Yucca Mountain Transportation Implications for California

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Yucca Mountain Transportation Implications for California

- California Cities Along Routes to Yucca Mountain
- SNF Transportation Safety and Security Issues
- NAS Report and Full-Scale Cask Testing
- Yucca Mountain Shipments Compared to Past Shipments
- Potential Shipments from California Reactors
- Potential Rail Shipments through California
- Potential Truck Shipments through California
- Heavily Impacted Areas Along California Routes
- Opportunities for Comment

Additional information: www.state.nv.us/nucwaste/trans.htm
California Cities along “Mostly Rail” Routes to Yucca Mountain
California Cities Along “Mostly Truck” Routes to Yucca Mountain
Spent Nuclear Fuel Remains Extremely Dangerous for Decades

<table>
<thead>
<tr>
<th>SNF Age (Years)</th>
<th>Activity (Curies)</th>
<th>Surface Dose Rate (Rem/Hr)</th>
<th>Lethal Exposure (Time)</th>
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<tbody>
<tr>
<td>1</td>
<td>2,500,0000</td>
<td>234,000</td>
<td>10 sec.</td>
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<td>5</td>
<td>600,000</td>
<td>46,800</td>
<td>1 min.</td>
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<td>400,000</td>
<td>23,400</td>
<td>2 min.</td>
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<tr>
<td>50</td>
<td>100,000</td>
<td>8,640</td>
<td>4 min.</td>
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Source: DOE/NE-007, 1980
Casks Are Vulnerable to Sabotage, And May Be Vulnerable to Very Severe Fires

GA-4/9 Truck Cask Design

Generic Large Rail Cask Design

Tow Missile Warhead Test, 1998

Baltimore Rail Tunnel Fire, 2001
Spent Nuclear Fuel Transportation
Safety & Security Issues

• Direct SNF exposure deadly for 50+ years
• Each cask contains enormous amount of dangerous fission products (especially Cesium-137, half-life 30 years, 136,00 to 810,000 curies per cask)
• Shipping casks not tested full-scale
• Cask breach in worst-case accident: 5-4,000+ latent cancer fatalities (LCFs) and $300,000-$10 billion+ cleanup costs
• Cask breach in successful terrorist attack: 4-1,800+ LCFs and $10 billion+ cleanup costs
• Routine gamma radiation from casks hazardous to workers and to some members of public
• Lesson from Exxon Valdez accident – Disaster can occur after 8,000 safe shipments

Documentation available at www.state.nv.us/nucwaste/trans.htm
Nevada Agrees with Safety & Security Findings of NAS Transportation Study

• No fundamental barriers to safe transportation, but social and institutional challenges to repository transportation require expeditious resolution, and the challenges of sustained implementation should not be underestimated

• Malevolent acts (terrorism, sabotage, and theft) are a major technical and societal concern
  - Independent examination of security should be carried out before the commencement of repository shipments
  - Objective information about security risks and countermeasures should be shared with elected officials and the public to the fullest extent possible

Nevada Agrees with Risk & Impact Findings of NAS Transportation Study

- Risks can be reduced by shipping the oldest fuel first, maximizing use of rail transportation, using dedicated trains, and minimizing truck shipments
- DOE should identify and make public preferred highway and rail routes for repository shipments as soon as possible
- Most significant transportation accident risks would likely involve long-duration, fully-engulfing fires; additional steps must be taken to reduce the likelihood of such accidents.
- Full-scale testing should be used to determine how packages perform, but testing to destruction should not be required
- For many members of the public, social and economic impacts (often referred to as perceived risk impacts) are as important as health and safety impacts.
NRC Regulations Establish Cask Accident Performance Standards

30 foot drop onto essentially unyielding surface

40 inch drop onto 6 inch steel spike

8-hour submersion of undamaged cask under 50 feet of water

30-minute fire @ 1475°F

Source: Sandia National Laboratories
Nevada Cask Testing Recommendations Revised in Response to NAS Study

- **Meaningful stakeholder role** in development of testing protocols & selection of test facilities and personnel
- **Full-scale regulatory testing** (sequential drop, puncture, fire, and immersion), of each cask design to be used for repository shipments, required either for NRC certification, or for DOE procurement (Est. cost $50-70 million total for 5-7 casks)
- **Extra-regulatory fire test** of LWT or Rail cask - engulfing fire, 3 hours @ 1475°F-1800°F (800°C-1000°C), followed by cool-down (Est. cost $4-7 million)
- Determine cask and fuel failure thresholds by computer simulations and component testing (**not** full-scale casks)
- No need at this time to evaluate costs and benefits of destructive testing of a randomly-selected production model cask (originally recommended by NV)
Estimated Shipments of SNF & HLW to Yucca Mountain

24 Years (70,000 MTU limitation retained)
Mostly Rail: 10,725 Cask-Shipments
  - about 2 or 3 trains, per week, and 1 truck cask per week
Mostly Truck: 53,086 Cask-Shipments
  - about 6 trucks per day

38 Years (70,000 MTU limitation lifted)
Mostly Rail: 22,057 Cask-Shipments
  - about 3 trains per week, and 2 truck casks per week
Mostly Truck: 108,899 Cask-Shipments
  - about 8 trucks per day

Source: DOE-EIS-0250, Appendix J
Yucca Mountain Shipments Compared to Past Shipments

