GOING THE DISTANCE? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States

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THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

Presentation to
Blue Ribbon Commission on America's Nuclear Future
November 2, 2010

Background

- Report issued in February 2006
- Tasking
  - Assess risks of spent nuclear fuel (SNF) and high-level radioactive waste (HLW) transport in the United States
  - Identify key technical and societal concerns for SNF/HLW transport, now and in the future, and recommend actions to address those concerns
  - Assess the manner in which DOE selects routes for shipment of research reactor SNF between its facilities and recommend improvements

Principal Finding/Transport Safety

- The committee could identify no fundamental technical barriers to the safe transport of SNF/HLW in the United States
- Transport is a low-radiological-risk activity when conducted in strict adherence with existing regulations
  - Highway for small-quantity shipments
  - Rail for large-quantity shipments

What do We Know About Transportation Safety?

- Quite a bit, based on:
  - Four decades of real-world experience
  - Increasingly sophisticated analytical/computer modeling of severe accident conditions
  - Full-scale package testing under severe accident conditions

SNF Transport Experience

- United States
  - ~3,000 MTHM (1960s-2005)
  - Mostly by highway
  - Some cross country (research reactor fuel)
- Worldwide
  - 73,000-98,000 MTHM (1960s-2001)
  - Mostly Europe
  - Mostly by rail, but also by highway and sea
  - Mostly short distances (≤ 1000 km)

Full-Scale Testing

- Sandia National Lab Crash Tests (1977)
  - Tractor-trailer, rail-grade crossing, railcar impact tests
  - ~60 and/or 80 mph, one test included a fire

Sandia National Laboratories

Modeling of Severe Accidents

1984 tunnel fire near Manchester, England

www.todchat.com

Principal Finding/Transport Security

- Malevolent acts against SNF/HLW shipments are a major technical and societal concern
- An independent examination of transportation security should be carried out prior to the commencement of large-quantity shipments to a federal repository or to interim storage

Health and Safety Risks

- Radiological health and safety risks associated with the transport of SNF/HLW are well understood and generally low …
- … With the possible exception of risks from releases in extreme accidents involving very-long-duration fires
- The likelihood of such extreme accidents appears to be very small, and their occurrence and consequences can be further reduced through relatively simple operational restrictions

Health and Safety Risks (continued)

- The Nuclear Regulatory Commission should undertake additional analyses of very-long-duration fire scenarios that bound expected real-world accident conditions … and implement operational controls and restrictions as necessary to reduce the chances that such conditions might be encountered in service

Social Risks

- Social risks (i.e., risks to social well-being) pose important challenges to SNF/HLW transportation programs in the United States
  - Arise from social processes and perceptions
  - Can be difficult to characterize
- Take early proactive steps to establish formal mechanisms for gathering advice about social risks and their management

Improving SNF/HLW Transportation in the United States

- Many of the findings/recommendations in the report focus on DOE's program to transport SNF/HLW to Yucca Mountain
- But they also apply to other large-quantity shipping programs
  - Private Fuel Storage
  - Future interim storage facilities

Rail vs. Highway Transport

- Transport of SNF/HLW by rail has clear safety, operational, and policy advantages over highway transport for large-quantity shipping programs
  - Reduces number of shipments
  - Provides greater separation from vehicular traffic and people
  - Operational logistics are simpler
  - Clear public preference for rail
  - But not all SNF storage sites have rail access

Dedicated vs. General Trains

- There are clear advantages that favor the use of dedicated trains for shipping SNF/HLW
  - SNF/HLW transport by dedicated trains is common in the U.S. and many other countries
  - Reduced transit time = lower exposures, faster turnaround, requires fewer packages and transporters
  - Simplifies operational security

Order of Shipping SNF

- DOE should negotiate with commercial spent fuel owners to ship older fuel first to a federal repository or federal interim storage … should these negotiations prove ineffective, Congress should consider legislative remedies
  - DOE has authority to accord priority to acceptance of SNF from shut down reactors
  - Otherwise must accept SNF designated by owner
  - Could result in logistically complex movements of radiologically active spent fuel

Pilot Program for Shipping SNF

- Initiate transport to the federal repository through a pilot program involving relatively short, logistically simple movements of older fuel from closed reactors
  - Would allow for optimized routing, scheduling, and emergency responder planning and training
  - Treat as a pilot program to gain experience and build public confidence

Organizational Responsibilities

- The DOE Secretary and the U.S. Congress should examine the following options for changing the organizational structure of DOE's program for transporting SNF/HLW to a federal repository to increase its chances for success:
  - Quasi-independent DOE office
  - Quasi-government corporation
  - Fully private organization operated by the commercial nuclear industry
- Objectives: provide greater planning authority and budget flexibility to make multiyear commitments

Closing Thoughts

- Transportation is an essential element of SNF/HLW management systems--needs to be built in from beginning
- Design for rail using dedicated trains
- Involve state, tribal, and local governments in route selection/emergency response
- Develop pilot programs to gain experience and demonstrate competence