Spent Nuclear Fuel Transportation has an enviable safety record

- The U.S. nuclear energy industry has completed more than 3,000 shipments of spent nuclear fuel over the past 40 years;
- Internationally, there have been more than 7000 shipments of used fuel (over 80,000 metric tons) over many millions of kilometers by land and sea.
- Although there have been accidents, none of those shipments have ever released any of their radioactive cargo, and no injuries, fatalities or environmental damage as a result of the SNF being shipped.

In 2006, The National Research Council’s’ Committee on Transportation of Radioactive Waste found:

- There is no fundamental technical barrier to the safe transport of spent fuel in the U.S.
- U.S. regulations are adequate to ensure package containment effectiveness over a wide range of transport conditions
- The accident risk associated with spent fuel shipments is more than three orders of magnitude less than for some other common hazardous materials.

Furthermore, the study performed by the National Research Council found that a hundred shipments of SNF is thousands of time less risky than shipments of other common hazardous materials.

When the low risk per shipment of SNF is combined with the even lower frequency of shipments, the overall risk from SNF transportation is extremely low.
SNF Transport Planning

So, given the exemplary safety record of SNF shipments to date, the low risk associated with each shipment and the very low number of shipments, is any work necessary to address SNF transportation safety prior to beginning shipments to a consolidated storage facility?

Well, yes, there is.

- The SNF transport safety record to date is due to extraordinary care by both the industry and its regulators.
- That standard of care has been applied to the hardware and processes in use today, but:
  - Future shipments will face new requirements and operational challenges not yet experienced.
  - Addressing new requirements and challenges with the same standard of care as current SNF transportation activities will ensure the enviable safety record continues.

Challenges to Maintaining the Enviable SNF Transportation Safety Record

There are aspects of shipping commercial SNF from dry storage that have not been previously addressed. Using the Limited throughput of a pilot Centralized Interim Storage Facility (CISF) as the training platform would facilitate addressing these first time issues in a staged and adaptive manor:

- First time domestic use of a new generation of large, rail transportation casks;
- Providing federal funds for training and technical assistance to public safety officials as required by Section 180(c) of the Nuclear Waste Policy Act (NWPA);
- Loading these transport casks with large SNF canisters at shutdown sites where operating power plant infrastructure no longer exists;
- Managing the operational logistics for 6 special rail cars that won’t fit onto most shutdown reactor sites;
- Dealing with multimodal shipments for transport away from many shutdown sites that no longer have rail access;
- First time use of new route selection regulations for shipment of commercial SNF by railroads.

None of these issues are show stoppers, but doing too many new things at once can be distracting and that can compromise safety.
Challenges to Maintaining the Enviable SNF Transportation Safety Record

First time use of large, new generation rail casks for commercial SNF shipments. Tests of previous generation truck casks were performed by in the 1970s by crashing a locomotive into a cask on a truck trailer. The results offered important benchmarking data for modeling.

- Stakeholders have pressed for full scale testing of the new generation of casks before use. The NRC deferred their test plan for a serious hypothetical accident involving one of these casks until DOE could contribute support for the test and until one of the new generation casks became available.
- The NRC test protocol should be dusted off and updated;
- DOE should procure a representative cask for the testing and results should be thoroughly documented;
- Ideally, the package performance test would be combined with an emergency response exercise to provide real crash scene experience for emergency responders;

The Nuclear Waste Policy Act (NWPA) requires federal financial support and technical assistance for public safety officials along the transportation corridors. This has never been done for commercial SNF shipments.

- DOE Published a draft Rule for implementing this funding mandate in 2008. In that Draft Rule, a commitment was made to initiate funding 3-5 years before the first shipment.
- DOE needs to publish its final rulemaking and initiate the planning grants well before shipments are expected to start.
- Managing a large grant process with overlapping jurisdictions and mutual support agreements is likely to be fraught with start-up challenges. Testing the process with the lower throughput and fewer shipping sites included in a CISF is an ideal way to begin the process.
- Although SNF shipments present lower risks than many other hazardous materials commonly moved, emergency responders in many states don’t have any experience with them. A learning curve will be involved until the relative risks and response protocols are better understood.
Challenges to Maintaining the Enviable SNF Transportation Safety Record

Loading large rail transport casks with SNF canisters at decommissioned shutdown sites has never been done before.

- While not technically challenging, loading transport casks using portable cranes with no fixed shelter is different than loading SNF canisters into casks from a pool at an operating plant. NAC has loaded SNF w/o site facilities.
- Although equipment exists to facilitate these transfers, thorough training of operators and close coordination between cask vendors, crane operators and utility staff will be critical.
- Using a comparatively low volume, low throughput CISF workload (18 versus 58 shipments/year) to test these loading processes thoroughly before trying to manage transport of 3,000 MTHM/year to a repository makes excellent sense.

Processes and agreements need to be established for operating & storing 6 special rail cars that won’t fit onto most shutdown reactor sites while waiting for transport casks to be loaded

- New rail cars have to be developed and tested to meet AAR S-2043 requirements. Protocols for real-time monitoring these rail cars have not yet been developed.
- High capacity rail cars meeting the AAR S-2043 235 spec are long. A flat bed 12 axle car with 300 ton capacity is 78’ between pulling faces.
- A standard DOE shipment of 3 cask cars, 2 buffer cars and 1 escort car requires over 400’ of parking space. That isn’t available at most shutdown reactor sites.
- Making these arrangements and conducting Table-Top coordination exercises before shipments begin will ensure safe operations continue.
Dealing with Multi-Modal Shipments from Sites that no Longer Have Rail Access

Identifying viable intermodal transfer points for shifting casks from heavy haul trucks to rail cars will be a challenge for these cargoes.

- Large, intermodal facilities exist in the US, but are not conveniently located near nuclear power plants.
- It is likely that procedures and portable equipment for making SNF cask transfers from trucks to trains will be needed.

Again, using low volume shipments to a CISF to pilot these efforts will be very helpful for eventual large scale shipping campaigns to a repository.

Rail Routing Criteria in 49 CFR 172.820 have never been used for Commercial SNF Shipments

States and Tribes along potential transportation corridors have expressed an interest in participating in routing decisions.

- The protocols, timing and roles for states and tribes in selecting routes for rail shipment of commercial SNF have not been developed.
- Selection of routes will affect DOE’s funding for emergency response training. That funding is required 3-5 years before the first shipment.
- Once again, using the constrained shipment volume required for a pilot CISF as a test case for resolving these issues will markedly improve high volume shipments to a repository when it opens.
As the National Academy of Sciences aptly noted in 2006, there are no fundamental technical barriers to the safe transport of spent fuel in the U.S.

- That said, transportation safety is the result of both technical and human aspects of operations. Human errors are more likely when doing unfamiliar tasks. Training on new processes, procedures and equipment required for transporting canistered SNF from shutdown sites to a centralized storage facility is needed so they become as familiar as current operations.

- Providing operational oversight to ensure the new policies and procedures are adhered to will also be important to maintaining our excellent SNF transportation safety record.

- Using the low volume shipment operations of a pilot CISF as a test case to conduct this training will resolve any issues long before high volume shipments to a repository begin.

- NAC International has the transportation operational experience and the hardware needed to conduct both the training and the operations from many of the shutdown & decommissioned nuclear plants that are the priority in DOE’s Nuclear Waste Management Strategy.