• 43 Times More SNF Shipped Per Year
• 8 to 38 Times More Casks Shipped Per Year
• 5 to 40 Times More Shipments Per Year
• 443% Increase In Average Rail Shipment Distance
• 280% Increase In Average Truck Shipment Distance
• Western Route Characteristics and Operating Conditions
• Potential Unprecedented Reliance on Heavy Haul Truck and Barge Shipments

California Nuclear Power Plants

Humboldt Bay

Diablo Canyon

Rancho Seco

San Onofre
## Estimated California Rail Shipments to Yucca Mountain

<table>
<thead>
<tr>
<th>Location</th>
<th>24 Years (Casks)</th>
<th>38 Years (Casks)</th>
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<tbody>
<tr>
<td>Diablo Canyon</td>
<td>121</td>
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<tr>
<td>Humboldt Bay</td>
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<td>6</td>
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<tr>
<td>Rancho Seco</td>
<td>21</td>
<td>21</td>
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<tr>
<td>San Onofre</td>
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<td>277</td>
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<tr>
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<td>286</td>
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### Estimated California Truck Shipments to Yucca Mountain

<table>
<thead>
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<th>Location</th>
<th>24 Years (Casks)</th>
<th>38 Years (Casks)</th>
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</thead>
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<tr>
<td>Rancho Seco</td>
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<td>124</td>
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<tr>
<td>San Onofre</td>
<td>853</td>
<td>1,698</td>
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<tr>
<td></td>
<td><strong>1,750</strong></td>
<td><strong>3,967</strong></td>
</tr>
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</table>
Yucca Mountain Transportation System Issues

• Yucca Mountain lacks rail access
• Proposed Caliente rail line would be longest (320 miles) new rail construction in US since 1930s, cost more than $2 billion
• At least 24 of 72 shipping sites lack direct rail access
• No DOE comprehensive plan for national transportation to Yucca Mountain
• DOE has proposed “suite of routes” approach to route selection, which would utilize two or more rail and highway routes from each shipping site
• Proposed DOE TAD canister system would require rail access or barges and heavy haul trucks
• Legal-weight trucks used for at least 10% of SNF
24 Reactor Sites Lack Rail Access

DOE Considering Barge Shipments at 17 Sites
Dedicated Rail Routes to Yucca Mt via Rail Gateways to the Proposed Caliente Spur

The map depicts routes from the nuclear waste shipping sites to the proposed Yucca Mt. repository via the proposed Caliente spur. It shows routes on Class I track from the shipping sites to the Union Pacific Gateways of Kansas City and Memphis. The map also depicts the truck routes from reactor sites that cannot handle rail shipments and the barge routes identified in the Final Environmental Impact Statement.
Mostly Rail, 24 Years
Shipments Through California

- **Minimum: 660 rail casks (6%)**
  About 28 Casks, in 7-10 Trains, plus 20 truck shipments, per Year (DOE, 2002)

- **Maximum: 8,528 rail casks (88%)**
  About 355 Casks, in 110-120 Trains, plus 44 truck shipments, per Year (PIC, 1996)

- **Current Estimate: 4,384 rail casks (45%)**
  About 182 Casks, in 60-70 Trains, plus 20 truck shipments, per Year (NANP Suite of Routes Analysis, 2007)
Mostly Rail, 38 Years
Shipments Through California

- **Minimum: 1,207 rail casks (5%)**
  About 32 Casks, in 10 Trains, plus 31 truck shipments, per Year (DOE, 2002)

- **Maximum: 14,924 rail casks (78%)**
  About 392 Casks, in 130 Trains, plus 82 truck shipments, per Year (PIC, 1996)

- **Current Estimate: 7,450 rail casks (39%)**
  About 196 Casks, in 65 Trains, plus 31 truck shipments, per Year (NANP Suite of Routes Analysis, 2007)
Mostly Truck, 24 Years Shipments Through California

- **Minimum: 6,867 trucks (13%)**
  About 290 Casks per Year, 6 casks per week
  (DOE, 2002)

- **Maximum: 48,062 trucks (90%)**
  About 2,000 Casks per Year, 38 casks per week
  (PIC, 1996)

- **Current Estimate: 23,764 trucks (45%)**
  About 990 Casks per Year, 19 casks per week
  (NANP Suite of Routes Analysis, 2007)
Mostly Truck, 38 Years
Shipments Through California

- **Minimum: 14,179 trucks (13%)**
  About 370 Casks per Year, 7 casks per week
  (DOE, 2002)

- **Maximum: 89,554 trucks (82%)**
  About 2,350 Casks per Year, 45 casks per week
  (PIC, 1996)

- **Current Estimate: 44,158 casks (40%)**
  About 1,160 Casks per Year, 22 casks per week
  (NANP Suite of Routes Analysis, 2007)
Heavily Impacted Area – San Bernardino
Heavily Impacted Area – El Cajon Pass
Opportunities to Comment
Yucca Mountain Transportation

- Summer, 2007 – DOE Draft National Transportation Plan
- October, 2007 – DOE Draft Supplement to YM EIS (TAD canister System)
- October, 2007 – DOE Draft Rail Alignment EIS
- June, 2008 – DOE Repository License Application to U.S. Nuclear Regulatory Commission