

#### Yucca Mountain

#### **Transportation Issues**

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# Overview

- •DOE Proposed Transportation System
- •Transportation Risks and Impacts
- •Nevada Recommendations for Managing Transportation Risks and Impacts
- •Scorecard Nevada Recommendations Largely Accepted by NAS & BRC, But Only Limited Acceptance by DOE



Now-Terminated Yucca Mountain Transportation System (2008 SEIS)

- Ship 9,495 rail casks (2,800 trains) & 2,650 truck casks over 50 years [p.6-8]
- If No 2<sup>nd</sup> Repository: 21,909 rail casks (about 6,700 trains) & 5,025 truck casks [p.8-41]
- Average 1-3 trains (3-5 casks per train) & 1-2 trucks (1 cask per truck) per week for 50 years
- Every day, for 50 years, one or more loaded casks on rail or road, from 76 shipping sites to a single national repository or storage site

#### **National Transportation Impacts**



# NRC ASLB Admitted 46 Transportation NEPA Contentions (May 11, 2009 Order)

As California persuasively argues, "[w]ithout transportation of the waste to it, Yucca Mountain would be just a very large, fancy, and expensive hole in a mountain."...there can be no serious dispute that the NRC's NEPA responsibilities do not end at the boundaries of the proposed repository, but rather extend to the transportation of nuclear waste to the repository. The two are closely interdependent. Without the repository, waste would not be transported to Yucca Mountain. Without transportation of waste to it, construction of the repository would be irrational. Under NEPA, both must be considered.

#### Nevada NEPA Contentions Transportation Radiological Impacts

# The DOE 2008 FSEIS evaluates four major categories of transportation radiological impacts:

- incident-free exposures to members of the public residing near or traveling on transportation routes (up to 0.016 rem to a person in a gridlock traffic jam); [Pp.6-20, 6-21, 8-41]
- **incident-free exposures to transportation workers** such as escorts, truck drivers, & inspectors (by administrative controls, DOE would limit individual doses to 0.5 rem per year; the allowable occupational dose is 5 rem per year); [Pp.6-21, 8-41]
- release of radioactive material as a result of the maximum reasonably foreseeable transportation accident (probability about 5 in one million per year), involving a fully engulfing fire, 34 rem dose to the maximally exposed individual, 16,000 person-rem population dose and 9.4 latent cancer fatalities in an urban area, and cleanup-costs of \$300,000 to \$10 billion; [Pp.6-15, 6-24, G-56]
- release of radioactive material following a successful act of sabotage or terrorism, using a high-energy density device, resulting in 27-43 rem dose to the maximally exposed individual, 32,000-47,000 person-rem population dose and 19-28 latent cancer fatalities in an urban area, and cleanup costs similar to a severe transportation accident. [Pp.6-27, CR-467]

#### Nevada contentions specifically challenge the NEPA sufficiency of DOE's transportation radiological impact evaluations. These impacts will be further evaluated in great detail in the now restarted licensing proceeding.

Source: Halstead and Dilger, ANS IHLRWMC 2011, Albuquerque, NM, April 10-14, 2011, Pp. 410-411.

### Shipping Cask Vulnerability in Severe Accident Fires – Ongoing Debate

MacArthur Maze - 2007

**Baltimore Rail Tunnel - 2001** 







### Shipping Casks Are Vulnerable to Terrorist Attacks

#### Truck Cask Test, 1982

#### Rail Cask Test, 1998





Nevada NEPA Contentions Other Transportation Impacts

- Construction and operation of the Caliente Rail Alignment (RA EIS is part of LA)
- Las Vegas Transportation Impacts
- Representative Routes Nationally and Impacts on Highly Populated Areas
- Use of TAD Canisters and Modal Mix
- Region of Influence for Transportation Impacts

#### **Proposed Caliente Rail Corridor**



#### **Caliente Corridor Terrain Challenges**

Caliente Rail Profile



#### Caliente Corridor NEPA Issues



Mountains = Cuts, Fills, Grades, Curves



**Bridges & Flood Hazards** 



#### Land Use Conflicts



#### **Limited Economic Benefits**

#### **UP Mainline to Caliente Safety Issues**







# Las Vegas Transportation Impacts

Rail Casks through Las Vegas to Yucca Mountain via Caliente Minimum – 8% Maximum – 79% 4 - 110 trainloads per year



# STATE OF NEVADA SAFETY AND SECURITY RECOMMENDATIONS

- 1. Oldest fuel first
- 2. Mostly rail (65-75%)
- 3. Dual-purpose casks
- 4. Dedicated trains
- 5. Full-scale cask testing

6. NEPA process for rail spur selection

7. WIEB "straw man" routing process

8. Section 180c program rulemaking

9. State regulatory enhancements

10. Terrorism and sabotage concerns

# Older fuel first



Nevada has recommended that DOE ship the oldest fuel first, or at least ship older fuel first. Shipping fuel 50 years out of reactor, compared to shipping 5year-cooled fuel, could reduce radiological hazards 65-85 percent.

