The Curious History of Transportation Planning for HLW Repositories in the US

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Additional documentation available at
http://www.state.nv.us/nucwaste/trans.htm
Curious History Lessons

• Transportation Institutional Issues, 1986-2004
• Full-scale Cask Testing, 1977-2004
• Repository Site Transportation Comparative Analysis – 1986 EAs
• Rail Access to Yucca Mountain, 1986-2004
Institutional Issues -1986

• “The Department of Energy (DOE) recognizes that the success of its program to develop and implement a national system for nuclear waste management and disposal, as directed by the Nuclear Waste Policy Act of 1982 (NWPA), depends not only on safety, but on broad-based public understanding of and confidence in program activities and objectives. While each program element has its particular sensitivity, the transportation of the waste to facilities developed under the NWPA may be the most visible element nationwide. Therefore, DOE’s Office of Civilian Radioactive Waste Management (OCRWM) has developed this Transportation Institutional Plan to lay the foundation for interaction among all interested parties for the purpose of productive cooperation and resolution of issues related to establishment and operation of the NWPA transportation system.” Preface, DOE Transportation Institutional Plan, 1986
Unresolved Issues - 1986
DOE Transportation Institutional Plan

- Transportation of Defense Waste
- Prenotification
- Physical Protection Procedures
- Highway Routing
- Rail Routing
- Inspection and Enforcement
- Emergency Response
- Liability Coverage
- Cask Design and Testing
- Overweight Truck Shipments
- Rail Service Analysis
- Mixture of Modes
- Infrastructure Improvements
- OCRWM Training Standards
- Transportation Operational Procedures
- State, Tribal, and Local Regulation of Transportation
Unresolved Issues - 2004
State of Nevada

• Oldest Fuel First
• Mostly Rail (65-75%)
• Dual-Purpose Casks
• Dedicated Trains
• Full-scale Cask Testing (Regulatory & Extra-regulatory)
• NEPA Process for Selection of Rail Spur
• WIEB “Straw Man” Routing Process
• Sec 180(c) Program Rulemaking
• State Regulatory Enhancements (Safety & Perception)
• Terrorism and Sabotage Concerns
Cask Testing, 1977-2004

- NRC does not require physical testing
- No currently certified US cask has been tested full-scale to demonstrate compliance with 10CFR71 (drop, puncture, fire, immersion)
- Demonstration testing of obsolete casks & analysis at Sandia, 1977-1979
- Operation Smash Hit, UK, 1983
- 1/2-scale and 1/4-scale drop tests (5 US casks)
- Scale-model impact limiter tests (9 US casks)
- NRC Package Performance Study (PPS)
Nevada Recommendations, 1990-2004
Full-Scale Physical Testing of Casks

- Meaningful stakeholder role in development of testing protocols & selection of test facilities and personnel
- Full-scale physical testing (sequential drop, puncture, fire, and immersion) prior to NRC certification
- Additional testing (casks, components, models) and computer simulations to determine performance in extra-regulatory accidents and to determine failure thresholds
- Reevaluate Modal Study findings, and if appropriate, revise NRC cask performance standards
- Evaluate costs and benefits of destructive testing of a randomly-selected production model cask
NRC Cask Testing Plan, 2004
SECY-04-0135, July 2004

- Rejects stakeholder recommendations (NV-regulatory testing, AAR-test to failure)
- Abandons staff and contractor proposals (extreme extra-regulatory tests)
- Proposes $40 million demonstration test (no significant data for validation of existing codes or scaling assumptions)
- Cites “Operation Smash Hit” as example
NRC Ignores Operation Smash Hit History – Regulatory Test of Production Model Cask
NRC Ignores Operation Smash Hit History
Drop Test, No Limiters, Vulnerable Orientation
NRC Ignores Operation Smash Hit History
Cask Lid Performance
NRC Ignores Operation Smash Hit History
Credible Demonstration Crash Test
NRC Ignores Operation Smash Hit History
Extreme Impact (100 mph)
Repository Site Transportation Comparative Analysis – 1986

• DOE Environmental Assessments evaluated repository candidate sites in MS, NV, TX, UT, & WA
• DOE identified preferred rail and highway access routes to each site from national transportation network
• DOE applied NRC repository siting guidelines for transportation (10 CFR 960.5-2-7) – favorable conditions and potentially adverse conditions
• For Yucca Mountain, DOE identified relatively short rail and highway access routes, with favorable terrain
• Yucca Mountain transportation access was still least favorable, & most costly, when compared to other sites
Yucca Mountain Transportation Access Routes – DOE 1986 EA
## Yucca Mountain Transport Access Compared

