

Yucca Mountain Transportation Risk and Impact Issues

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Yucca Mountain Transportation Risk and Impact Issues

- Risk Management Recommendations
- Radiological Characteristics of Spent Fuel
- Routine Radiation Exposures
- Severe Accident Consequences
- Terrorism Consequences
- Current Nevada Impact Studies

Additional documentation available at
www.state.nv.us/nucwaste/trans.htm

Nevada Recommendations

Comprehensive Risk Management

- Comprehensive risk assessment (CRA) should cover all transportation system phases, events, and consequences (Golding and White, 1990)
- CRA calculates probabilities only where existing data, theories, and models are sufficient to support use of rigorous quantitative methods, and uses sensitivity analysis to illustrate impact of differing assumptions and variations in quality of data
- CRA should be used as working risk management tool throughout life of project, with ongoing public participation
- CRA should be basis of risk communication throughout life of the project

Nevada Recommendations

Preferred Transportation System

- Dual purpose casks for at-reactor storage and transport
- Ship oldest fuel first (at least 20 years at-reactor cooling)
- Maximum use of rail (mode of choice)
- Mandatory use of dedicated trains, special safety protocols, and special car designs as recommended by AAR
- Early DOE and carrier identification of preferred cross-country mainline routes in consultation with stakeholders
- Early involvement of corridor states and Indian Tribes, including financial assistance under Section 180(c)

Nevada Recommendations

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

Nevada Recommendations

Accident Prevention & Emergency Response

- Maximize use of regional organizations such as Western Governors Association (WGA) and Western Interstate Energy Board (WIEB) for planning, implementation, and program evaluation
- Coordinate with Indian Tribes and local governments
- Develop comprehensive safety program modeled after WGA-State-DOE WIPP Transportation Program
- Adopt WIEB Sept., 1994 proposal for evaluation and final designation of preferred shipping routes
- Implement Section 180(c) Financial Assistance to State, local, & tribal governments through rulemaking
- Revise DOE Plan for Privatization of Transportation Services to emphasize safety and public acceptance

Fresh Fuel Assemblies



Spent Fuel Storage Pool



Radiological Characteristics of a Spent Fuel Assembly (33,000 MWd/MTU Burnup)

(DOE/NE-007, 1980)

SNF Age (Years)	Activity (Curies)	Surface Dose Rate (Rem/Hr)	Lethal Exposure (Time)
1	2,500,0000	234,000	10 sec.
5	600,000	46,800	1 min.
10	400,000	23,400	2 min.
50	100,000	8,640	4 min.

Shipping Cask Inventories

- The representative truck cask (GA-4) loaded with 23-year cooled PWR SNF contains a radionuclide inventory of 355,000 curies total activity, including 136,000 curies of Cesium-137 (for 10-year cooled SNF, total inventory is 846,000 curies, including 177,000 curies of Cesium-137)
- The representative large (26 PWR) rail transport-only cask loaded with 23-year cooled PWR SNF contains a radionuclide inventory of 2,100,000 curies, including 816,000 curies of Cesium-137
- Casks loaded with HLW, DOE SNF, and Naval SNF also contain large radionuclide inventories dominated by Cesium-137 (27,000-450,000 curies)

Source: DOE FEIS, Table J-12

Routine Radiation Exposures

- Exposure rate 10 mrem/hour at 2 meters from cask
- Exposure to truck safety inspectors: 2,000-8,000 mrem/year (Potential for 200 rem over 24 years)
- Exposure to occupants of vehicle next to SNF truck cask in traffic gridlock (1 - 4 hours): 10 - 40 mrem per person per incident
- Exposure to service station attendant (maximally exposed member of public): 100-1,000 mrem/year
- Exposures at commercial and residential locations along potential routes in Nevada: 30 - 200 mrem/year

