Overview of Design Selection Process

Presented to:
Nuclear Waste Technical Review Board
Panel For the Repository

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LADS Two Phase Process

1. Define Design Alternatives and Features, DA/DFs
   - 9/98

2. Identify Enhanced Design Alternatives (EDAs) for Evaluation
   - 1/4/99

3. Develop DA/DF Evaluation Criteria
   - 1/15/99

4. Develop and Apply EDA Evaluation Criteria
   - 1/18/99

5. Evaluate DA/DFs
   - 2/26/99

6. Evaluate and Rank EDAs
   - 3/1/99

7. Document and Review Results (L3 & 2 Milestones)
   - 3/8/99

8. 11/12/98

9. 12/22/98

10. 3/5/99
Design Alternatives (DA)

- DA1: Tailored WP Spatial Distribution
- DA2: Low Thermal Load
- DA3: Continuous Post-closure Ventilation
- DA4: Enhanced Access
- DA5: Modified Waste Emplacement Mode
- DA6: VA Reference Design
- DA8: Modular Design
Design Features (DF)

- DF1: Ceramic coatings
- DF2: Drip shields
- DF3: Backfill
- DF4: Aging and blending
- DF7: Pre-closure ventilation
- DF8: Rod consolidation
- DF9: Timing of repository closure
- DF10: Maintenance of underground features and ground support
- DF11: Drift diameter
Design Features (DF)

(Continued)

- DF12: Drift spacing/waste package spacing
- DF14: Waste package corrosion-resistant materials
- DF15: Richards barrier
- DF16: Diffusive barrier under waste package
- DF17: Getter under waste package
- DF18: Canister assemblies
- DF19: Additives and fillers
- DF20: Ground support options
- DF22: Near-field rock treatment
Design Features (DF) (Continued)

- DF 23: Surface modifications
- DF25: Repository horizon elevation
- DF26: Higher thermal loading
Phase 1 Evaluation Criteria for Design Alternatives and Design Features

1. Post-Closure Performance

2. Pre-closure Performance
   - Ability to limit exposure to public in case of Design Basis Events

3. Assurance of Safety
   - Support for attributes of Repository Safety Strategy
   - Significance of the uncertainty in post-closure performance and ability to reduce uncertainties by the time of LA, construction, and closure
Phase 1 Evaluation Criteria for Design Alternatives and Design Features (Continued)

4. Engineering Acceptance
   – Communication of element functions
   – Engineering analysis follows accepted methods
   – Demonstrable post-closure function
   – Regulatory and/or engineering precedence
   – Availability of qualified data in the LA time-frame
   – Constructability with proven methods
   – Consistency with high level design goals for the MGR (e.g, the CRD or CDA)
Phase 1 Evaluation Criteria for Design Alternatives and Design Features

(Continued)

5. Construction, Operations, and Maintenance

– Worker radiation safety and/or industrial safety
– Reliability, availability, maintainability, and inspectability
– Throughput capacity
– Ability to perform performance confirmation activities
Phase 1 Evaluation Criteria for Design Alternatives and Design Features

(Continued)

6. Schedule
   - Time for site characterization, design, licensing, and construction

7. Cost
   - Total system life cycle cost

8. Environmental Considerations
   - Evaluation relative to the NEPA process for environmental protection
Confidence in Assessments of Evaluation Criteria

- Confidence in each DA and DF assessment
- “Scales” (1 to 5) relative to supportability, defensibility, and uncertainties
- Elicited from the lead design engineers; these are engineering judgments based on available data and information
- Provides information on uncertainties in engineering and natural systems
EDA Development Methodology

- Enhanced Design Alternatives (EDAs) are design concepts that have been "enhanced" with various design features
- Build-up of EDAs with high probability of success, rather than screening/eliminating to arrive at "best" option
- Sought 5-10 EDAs for Phase 2 evaluation
- Diverse set representing a range of design types
- Take advantage of evaluations of DA and DFs, plus engineering judgment; PA, defense-in-depth, and cost evaluations as well
- No handbook methodology for creative design--no "algorithm" that will produce a "right" answer
Make-Up and Focus of Teams

• Three teams focused on one of the following:
  – Low Temperature Designs
  – Enhanced Access Designs
  – High Temperature Designs

• Representatives from the larger LADS team (both sides of the organization chart)

• DA and DF leads served as resources to all of the teams
# General Schedule of EDA Workshop Activities

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Activity</th>
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<tbody>
<tr>
<td>1/4</td>
<td>Monday</td>
<td>Presentation of DF evaluations (general session)</td>
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<tr>
<td>1/5</td>
<td>Tuesday</td>
<td>Presentation of DF/DA evaluations (general session)</td>
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<tr>
<td>1/6</td>
<td>Wednesday</td>
<td>Presentation of DF/DA evaluations; DID assessment for VA, guidance to teams (general session)</td>
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<tr>
<td>1/7</td>
<td>Thursday</td>
<td>First pass by teams (team sessions)</td>
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<tr>
<td>1/8</td>
<td>Friday</td>
<td>Review first pass evaluations (general session)</td>
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<tr>
<td>1/11</td>
<td>Monday</td>
<td>Second pass by teams (team sessions) review second pass (general session)</td>
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<tr>
<td>1/12</td>
<td>Tuesday</td>
<td>PA/DID/Cost evaluations based on second pass (team sessions)</td>
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<tr>
<td>1/13</td>
<td>Wednesday</td>
<td>Team caucus (team sessions)</td>
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<tr>
<td>1/14</td>
<td>Thursday</td>
<td>Review evaluations and all assessments (general session)</td>
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<tr>
<td>1/15</td>
<td>Friday</td>
<td>Select EDAs (general session)</td>
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Summary of Candidate EDAs

• Presentation by EDA leads
  – Low Temperature Designs
  – High Temperature Designs
  – Enhanced Access Designs
• Description of design concepts
• Focus on features “integral” to design
• Identify features that can be applied to other designs as well (for DID, performance enhancement, etc.)
• Identify features not selected to support design concept