



Spent Fuel Transportation Risk Assessment (SFTRA) Draft NUREG-2125

An Overview for the
SFST Regulatory Conference
Sept. 12, 2012

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SFTRA Purpose and Goals

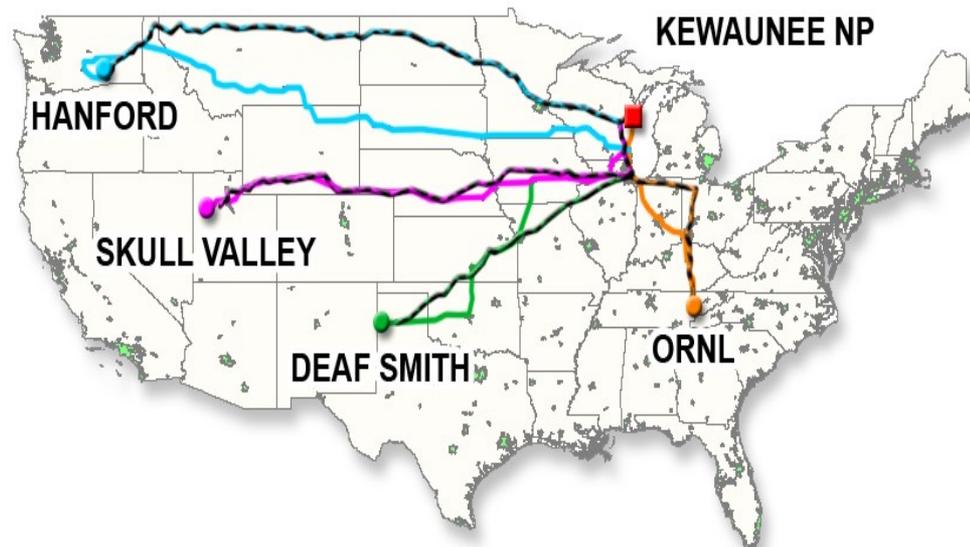
- Continuing review
 - Final Environmental Statement (NUREG-0170, 1977)
 - “Modal Study” (NUREG/CR-4829, 1987)
 - Reexamination of Spent Fuel Shipment Risk Estimates (NUREG/CR-6672, 2000)
- NRC’s safety mission
 - Considering public comment, provide updated basis for NRC’s safety regulations applicable to spent fuel transportation
- Outreach responsibilities
 - Reassure public regarding spent fuel shipments
 - Basic message: Risks are low, so safety is high
 - Improve public understanding and acceptance of spent fuel shipments
- Potential shipments
 - Significant issue when study began (2006) – much less so now (post Yucca Mtn curtailment)
 - Applicable to future shipments
- SFTRA is a generic risk assessment, not
 - Specific to any facility
 - Driven by any external requirement or commitment
 - An EIS or major federal action
 - Required for any licensing action, nor does it contain any regulatory proposals
 - An analysis of transport security

SFTRA Basic Methodology

- Radiological impacts of spent nuclear fuel (SNF) shipments
 - Routine conditions
 - Determine doses to various populations from cask during routine transport
 - Accident conditions
 - Perform finite element analysis of cask response to impact and thermal accident conditions
 - HOLTEC HISTAR-100, NAC STC, GA-4
 - Use “event trees” developed by U.S. DOT to estimate probabilities of accident conditions
- Use RADTRAN to calculate routine doses and accident dose risks for representative truck and rail shipments
- Approach similar to that in NUREG-0170 and NUREG/CR-6672