<table>
<thead>
<tr>
<th>Condition</th>
<th>Davis Canyon, Utah</th>
<th>Deaf Smith, Texas</th>
<th>Hanford, Washington</th>
<th>Richton, Mississippi</th>
<th>Yucca Mountain, Nevada</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nearest Mainline railroad (miles)</td>
<td>74</td>
<td>25</td>
<td>51</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td>Nearest Alternative Rail line</td>
<td>Not identified</td>
<td>40</td>
<td>101</td>
<td>26</td>
<td>265</td>
</tr>
<tr>
<td>Rail Access new Construction (miles)</td>
<td>39</td>
<td>26</td>
<td>3</td>
<td>26</td>
<td>100</td>
</tr>
<tr>
<td>Rail Access cost (Million 1985 dollars)</td>
<td>142</td>
<td>21</td>
<td>6</td>
<td>16</td>
<td>151</td>
</tr>
<tr>
<td>Nearest Interstate Highway (miles)</td>
<td>89</td>
<td>14</td>
<td>28</td>
<td>26</td>
<td>100</td>
</tr>
<tr>
<td>Nearest Alternative Interstate (miles)</td>
<td>198</td>
<td>200</td>
<td>72</td>
<td>84</td>
<td>208</td>
</tr>
</tbody>
</table>
DOE Rail Access Planning for Yucca Mountain, 1990-2004

- DOE Preliminary Rail Route Study, 1990
- DOE Caliente Route Conceptual Design, 1991
- DOE Preliminary Transportation Strategy, 1996
- DOE Yucca Mountain Draft EIS, 1999
- DOE Yucca Mountain Final EIS, 2002
- DOE Notice of Preferred Rail Corridor, Dec. 29, 2003
- DOE Supplement Analysis, March 10, 2004
- DOE Record of Decision, April 8, 2004
- DOE Notice of Intent, April 8, 2004
- BLM Notice of DOE Application for Land Withdrawal, May 21, 2004
DOE Rail Route Studies, 1990-1991
## DOE FEIS Rail Corridors Compared

<table>
<thead>
<tr>
<th></th>
<th>Caliente</th>
<th>Carlin</th>
<th>Chalk Mountain</th>
<th>Jean</th>
<th>Valley</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost (Millions of 2001 $)</strong></td>
<td>$880</td>
<td>$821</td>
<td>$622</td>
<td>$462</td>
<td>$283</td>
</tr>
<tr>
<td><strong>Length (miles)</strong></td>
<td>319</td>
<td>323</td>
<td>214</td>
<td>114</td>
<td>98</td>
</tr>
<tr>
<td><strong>One-way travel time (hrs)</strong></td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td><strong>Disturbed land area (sq mi)</strong></td>
<td>18.3</td>
<td>19.3</td>
<td>12.6</td>
<td>9.2</td>
<td>5</td>
</tr>
<tr>
<td><strong>Construction time</strong></td>
<td>46</td>
<td>46</td>
<td>43</td>
<td>43</td>
<td>40</td>
</tr>
<tr>
<td><strong>1990 Population</strong></td>
<td>350</td>
<td>3200</td>
<td>589</td>
<td>492</td>
<td>219</td>
</tr>
<tr>
<td><strong>Tribal Lands</strong></td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>
“DOE would prefer to use a branch rail line to ship spent nuclear fuel and high-level radioactive waste to Yucca Mountain.”

- DOE identified five potential rail corridors: Caliente, Carlin, Chalk Mt, Jean, & Valley
- DOE asserted Final EIS presents sufficient information to select preferred mode and preferred corridor in NV
- DOE deferred formal selection of preferred shipment mode and preferred highway or rail corridor in NV
- DOE deferred final decisions on rail operating assumptions (such as shared use & dedicated trains)
DOE Decisions, 2003-2004
Yucca Mountain Rail Access

• Applied to BLM to withdraw public land along Caliente Corridor during DOE studies
• Selected “mostly rail” as preferred mode nationally and in Nevada
• Identified direct legal-weight truck (LWT) shipments as part of “mostly rail” scenario
• Identified shipment of LWT casks on rail cars to Nevada intermodal facility, and highway shipments in Nevada, as potential alternative mode pending completion of rail line
• Selected Caliente as preferred rail corridor
• Assumed lead agency status for preparation of Caliente rail corridor EIS
Caliente Rail Route
DOE Yucca Mountain Final EIS, 2002

[Map showing rail route from Caliente to Yucca Mountain with various towns and landmarks labeled, such as Nellis Air Force Range, Scotty's Junction, Beatty, Warm Springs, and others.]
State of Nevada Views on the Proposed Caliente Rail Corridor

• UP mainline through Caliente is a poor choice for originating a branch rail line to Yucca Mtn
• DOE ignored NV 1995 EIS scoping recommendations
• Caliente rail corridor is unacceptable
  - Difficult terrain poses severe impacts
  - Potential adverse impacts on Las Vegas
• NV 2004 Lawsuit: DOE Selection of Caliente is arbitrary and capricious, and contrary to law
  - DOE usurped authority of Surface Transportation Bd
  - DOE failed to prepare SEIS on LWT/rail intermodal
  - FEIS failed to identify and properly study preferred corridor (failed to evaluate expected impacts on specific parcels and current users of land, or specific land use conflicts, or necessary land exchanges)
Lessons from History: Union Pacific LA & SL Line (Salt Lake Route)