### **Dose Rate Reduction Over Time**

Age (years)	Activity (curies/assembly)	Surface Dose Rate (rem/hr)	Lethal Exposure (time to 450 rem)
1	2,500,000	234,000	7 seconds
5	600,000	46,800	35 seconds
10	400,000	23,400	70 seconds
50	100,000	8,640	188 seconds
100	50,000	2,150	750 seconds

Source: Waste Confidence Rulemaking, DOE/NE-0007 (April 15, 1980) Table II-4, p. II-56; NRC Glossary, http://www.nrc.gov/reading-rm/basic-ref/glossary/lethal-dose-ld.html

# **Mostly Rail**



- Nevada has
  recommended that DOE
  select rail as the
  preferred mode of
  transportation
- Based on shipping site current capabilities, the share of SNF that could realistically be shipped by rail may be 65-75 percent.

### **Dual Purpose Casks**



- Nevada has recommended that DOE base its transportation system on use of dual-purpose (transportable storage) casks of a standardized design, with a range of capacities resulting in loaded cask weights of about 125, 100, and 70 tons.
- In 1995, Nevada endorsed the DOE proposal for a similar approach using a multipurpose canister (MPC) system for storage and transport.

# **Dedicated Trains**

- A train that transports only spent fuel or highlevel waste and no other cargo.
- The NAS found that there were: "clear operational, safety, security, communications, planning, programmatic, and public preference advantages that favor the use of dedicated trains,"



# **Cask Testing**



Progress on this issue has been uneven and difficult, yet substantial. The NAS 2006 report "strongly endorses the use of full-scale testing to determine how packages will perform under both regulatory and credible extra-regulatory conditions."

Nevada views the "Operation Smash Hit" testing as a possible approach combining regulatory and demonstration testing

# **Rail Access**

The State of Nevada filed a lawsuit challenging the process used by DOE to select a rail route as part of the 2002 FEIS for to the now defunct Yucca Mountain site. The court order in that case would allow Nevada to resume its objection to the selection of the Caliente rail alignment at a future date.

NRC accepted Nevada contentions on rail access in the Yucca Mountain licensing proceeding.



# Shipment Routes: WIEB Straw man



#### Section 180c

Nevada has recommended that DOE implement the transportation planning and emergency response training program, required under Section 180c of the NWPAA, through formal rulemaking.





# State, Local, & Tribal Regulation

- Nevada recommends that DOE support state regulatory enhancements to manage transportation risks and address public perception of transportation risks.
- These would include, but not be limited to:
  - port-of-entry inspections
  - state escorts
  - seasonal, day-of-week, and time-of-day restrictions



# **Terrorism and Sabotage**

DOE shipments would not be subject to NRC physical protection regulations (10 CFR 73.37), and therefore DOE needs to fully address terrorism issues.

In many cases the NRC has satisfactorily responded to the specific requests made in Nevada's 1999 petition for rulemaking (Docket PRM 73-10).

The NAS and BRC reports acknowledge the threat of terrorism and sabotage, but fell short of making specific recommendations for managing terrorism and sabotage risks



#### **The Scorecard**

Organization	Endorsement by National Academy of	Endorsement by Blue Ribbon Commission	Adoption by Dept. of Energy (FSEIS)	Adoption by NRC
Issue	Sciences			
Oldest fuel first	Satisfactory	Satisfactory	Unsatisfactory	N/A
Dual Purpose Casks	Incomplete	Incomplete	Incomplete	N/A
Mostly rail	Satisfactory	Satisfactory	Satisfactory	N/A
Dedicated Trains	Satisfactory	Satisfactory	Satisfactory	Incomplete
Cask Testing	Satisfactory	Satisfactory	Incomplete	Satisfactory
Rail Access/NEPA	Unsatisfactory	Incomplete	Unsatisfactory	Satisfactory
Shipment Routes	Satisfactory	Satisfactory	Unsatisfactory	N/A
Section 180(c)	Satisfactory	Satisfactory	Incomplete	N/A
State, Local, & Tribal	Satisfactory	Satisfactory	Incomplete	N/A
Regulation				
Terrorism and Sabotage	Incomplete	Incomplete	Incomplete	Satisfactory

# Conclusion

- State of Nevada's ten recommendations for safety and security in 1986 have proved durable
- The majority have been endorsed by the BRC and the NAS
- Several have been adopted by NRC (cask testing, rail access, & sabotage) and by AAR (dedicated trains)
- Limited progress in adoption by DOE
- Full range of transportation impacts will be addressed in the NRC licensing proceeding

#### **Question & Answers**

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