NUCLEAR WASTE TECHNICAL REVIEW BOARD
FULL BOARD MEETING

SUBJECT: WASTE PACKAGE PHYSICAL CHARACTERISTICS

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Outline

• Types of waste for disposal
• Disposal container dimensions
• Disposal container loaded weights
• Shielding considerations
• Changes from advanced conceptual design
• Future considerations
Types of Waste for Disposal

- Commercial spent fuel in bare assemblies
- Canisters of commercial spent fuel
- Canisters of vitrified Defense High-Level Waste (DHLW)
- Navy spent fuel
- Other DOE-owned spent fuel in canisters
OUTER BARRIER LID (A516)

INNER BARRIER LID (ALLOY 625)

INNER BARRIER (ALLOY 625)

SIDE GUIDE (A516)

INTERLOCKING PLATES (CUTAWAY VIEW) (STAINLESS STEEL BORON)

INNER BARRIER LID (ALLOY 625)

OUTER BARRIER LID (A516)

CORNER GUIDE (A516)

CORNER STIFFENER (A516)

SIDE COVER (A516)

TUBE (A516)

21 PWR Waste Container
OUTER BARRIER LID
(A 516)

INNER BARRIER
(ALLOY 625)

INTERLOCKING PLATES
(STAINLESS STEEL BORON)

SUPPORT GUIDES
(A 516)

INNER BARRIER Lid
(ALLOY 625)

OUTER BARRIER LID
(A 516)

INNER BARRIER LID
(ALLOY 625)

OUTER BARRIER LID
(A 516)

44 BWR AUCF WASTE CONTAINER
INNER BARRIER LID

OUTER BARRIER

INNER BARRIER

SPENT NUCLEAR FUEL CANISTER

OUTER BARRIER LID

CANISTERED FUEL DISPOSAL CONTAINER
21-PWR / 40-BWR
OUTER BARRIER LID (A 516)

INNER BARRIER LID (ALLOY 625)

INNER BARRIER LID (ALLOY 625)

OUTER BARRIER LID (ALLOY 625)

OUTER BARRIER (A 516)

INNER BARRIER (ALLOY 625)

4 POUR CANISTERS (304L)

CANISTER GUIDE (A 516)

DHLW WASTE CONTAINER
PROPOSED DEFENSE HIGH LEVEL WASTE/DOE SNF WASTE CONTAINER
# Loaded Disposal Container Dimensions (meters)

<table>
<thead>
<tr>
<th>Description</th>
<th>Diameter</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial spent fuel 21PWR uncanistered</td>
<td>1.7</td>
<td>5.3</td>
</tr>
<tr>
<td>Commercial spent fuel 44 BWR uncanistered</td>
<td>1.6</td>
<td>5.3</td>
</tr>
<tr>
<td>Canistered 21 PWR commercial spent fuel</td>
<td>1.9</td>
<td>5.7</td>
</tr>
<tr>
<td>Containers with 4 DHLW canisters</td>
<td>1.8</td>
<td>3.8</td>
</tr>
<tr>
<td>Containers with 5 DHLW and 1 DOE spent fuel canister (Proposed)</td>
<td>2.0</td>
<td>3.8</td>
</tr>
</tbody>
</table>
Loaded Disposal Container Weights (tonnes)

- Commercial spent fuel 21PWR uncanistered 50.3
- Commercial spent fuel 44 BWR uncanistered 46.5
- Canistered 21 PWR commercial spent fuel 62.5
- Containers with 4 DHLW canisters 30.3
- Containers with 5 DHLW and 1 DOE spent fuel canister (Proposed) 35.5
Changes from Advanced Conceptual Design

• Heated outer shell inserted over inner shell (selected for reference design)
• Inner barrier material from alloy 825 to 625
  – More corrosion-resistant in severe environments
• Basket support and tubes from stainless steel to carbon steel
  – Less cost plus better strength and thermal conductivity
• Outer barrier for DHLW containers from copper nickel to carbon steel
  – Reduced cost and negligible impact on performance
• DOE-owned spent fuel containers being evaluated
Radiation Dose in Emplacement Drifts (Rem/Hour)

<table>
<thead>
<tr>
<th>Spent Nuclear Fuel Waste Packages</th>
<th>Surface of Waste Package</th>
<th>At 2 Meters From Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>Defense High-Level Waste Packages</td>
<td>65</td>
<td>20</td>
</tr>
</tbody>
</table>
Shielding Individual Waste Packages

• Should shielding be provided on individual waste packages instead of on transporter?
  
  – Advantage of shielding on packages
    » Permits limited personnel access to emplacement drifts after cooling

  – Disadvantages of shielding on packages
    » Decreases thermal conductivity, increases fuel temperature, reduces cladding performance
    » Increased size will require larger drifts
    » Increased weight makes waste package handling more difficult
    » Has no function after closure
    » Increases waste package cost
## Fully Shielded Waste Package Concepts

<table>
<thead>
<tr>
<th>Shielding Type</th>
<th>Diameter Increase in (meters)</th>
<th>Weight Increase (Tonnes)</th>
<th>Cost Increase Per Container ($ Thousands)</th>
<th>Total cost Increase in ($Billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete with stainless steel Sheathing</td>
<td>0.4</td>
<td>68</td>
<td>100</td>
<td>1.6</td>
</tr>
<tr>
<td>Carbon steel 18” thick</td>
<td>0.9</td>
<td>111</td>
<td>900</td>
<td>14.7</td>
</tr>
</tbody>
</table>
Future Considerations

• Increase from 21 PWR/44 BWR to 24 PWR/52BWR
• Add thermal shunts in baskets
• Reduce or eliminate baskets for some DOE-owned spent fuel
• Reduce stainless steel boron plates in BWR containers
• Consider an additional outer barrier for high humidity