Example Routes

Kewaunee NP Routes



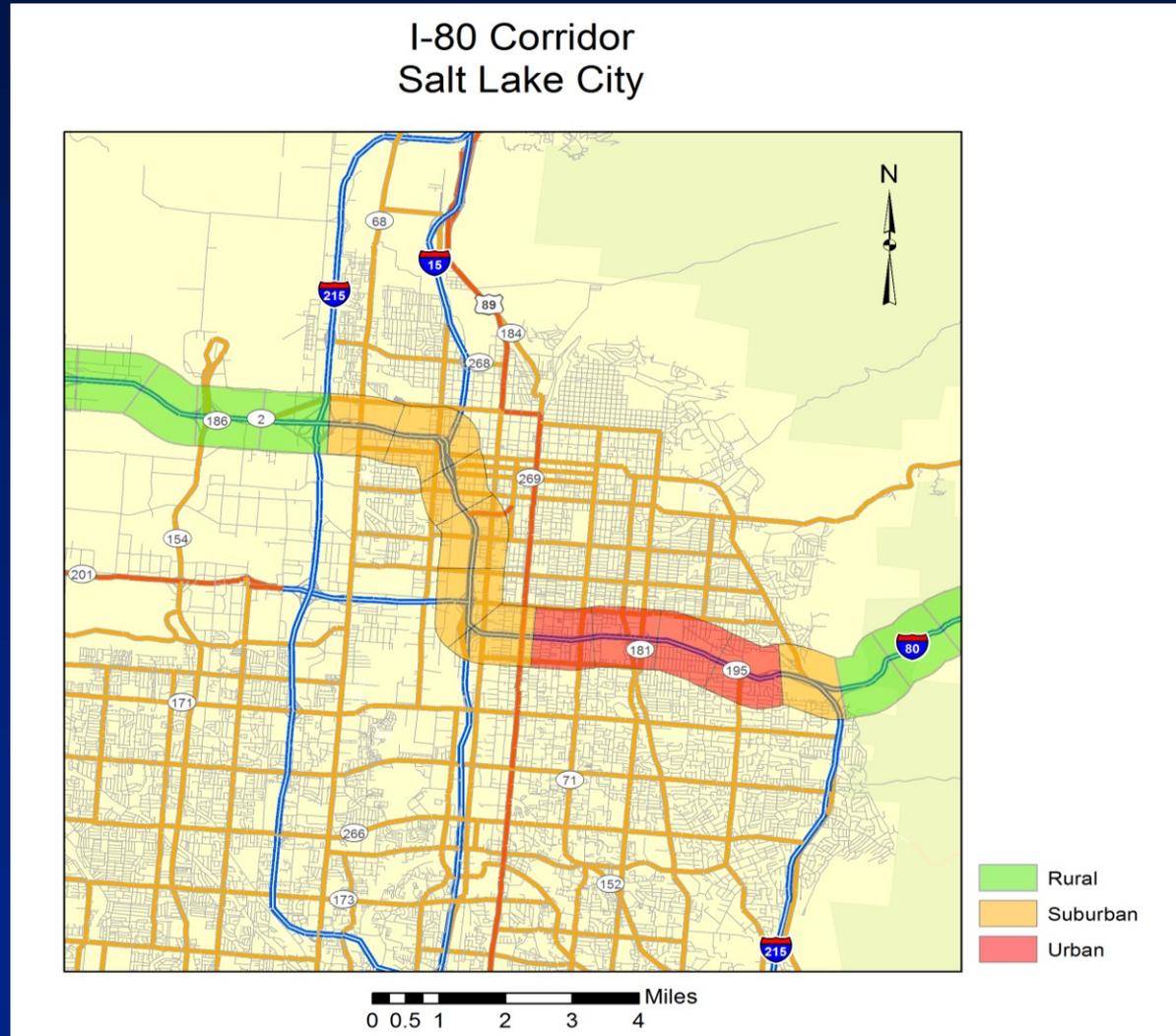
Maine Yankee NP Routes



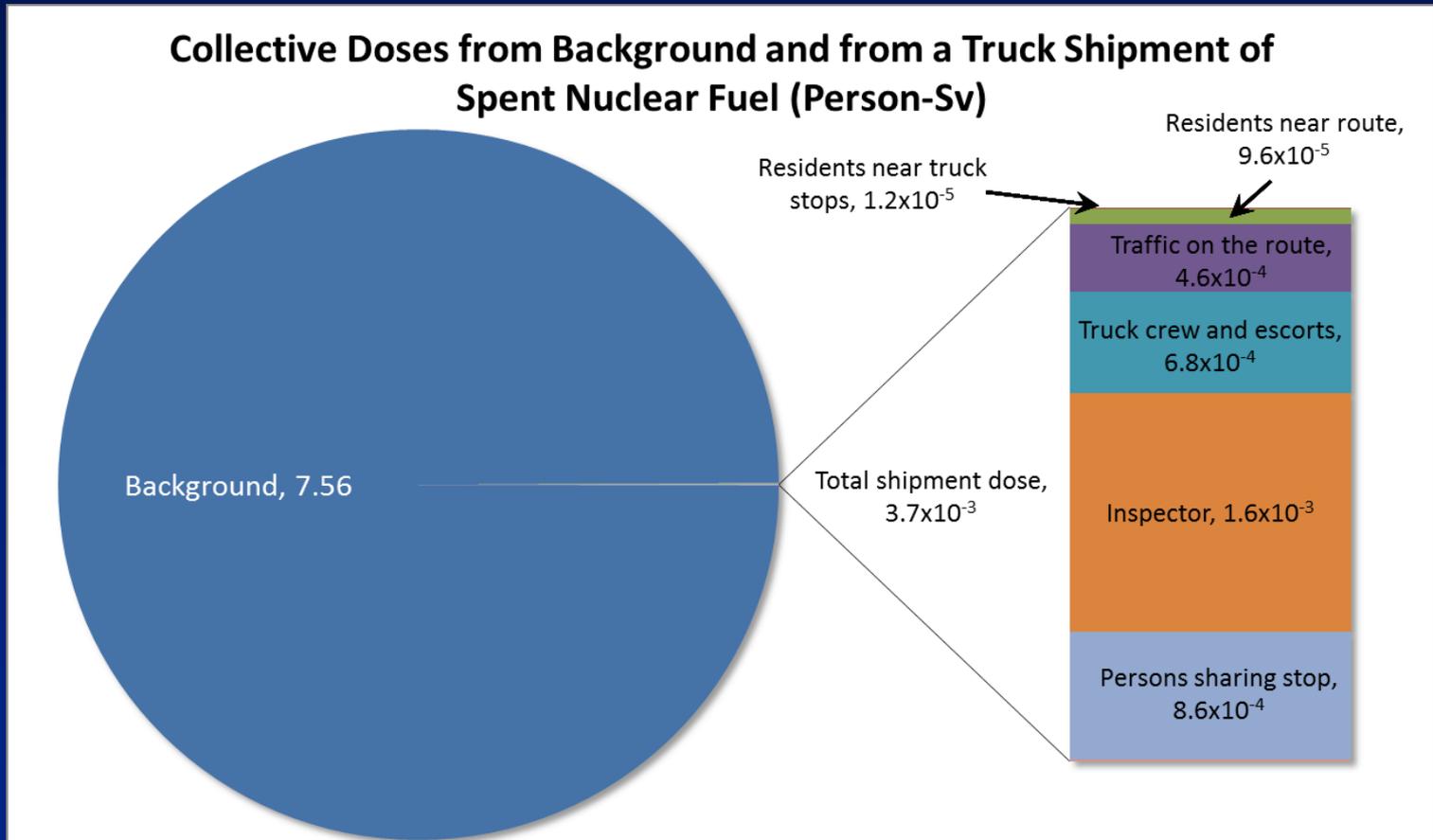
These routes represent a variety of route lengths and populations. They include the eastern and western states, and cross-country routes.

Example Truck Route Segments

WebTRAGIS was used to determine the urban, suburban, and rural segment population densities and lengths on a state-by-state basis.

