YUCCA MOUNTAIN TRANSPORTATION SECURITY ISSUES: OVERVIEW AND UPDATE

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Presentation Outline

Transportation Security

1. Review of existing sabotage and terrorism debates, research and consequence assessments.
2. Critical uncertainties (five) in DOE transportation planning.
3. National Academy of Sciences recent contribution to the debates.
4. Recent trends in terrorism related research and alternative methodologies for assessing threat to repository shipments.
Relevant Literature and Research

- **Nevada Attorney General NRC Petition for Rulemaking 1999.**
  - Vulnerability of cask to attack.
  - Shipment characteristics and overall program differ significantly from past shipments and programs.
  - Request general strengthening of safeguards, regulations, and comprehensive reexamination of the consequences of radiological sabotage and/or terrorism attacks designed to disperse contents of cask in transit.

- **Sponsored Studies:**
  - Radioactive Waste Management Associates reanalysis studies of FEIS assumptions.
    - Cost of clean-up truck incident is estimated from $6.1 billion, to $10 billion USD
    - Truck incident with anti-tank weapon and full perforation of cask could result in 3000 to 18000 LCF
    - Contamination zone could reach 10 sq kilometers (3.9 sq miles).
  - Ballard and Halstead studies. And past Waste Management presentations from Nevada.

- **Other relevant research**
  - United States Army studies of multiple devices.
  - ICFI and Aberdeen Testing Ground data.

- **Nuclear Regulatory Commission**
  - NRC 1977 imposed safeguards and physical protection requirements.
  - NRC 1984 consequence studies – urban study.
  - NRC proposed rule eliminating physical protection (10CFR73.37), eventually abandoned.
  - Consistent NRC pattern of downplaying consequences in following years based on their research and analysis.

- **Department of Energy**
  - DOE Draft EIS (DEIS, DOE 1999).
    - Sandia Study shows vulnerability of cask to attacks (SNL 1999).
  - DOE EIS (FEIS)
    - Focus on health impacts to the exclusion of other impacts.
    - Estimated clean up cost is $10 billion USD, truck cask incident = 96K person rem and 48 LCF and rail incident = 17L person rem with 9 LCF.
  - DOE Record of Decision

- **Currently awaiting NRC response to Nevada petition for rulemaking (in process since 1999).**
Truck casks are vulnerable to attack: DOE test, Sandia, 1982
Rail casks are vulnerable to attack:
IFCI test, Aberdeen, 1998
Consequences of Successful Attack

- Both truck and rail shipping casks are vulnerable to an attack using a single, current-generation weapon, resulting in release of radioactive materials.
- A successful attack could contaminate an area up to several square miles.
- A successful attack in an urban area would constitute a major act of economic sabotage, potentially costing billions of dollars (public health consequences would likely be mitigated by quarantine and clean-up).
- Attack consequences could be greatly exacerbated by use of multiple weapons.
Special Security Concerns in Las Vegas
- Proximity of “The Strip” to UP RR to Caliente
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Critical Uncertainty #1: Rail Access to Yucca Mountain

- DOE schedule for rail access is unrealistic
- Cost estimates are soaring for Caliente corridor, currently 2.5 times original estimate ($800,000,000 to $2,000,000,000 USD).
- A second corridor (Mina option) has its own unique set of issues and estimated cost of $1,600,000,000
- Difficult terrain, environmental impacts, stakeholder concerns, etc. increase rail construction uncertainties.
- Many shipments, early shipments, or all shipments, may be made by legal-weight truck (LWT)
Critical Uncertainty #2: Proposed TAD Canister System

- Uncertainties related to the DOE decision to adopt an integrated transportation, aging, and disposal (TAD) canister system.
  - Significant differences from concept detailed in Final EIS, verses implementation and deployment of TAD concept.
  - Utility company financial concerns may pose significant issues.
  - Incompatibility of TAD system with dry storage systems already in use or planned at reactor sites.
Critical Uncertainty #3: Instead of OFF, Hotter SNF May Ship First

- No commitment by DOE to ship oldest or older fuel first (OFF) as recommended by reports from State of Nevada, GAO and NAS.
- Standard Contracts allow utilities to ship hotter fuel first
- Industry trend toward higher burn-up SNF
- DOE technical specifications for TAD system encourage hotter fuel first
  - Initial enrichment up to 5%.
  - Reactor burn-up to 80 GWDt
  - Cooling time for SNF in shipments – 5 years.
- Significantly greater consequences for successful acts of terrorism, especially regarding release of Cesium–137 and other fission products
Critical Uncertainty #4: Intermodal Transfers & More LWT Shipments

- 23 reactor sites lack direct rail access
- These sites account for 32% of first 63,000 MTU SNF to be shipped to repository, 47% of SNF to be shipped to repository in first 5 years
- Potential for 2,200 or more Heavy Haul Truck and/or barge shipments; or 10,000 or more LWT casks on rail cars
- Vulnerability of intermodal transfer operations
- Increased number of shipments in LWT casks
Critical Uncertainty #5: Global Nuclear Energy Partnership

