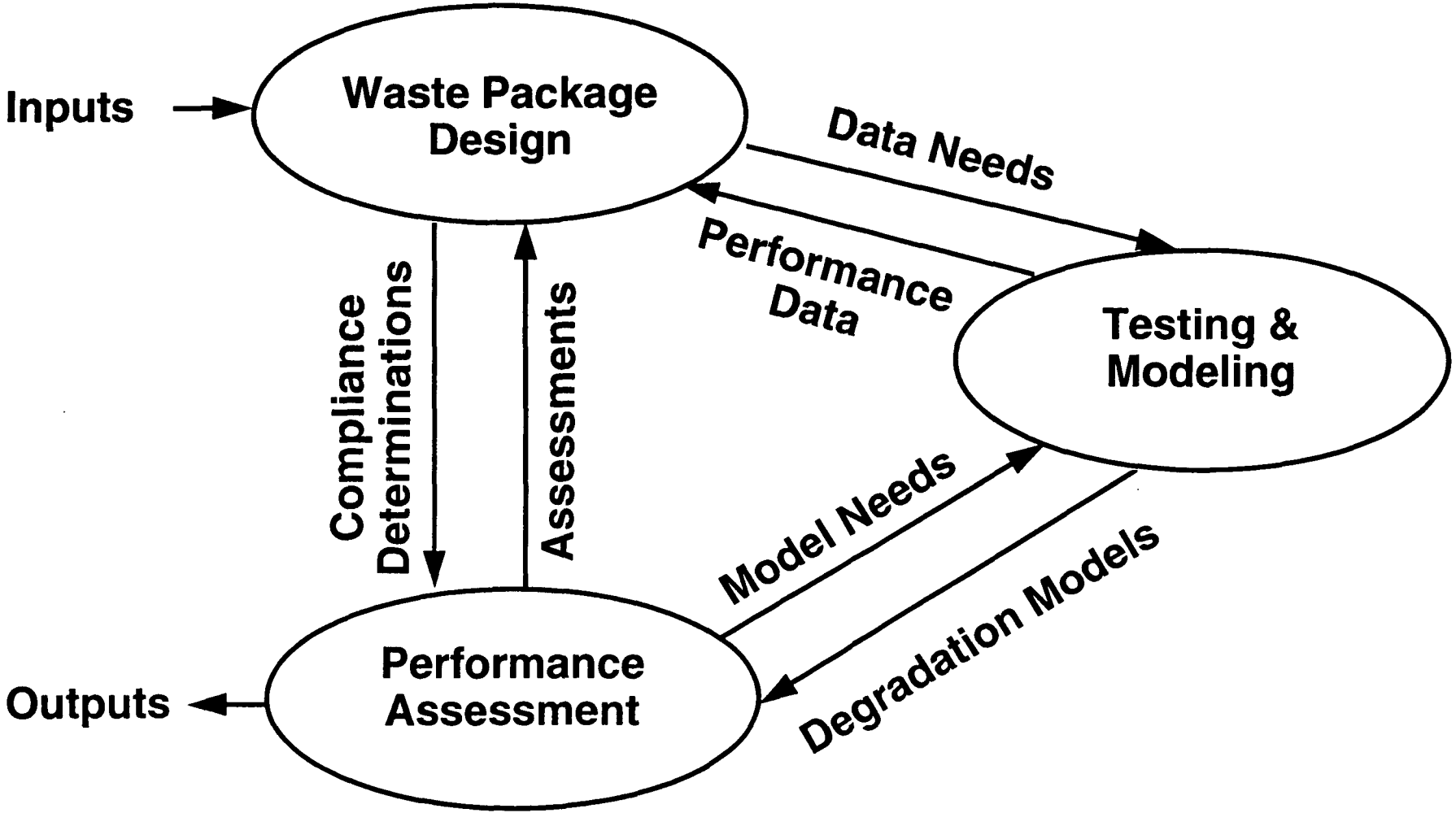
Preclosure Requirements:

- Radiation Protection
- Handling
- Criticality
- Unique Identification
- Reactive Materials
- Free Liquids
- Encapsulating or Stabilizing Matrix
- Available Technology
- Retrieval
- Performance Confirmation

Post-Closure Requirements:

- Containment
- Controlled Release
- Overall Performance
- Criticality
- Alternative Designs
- Emplacement Environment
- Performance Confirmation
- Thermal Loads

