



NUCLEAR WASTE TRANSPORTATION SAFETY AND SECURITY ISSUES

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NUCLEAR WASTE TRANSPORTATION SAFETY AND SECURITY ISSUES

- Critical Reviews of Probabilistic Risk Assessment Methodology, the Modal Study, and RADTRAN
- U.S. Spent Nuclear Fuel Shipments, 1979 - 1995
- Projected Shipments to Repository
- Future Shipments Will Be Significantly Different Than Past Shipments
- Safety Record of Past Shipments Does Not Guarantee Safety of Future Shipments
- Consequences of Terrorism and Sabotage Require New and Detailed Reassessment



State of Nevada Critical Reviews of Probabilistic Risk Assessment Methodology, the Modal Study, and RADTRAN

- **Tuler, Kasperson, & Ratick (1988) The Effects of Human Reliability in the Transportation of Spent Nuclear Fuel**
- **Audin (1990) Nuclear Waste Shipping Container Response to Severe Accident Conditions**
- **Resnikoff (1990) Probabilistic Risk Assessment and Nuclear Waste Transportation**
- **Golding and White (1990) Guidelines on the Scope, Content, and Use of Comprehensive Risk Assessment**
- **Freudenburg (1991) Organizational Management of Long-Term Risks**

U.S. Spent Nuclear Fuel Shipments, 1979 - 1995

- Amount Shipped: 1,335 MTU (79 MTU/year)
 - Total Shipments: 1,306 (77 Shipments/year)
 - Truck Share of Shipments: 89%
 - Rail Share of MTU: 75%
 - Average Rail Shipment Distance: 346 miles
(79% less than 500 miles)
 - Average Truck Shipment distance: 678 miles
(82% less 900 miles)
 - Origins/Destinations East of Mississippi River: 71% (930)
- Source: NUREG-0725, Rev. 11(July, 1996)

Projected Shipments Repository at Yucca Mountain (Current DOE Plan)

- Shipments Begin: 2010
- SNF Modal Mix: 12% Truck, 88% Rail
- Casks: New Designs, High-Capacity
- Rail Access to Repository: Yes
- Total Cask Shipments
 - Legal-Weight Truck: 6,300
 - Rail: 13,900
- Combined Total: 20,200

Source: Planning Information Corporation, 9/16/96

Projected Shipments

Interim Storage Facility and Repository

(Proposed in S.104 & HR. 1270)

- Shipments Begin: 2002-2003
- SNF Modal Mix: 35% Truck, 65% Rail
- Casks: Current Designs (New Designs)
- Intermodal Transfer Facility: At Caliente
- Total Cask Shipments Current Casks (New Casks)
 - Legal-Weight Truck: 79,300 (31,400)
 - Rail: 12,600 (12,600)
 - Heavy Haul Truck: 12,600 (12,600)
 - Combined Total: 104,500 (56,600)

Source: Planning Information Corporation, 9/16/96




Future Shipments Will Be Significantly Different Than Past Shipments

- 35 Times More SNF Shipped Per Year
- 8 to 24 Times More Shipments Per Year
- 500% Increase In Average Rail Shipment Distance
- 200% Increase In Average Truck Shipment Distance
- Western Route Characteristics (Mountainous Terrain, Severe Weather Conditions)
- Western Operating Conditions (Higher Speeds, Longer Emergency Response Times)
- Potential Unprecedented Reliance on Long-Distance Heavy Haul Truck Shipments

Safety Record of Past Shipments Does Not Guarantee Safety of Future Shipments

- 1957-1964: 11 accidents/incidents involving SNF
- 1971-1990: 7 accidents involving SNF
- No Releases from SNF Casks since 1962
- DOE calculated historical accident/incident rates
 - Truck : 0.7/10.5 per million shipment miles
 - Rail : 9.7/19.4 per million shipment miles
- Projected accidents/incidents during OCRWM shipments
 - Repository Only 185-250 accidents/355-550 incidents
 - Repository & ISF 175-355 accidents/425-925 incidents

Source: Halstead and Ballard, October, 1997



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Consequences of Terrorism and Sabotage Require New and Detailed Reassessment

- Potential Release from Attack with Explosives
- Primary Criticisms of NRC's 1984 Terrorism
Consequence Assessment and Proposed Rule
- Preferred Approach to Assessing Risks of Terrorism and
Sabotage Against SNF Shipments
- Guidelines For Assessing Consequences of Terrorist
Attacks Employing Anti-Tank Weapons
- Recommendations to NRC and DOE Regarding Terrorism
Consequence Assessment

Source: Halstead and Ballard, October, 1997

Consequences of Terrorist Attack with High Energy Explosive Device

- Scenario: Terrorists Attack Truck Cask Containing 1 PWR Assembly with HED(M3A1)
 - Hole Diameter: 152.5 mm (6.0 inches)
 - Fuel Rods Damaged: 111 of 223 (50%)
 - Fuel Mass Fractured: 20.82 kg (10%)
 - Fuel Mass Released: 2.55 kg (5.6 pounds) (1%)
 - Released as Aerosol: 2.94 g (1/10 ounce) (0.001%)
 - Blast Effect/Shrapnel Zone: 100+ meters
- Source: SAND82 - 2365 (June, 1983)

Primary Criticisms of NRC's 1984 Terrorism Consequence Assessment and Proposed Rule

- NRC underestimated potential damage to cask and spent fuel and release resulting from attack with explosives
- NRC underestimated potential health effects of attack resulting in release
- NRC did not evaluate standard economic impacts of attack resulting in release
- NRC did not evaluate special social and economic impacts of attack resulting in release
- NRC terminated rulemaking without explanation or response to comments
- NRC and DOE continue to use 1984 findings as basis of terrorism risk assessment

Preferred Approach to Assessing Risks of Terrorism and Sabotage Against SNF Shipments

- Consider broad range of potential perpetrators, attack objectives, and methods
- Assess Actions to Disrupt Shipments without Causing Damage to the Cask
- Assess Actions to Induce Severe Accidents, Possibly Causing Damage to the Cask and Release of Contents
- Assess Attacks on Shipping Casks that are Clearly Intended to Cause a Release of Radioactive Materials
 - Cask captured and penetrated by emplaced explosives
 - Cask perforated by anti-tank missile

Guidelines For Assessing Consequences of Terrorist Attacks Employing Anti-Tank Weapons

- Assumptions must be consistent with available technology and most likely shipment plans
- Reference Weapon: Milan or TOW missile
- Reference Cask: GA 4/9, NAC-TSC, 125-ton MPC
- Reference SNF: 10-year-old PWR
- Assume credible worst case attack time, location, and weather conditions
- Reference Location: Clark or Lincoln County, Nevada

Recommendations to NRC Regarding Terrorism Consequence Assessment

- Reexamine issues relative to 10CFR73 safeguards and transportation risks to be addressed in Yucca Mtn EIS
- Conduct comprehensive assessment of attacks that have potential for radiological sabotage
- Evaluate need for additional physical testing and appropriateness of existing computer models
- Facilitate meaningful participation by all affected stakeholders
- Publish all unclassified findings
- Reevaluate SSEL definition of radiological sabotage

Recommendations to DOE Regarding Terrorism Consequence Assessment

- Assess impacts of terrorism/sabotage resulting in release in Yucca Mtn EIS: health effects; environmental impacts; and standard and special socioeconomic impacts
- Incorporate terrorism/sabotage risk management and countermeasures in transportation plans and contracts
- Report on liability for costs and damages under Price Anderson system