• Construction delayed by rugged terrain, high costs, lawsuits and politics (1880-1905)
• Final spike driven January 20, 1905
• Tracks repeatedly washed out by flooding in Meadow Valley Wash
• Tracks in Clover Creek Canyon and Meadow Valley Wash relocated on higher alignment (1911-1912)
• Steady track upgrading by Union Pacific and recurring track washouts (1921-2005)
Recent Flooding (January 2005)
Meadow Valley Wash South of Caliente
UP Route Characteristics & Concerns
(Uvada, MP 501.1; Caliente, MP 459.8; Moapa, MP 383.5)

• “The 118-mile study corridor traverses very rugged terrain. The route is confined within the canyon walls of Clover Creek and Meadow Valley Wash. The route exhibits a high degree of curvature as it descends 4,300 ft. from the high plateau at the Utah border to the desert floor beyond the southern end of the study area [Moapa].” (UNR, 1991, p. 25)
• Track equipped with high quality materials and maintained in good to excellent condition
• Steep grades and tight curves require speed restrictions, especially for westbound trains on the downgrade
• 15 tunnels, 107 bridges, 66 culverts
• Numerous rockfall areas and flood areas
• Updated accident study needed
1998 Coal Train Derailment
Clover Canyon, North of Caliente
UNR 1991 Flood Warning

• “At MP 431.82 …The bridge appears to have been designed to allow passage of the 25-year storm. However there is a 30% chance that a 100-year storm (probability of 0.01) will occur in any 35 years, and a 51% chance that a 50-year storm will occur during the same period.” (p.29)

• “From the analysis of the 100-year flow through the wash between the bridge at MP 431.82 versus the capacity of the channel provided, it was found that there is a significant danger of track becoming flooded or possibly the bridge washing out.” (p.52)

Bridge Washout at MP 431.81
(January 2005)
State of Nevada 1995 Comments on NEPA Process for Rail Access

• Specify rail operating assumptions (ownership, shared use, train service, procurement, & hiring)
• Evaluate at least 3 feasible spur routes using technically credible methodology
• Compare feasibility, costs, ROW acquisition, Native American resources, US Air Force activities, and economic development costs & benefits, in addition to standard review of impacts on human & natural environment
• Specifically evaluate each spur option regarding potential shipments through Las Vegas on existing UP mainline
Caliente Corridor Runs East-West Across North-South Mountain Ranges
Caliente Corridor Topography Poses Severe Construction and Operation Impacts
Potential Rail Shipments through Las Vegas

Maximum Rail to Caliente, Consolidated Southern Routing

(Planning Information Corporation, September, 1996)
Potential Impacts on Las Vegas
Up to 89% of rail shipments through Las Vegas
Potential Impacts on Las Vegas
More than 80,000 people within one-half mile
State of Nevada Lawsuit
Challenging DOE Rail Access Decisions

- Filed Sept. 2004 in US Court of Appeals for the District of Columbia Circuit
- Challenges DOE improper assumption of lead agency status for preparation of rail corridor EIS
- Challenges DOE failure to prepare Supplemental EIS on LWT/rail intermodal transportation
- Challenges DOE failure to identify and study preferred rail corridor in Yucca Mountain Final EIS
- Requests that the Court set aside DOE’s lead agency status, DOE’s selection of a composite transportation mode, and DOE’s selection of the Caliente corridor
Nevada Believes DOE Failed to Properly Analyze Land Use Conflicts

• DOE failed to analyze expected impacts on specific parcels and current users of land, or specific land use conflicts or necessary land exchanges
• DOE admits that Caliente was not “clearly environmentally preferable” and was the most costly alternative
• DOE selected Caliente, without consulting residents and businesses along the corridor, based on the assumed absence of land use conflicts (It “appears to have the fewest land use or other conflicts that could lead to substantial delays in acquiring the necessary land and rights-of-way, or in beginning construction.”)
Railroad Impacts
(UP near Elgin)
Railroad Impacts
(UP near Crestline)
Railroad Impacts
(Typical Railroad Bed Cross-sections)
Railroad Land-Use Impact Summary

• The proposed action would construct about 300 miles of crushed stone wall, 10 - 30 feet thick, varying in height from 1 - 8 feet, with a railroad on top of the wall (Some portion of railroad right-of-way may also be fenced)

• Despite construction of overpasses, underpasses, and at-grade crossings, the proposed wall/railroad would be a major barrier to the movement of humans, vehicles, livestock, wild animals, and water

• The proposed wall/railroad would adversely impact residents, ranchers, miners, recreational users, and other users of public and private lands

• The proposed wall/railroad could adversely impact land use and land users located many miles distant from the railroad right-of-way
Land Use Conflict – Cattle and Sheep
Ranching in Garden Valley
Land Use Conflict – Cattle Ranching in Reveille Valley
Land Use Conflict – Historically Significant Family Ranching Operations
Land Use Conflict – Goldfield Mining District
Land Use Conflict – U.S. Air Force Bombing Activities Along Most of the Corridor
Land Use Conflict - Major Outdoor Art Installation: M. Heizer, “City”

An Artist at the End of the World

...ment to finish what may be the biggest sculpture on earth.

By Michael Kimmelman