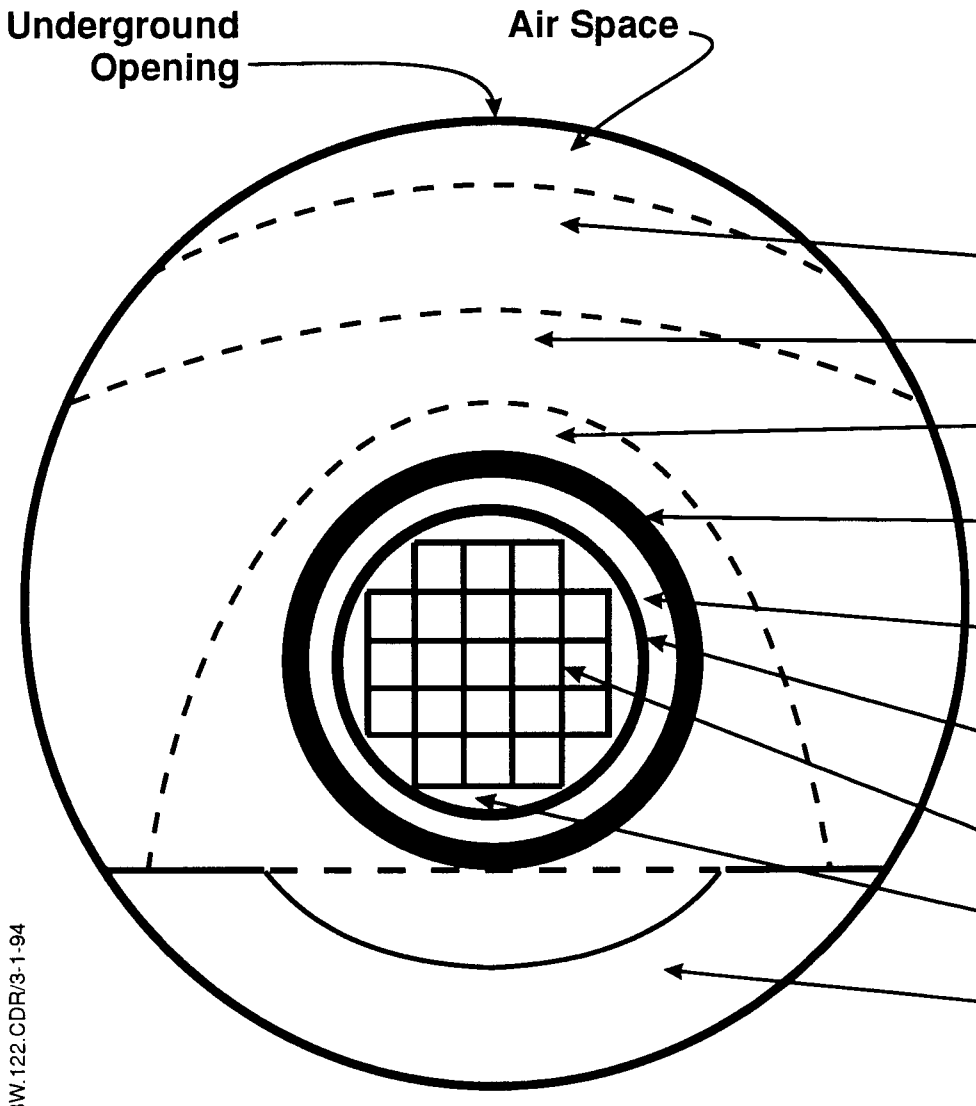
Interactions of Project Activities



EBS Components:

- Waste Forms
- Fillers
- Containers
- Packing
- Backfill
- Invert
- Other Man-Made Materials

MULTI-BARRIER WASTE PACKAGE



COMPONENTS	POSSIBLE MATERIALS
Engineered Backfill	Crushed Tuff
Engineered Backfill	Coarse Tuff
Packing	Tuff plus Zeolite
Outer Containment Barriier	Carbon Steel
Separator (if used)	Steel Shot
Inner Containment Barrier	Alloy 825
SNF/Basket Assembly	Borated Material
Buffer/Filler Material	Iron (Oxide) Powder
Engineered Invert	Concrete

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Design-Focused R&D Needs

Waste Package/EBS Environment:

- Temperature
- Rock Stability
- Water Chemistry, pH, Eh
- Flow Rate
- Water Contact Mode
- Effects of Colloids, Microbes and Introduced Materials

Design-Focused R&D Needs

Waste Forms:

- Cladding
  - Containment Credit Currently Being Evaluated
    - Cladding can be considered as a redundant barrier.
  - Utilize Damage Function Approach Including:
    - Creep Rupture
    - Stress-Corrosion Cracking
    - Hydrogen Attack
  - Predictive Models

Design-Focused R&D Needs

Containers:

- Corrosion-Resistant Materials
  - Propagation Rates for Stress-Corrosion Cracking
  - Propagation Rates for Pitting
  - Potential for Crevice and Galvanic Corrosion
  - Initiation of Long-Term Tests
  - Predictive Models

Design-Focused R&D Needs

Containers:

- Corrosion-Allowance Materials
  - Oxidation Rates as a Function of Temperature and Humidity
  - Aqueous Corrosion as a Function of Temperature and Solute Concentration
  - Potential for Localized, Galvanic and Microbiologically-Influenced Corrosion
  - Initiation of Long-Term Tests
  - Predictive Models

Waste Package/EBS Information Needs Stated in TSPA-1993

- Interaction of natural and man-made components
- Container degradation and waste form alteration rates
- Feasibility of maintaining long-term reducing environments (to reduce Np, and perhaps Tc, solubility)
- Potential for performance allocation to cladding
- Character of packing and backfill materials and potential for radionuclide retardation
- Water contact modes under expected repository conditions