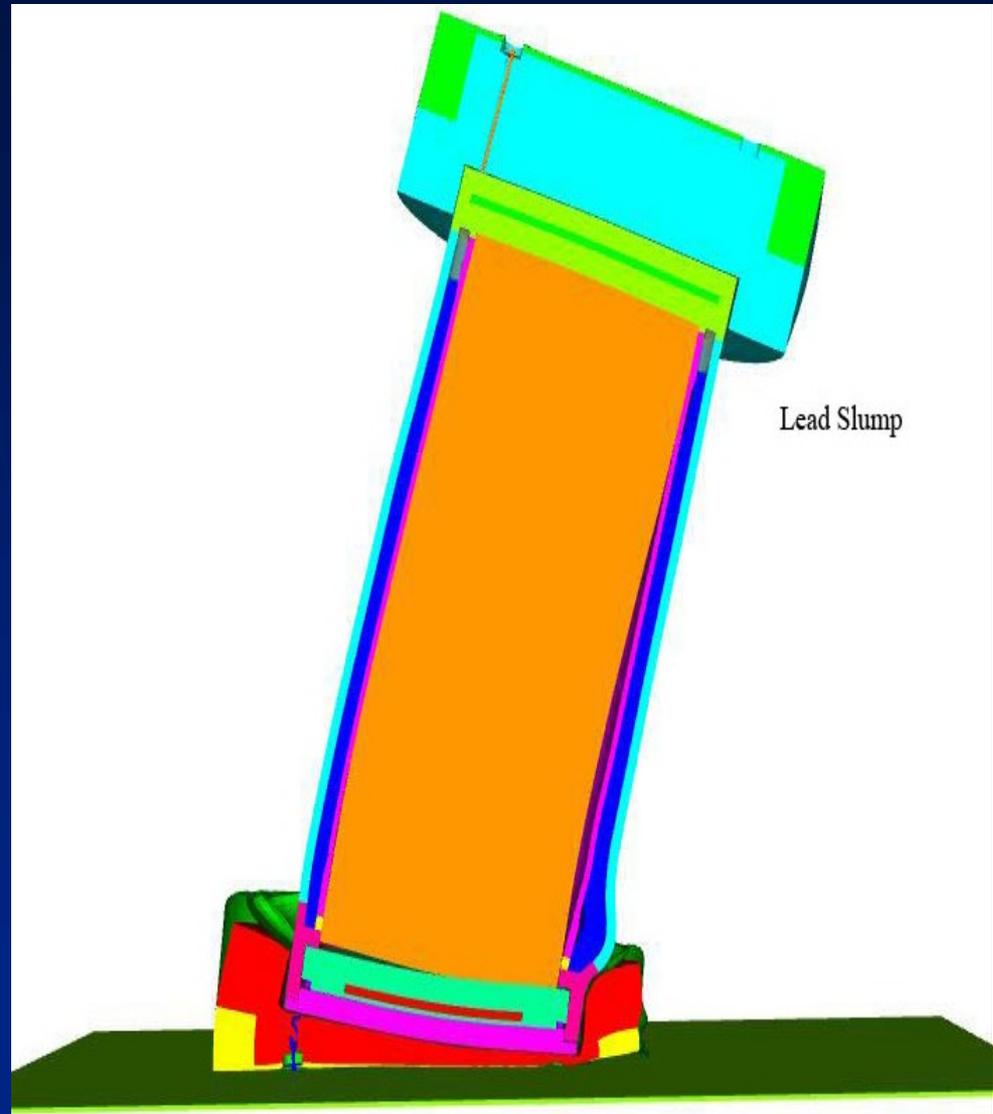


Results from Routine Transportation: Example for Maine Yankee to ORNL truck shipment



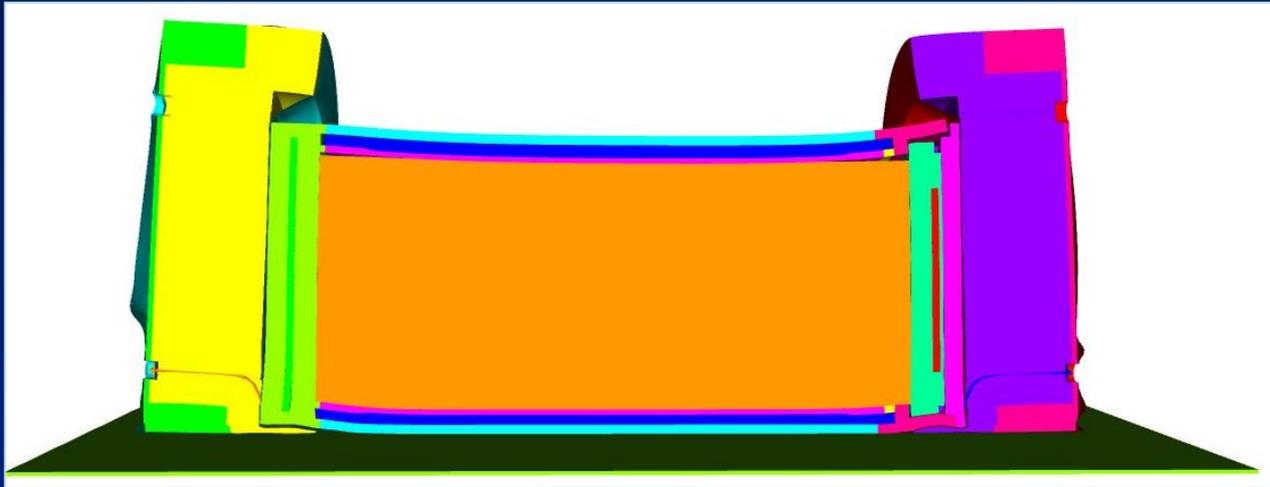
Rail-lead cask impact analysis

- Deformed shape of the rail-lead cask following the 120 mph impact onto a rigid target in the corner orientation
- No leak-path is formed so there is no release of contents