- The Global Nuclear Energy Partnership (GNEP) policy initiative is based on very different assumptions than the current Yucca Mountain project.
  - Reprocessing of civilian SNF would create new storage and transportation uncertainties.
  - Significant uncertainties regarding the compatibility of the TAD system and the GNEP concept.
  - Reprocessing facilities, and shipments to reprocessing facilities, could have greater symbolic target appeal and different attack vulnerabilities.
The study endorsed a number of specific measures for managing transportation risks:

- Risks can be reduced by shipping the older 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;
- Potential adverse social and economic impacts of repository shipments are important; 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; special government efforts will be needed to manage these social and economic impacts.
The general conclusions of the NAS study were:

- There are 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; and
- Malevolent acts (terrorism, sabotage, and theft) are a major technical and societal concern. Regarding malevolent acts, the NAS urged that an independent examination of security should be carried out before the commencement of repository shipments; and that objective information about security risks and countermeasures should be shared with elected officials and the public to the fullest extent possible.
The NAS also concluded that:

- Serious consideration should be given to taking the transportation program out of the DOE repository program, and perhaps out of DOE altogether.
  - While Nevada staff and consultants agree with most of the NAS concerns about the DOE institutional structure, Nevada has not endorsed this NAS recommendation because taking the transportation program out of DOE might result in less governmental oversight and less program accountability.
- Nevada strongly disagreed with one NAS recommendation:
  - NAS contended that DOE should proceed to construct “the Nevada rail spur” along the Caliente corridor.
  - NAS ignored Nevada concerns regarding
    - engineering feasibility,
    - adverse safety conditions,
    - and unacceptable environmental impacts.
  - Additionally NAS ignored evidence presented directly to the study committee that selection of the Caliente route would likely route significant numbers of rail shipments through downtown Las Vegas, less than one-mile from the Las Vegas Strip, resulting in unique adverse social and economic impacts, and requiring extraordinary planning and training for emergency response.
Emerging SNF Transportation Literature and Experiences with Terrorists

- London Assembly Report (British Safety and Security concerns with SNF transportation).
  - The report notes specific issues with: 1) routing and alternatives that minimize risks; 2) risk assessment issues; 3) the serious issues associated with integrated emergency preparedness; 4) the need for proactive monitoring in the event of routine and non-routine transport; 5) the need for better inspections and enforcement of statutory compliance; 6) the necessity of prearranged information protocols in the event of an incident; and finally 7) trackside security issues.

- Greenpeace sponsored Large and Associates Report.
  - The primary focus of this report identifies systematic vulnerabilities for fixed site and rail shipments in Great Britain. One observation is that terrorists would be intelligent enough to conduct secondary bomb or dual purpose attacks, the first attack being on SNF shipments directly and the second to delay response assets from addressing the incident scene in order to ensure maximum distribution of the radioactive plume.

- NATO sponsored research on power plant and transportation related attacks (unreleased to date) assesses several updated attack scenarios and analyses of cask vulnerabilities.
  - Based on the NATO study questions the two phase attack described in the U.S. Army 1983 peer review report and note this may underestimate current technical planning knowledge and tactical capabilities of known terrorist organizations in Chechnya, Iraq, and elsewhere. The NATO study divides the tactical aspects of a potential attack against nuclear waste transports into three phases: isolation events (stopping the transport vehicle – rail or highway); breach events (penetration or perforation of the cask); and dispersal events (use of a secondary device or devices to disperse cask contents).

- Israeli conflict in Lebanon, American experiences in Iraq, weapons technology.
Improved Terrorist Tactics and Improvised Explosive Devices
Realizing The New Threat Environment

- Suicide attackers and tactics.
- Insider assistance – voluntary or coerced.
- Hijack and control of cargo scenarios.
- Customized explosive devices.
- Diffusion of tactical and radiological knowledge (Web and training).
- Highly trained and battle hardened attackers.
- Knowledge and awareness of social and economic consequences of radiological incidents.
First Alternative Assessment Methodology

- Challenges to Planners
- Risk Reduction Strategies
- Critical Uncertainties
- Regulatory Issues

Categorical Precursory Analysis
First Alternative and Public Policy

1. Shelter SNF in place at production sites.
2. Ship to regional storage facilities.
3. Continue development of geologic repository facility.
“Day after” simulations

- Detailed Contingencies (Fives Years Hence)
- Range of Worst Case Characteristics
- Identification of Real World, Present Day Solutions for Future Problems
Conclusions

- Acknowledge vulnerability of shipping casks.
- Shelter the existing stocks of SNF in place for 30–50 years and ship older fuel first.
- Address shipment vulnerability through the repository transportation planning process.
- Use existing and emerging social scientific methodologies to assess threats and develop countermeasures.
- Use these methodologies to establish baseline data and conduct continuous comparative analysis over lifespan of the repository transportation program.