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

NUCLEAR WASTE TECHNICAL REVIEW BOARD
ENGINEERED BARRIER SYSTEM, TRANSPORTATION AND SYSTEMS
JOINT PANEL MEETING

SUBJECT: INTERACTIONS OF REPOSITORY
AND MULTIPLE-PURPOSE
CANISTER (MPC) DESIGN

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Mined Geologic Disposal System (MGDS)\nMultiple-Purpose Canister (MPC) Risk

- The initial MPC design/acquisition process is in advance of the MGDS design/acquisition process
  - Many of the MGDS criteria needed to meet the 10 CFR 60 requirements will be established or validated during site characterization
  - Until criteria & constraints are established or validated, conservative assumptions are used
REPOSITORY/WASTE PACKAGE DESIGN PROCESS

(DOE Order 4700.1)

Mission & Statutory Requirements

SCP Conceptual Design

Advanced Conceptual Design (ACD)

License Application Design (LAD)

Final Procurement & Construction Design

Construction

Design Requirements Criteria Constraints

Testing, Analysis, Performance Assessment

Testing, Analysis, Performance Assessment

Confirmation Testing, Analysis, Validation, Performance Assessment

Final Specifications & Requirements

Note: (LAD) is a Title I for those items not "important to safety" & "waste isolation" and a Title II for those items "important to safety" & "waste isolation"
Key MGDS Criteria/Constraints Needed to Meet 10 CFR 60

- Thermal Loading
- Criticality Control
- Containment
- Filler Materials
- Container Temperature
- Basket and Shield Plug Material
- Internal Interactions
- Unique Identification
- Handling and Grappling
Key MGDS Criteria/Constraints Needed to Meet 10 CFR 60
(Continued)

- Concept of Operation
- Emplacement Mode
- Backfilling
- Retrieval
- Repository Layout and Size
- Drift Size
- Ventilation Requirements
Thermal Loading

- Extensively investigated
  - Discussed Later
Criticality Control

- "The calculated effective multiplication factor ($k_{\text{eff}}$) must be sufficiently below unity to show at least a 5% margin, after allowance for the bias in the method of calculation and the uncertainty in the experiments used to validate the method of calculation"
  (10 CFR 60.131 (b)(7))

- Assume burnup credit
Containment

- "Containment of HLW within the waste packages will be substantially complete for a period to be determined by the Commission...not less than 300 nor more than 1,000 years after permanent closure of the geologic repository" (10 CFR 60.113(a)(ii)(A))

- Container material will be of a qualified material whose performance will meet the NRC requirement

- Closure must consist of a full-penetration weld at least equal to the minimum wall thickness such that the NRC requirement is met

- Credit for containment will be provided by disposal container
Filler Materials

- Filler materials could perform several functions:
  - Provide spent fuel rod mechanical stability
  - Assist in heat removal
  - Provide chemical buffering
  - Provide barrier to radionuclide migration
  - Assist in criticality control

- MPC design will allow possibility of the addition of filler materials at the repository
Concept of Operation

- MPC design considered the following:
  - The development, emplacement, and retrieval operations, such as weight, heat output, and shielding requirements
  - Remote handling of waste packages throughout the repository.
  - Waste transport, emplacement, retrieval, and relocation equipment need to be developed for handling the anticipated MPC weight and radiation level