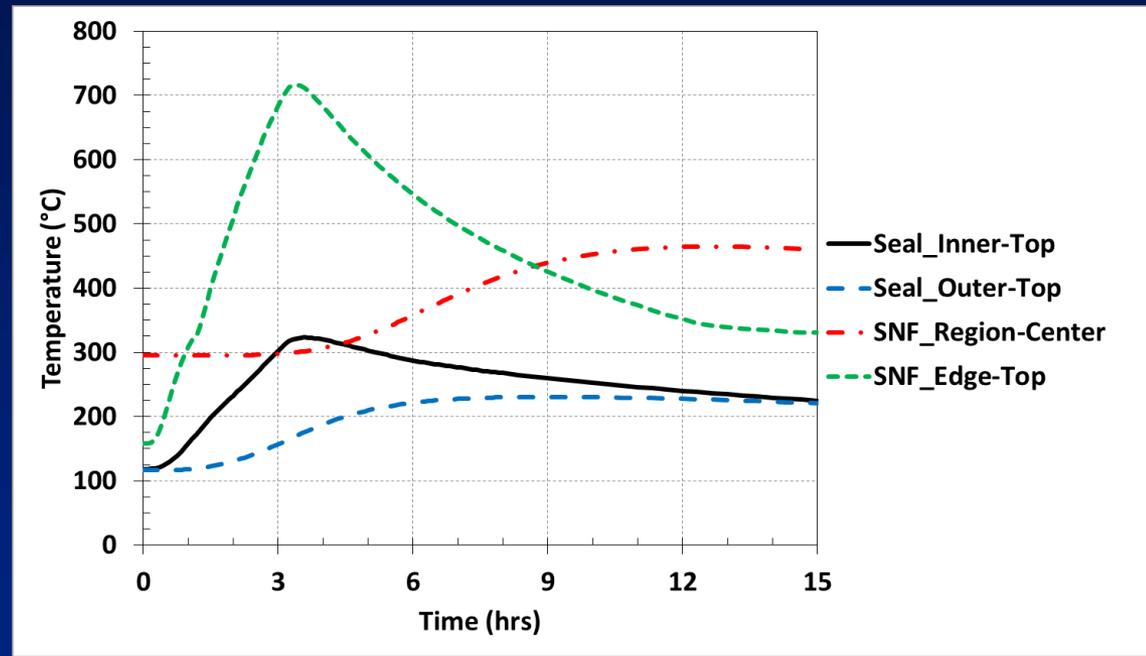
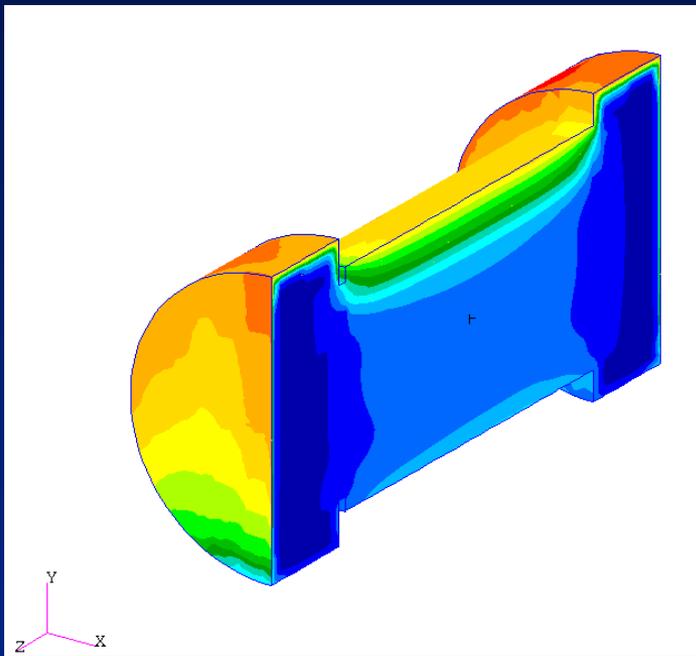
Rail-lead cask impact analysis