Source: Collins, Gathers, and Halstead, HPS 47th Mtg, July, 2002

Ely, NV – Potential Route



Goldfield, NV – Potential Route



Expected Transportation Accidents and Incidents (Historical SNF Accident Rates)

- DOE Mostly Truck National Scenario, 38 Years
 - 159 Truck Accidents
 - 2,391 Truck Regulatory Incidents
- DOE Mostly Rail National Scenario, 38 Years
 - 384 Rail/ 6 Truck Accidents
 - 767 Rail/ 91 Truck Regulatory Incidents
- Nevada Current Capabilities National Scenario, 38 Years
 - 291 Rail/ 46 Truck Accidents
 - 581 Rail/ 691 Truck Regulatory Incidents

Source: Halstead Testimony, 5/22/02

Consequences of Rail Accident – DOE Estimates

Maximum reasonably foreseeable rail accident in
urban area

Draft EIS (July 1999), Table 6-12

- Probability 1.4 in 10 million)
- Population dose (person-rem): 61,000
- Latent cancer fatalities: 31

Final EIS (February 2002), Table 6-15

- Probability 2.8 in 10 million
- Population dose (person-rem): 9,900
- Latent cancer fatalities: 5

Consequences of Rail Accident- Nevada Estimate

Nevada-sponsored study of rail accident similar to July 2001 Baltimore Tunnel Fire (equal to engulfing fire, 800°C, 7-12 hours)

- Radioactive Release: 73,000 curies Cs-134 & Cs-137 (respirable aerosol)
- Contaminated Area: 32 square miles
- Latent cancer fatalities: 4,000-28,000 over 50 years (200-1,400 during first year)
- Cleanup cost (2001\$): \$13.7 Billion

Source: RWMA, 9/15/01

Consequences of Successful Terrorist Attack

Successful attack on truck cask in urban area using high-energy explosive device (90% penetration)

- DOE estimated impacts [FEIS, Pp. 6-50 to 6-52]
 - Latent cancer fatalities: 48
- Nevada estimated impacts [RWMA, 4/15/02]
 - Latent cancer fatalities: 300 – 1,800
 - Economic cost (2000\$): More than \$10 Billion

Current Nevada Impact Studies

- Review of SNL Transportation Risk Reexamination Report (NUREG/CR-6672)
- Transportation Human Factors Analysis
- Reexamination of the Baltimore Rail Tunnel Fire
- Full-Scale Cask Impact and Fire Testing (Alternative to NRC PPS NUREG-1768)
- Reexamination of Transportation Terrorism and Sabotage Issues (Update analysis submitted to NRC in support of 1999 Petition for Rulemaking)
- Unique Local Hazards Analysis

Nevada Perspective on Controversy Over Baltimore Fire Studies

- Nevada publishes report on Baltimore Fire September 2001
- Nevada raises Baltimore Fire issues relative to NRC PPS full-scale testing proposal May 2002-Present
- NRC excludes Nevada consultants from technical meetings with NRC contractors (NIST) June-August, 2002
- NRC withholds draft reports and technical analyses requested by Nevada under FOIA August 2002-April 2003
- Baltimore Fire discussed at WM'03 Conference February 2003
- Baltimore Fire discussed at NRC PPS meetings March 2003
- NRC invites Nevada consultants to meet with NRC staff and contractors, provides requested data, and initiates open and ongoing dialogue April 2003-Present
- NRC Inspector General investigation May 2003-Present

Nevada Perspective on Baltimore Fire Study Issues to be Resolved

- NIST fire model & tunnel experiments
- Significance of water main break and oxygen supply
- Fire history reconstruction (duration, temperatures, cool down period)
- Hypothetical accident conditions (e.g., cask lid proximity to hottest region of fire)
- Selection of cask(s) to be evaluated and significance of welded internal canister
- Cask and fuel performance modeling
- Implications for extra-regulatory cask testing
- Need for independent peer review

Unique Local Conditions

Military Aircraft Overflights