- **Side orientation 90 mph impact onto a rigid_target**
- **Only cask and orientation resulting in a leak-path**
 - no leak-path if fuel is loaded in an inner welded canister



- **Side orientation 60 mph impact onto a rigid_target**
 - No leak path, but
 - The risk assessment assumes impacts into hard rock (5%) above 50 mph result in a leak-path
- **Side orientation impacts at any recorded accident velocity onto targets softer than hard rock do not result in a leak-path**

Rail-lead cask fire accident After 3-hour concentric fire:

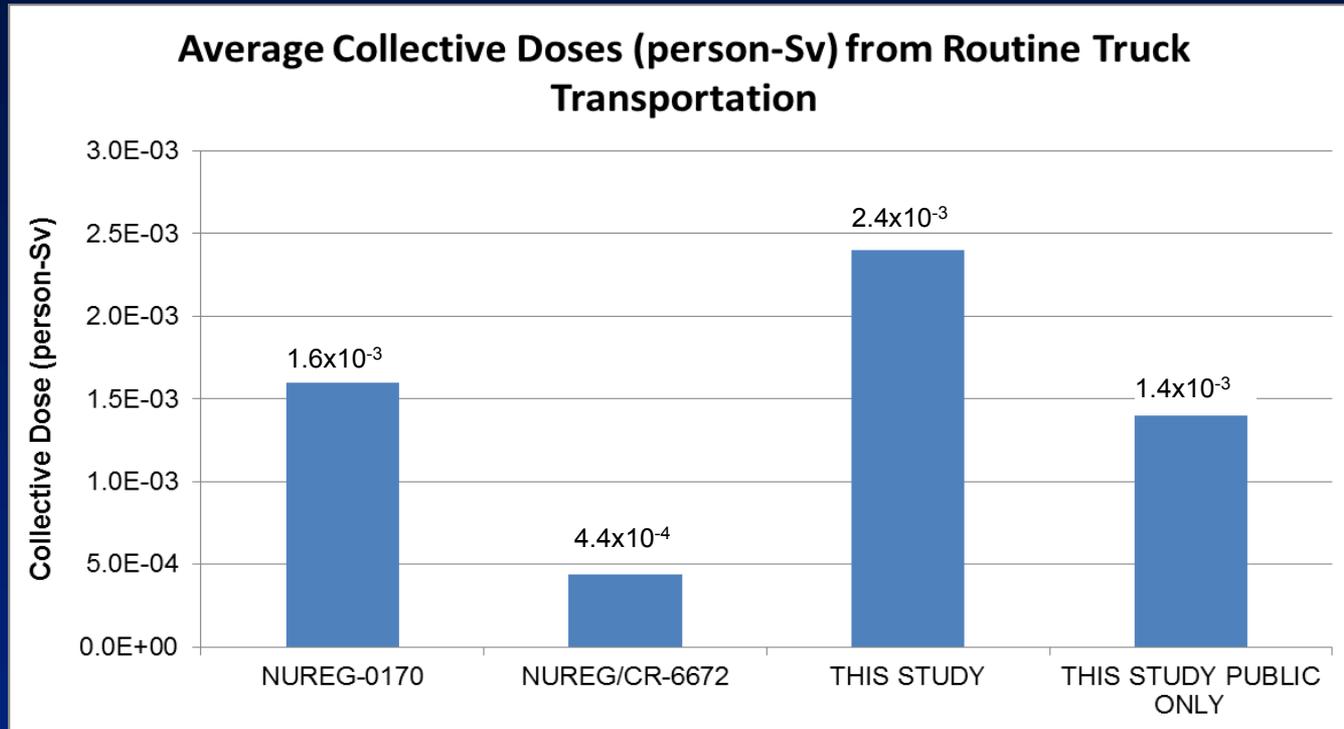


- Seal temperature is below its failure temperature of 350°C.
- Spent fuel temperature is below the rod-burst temperature of 750°C.

Accident Conditions: U.S. DOT Rail Accident Event Tree Segment

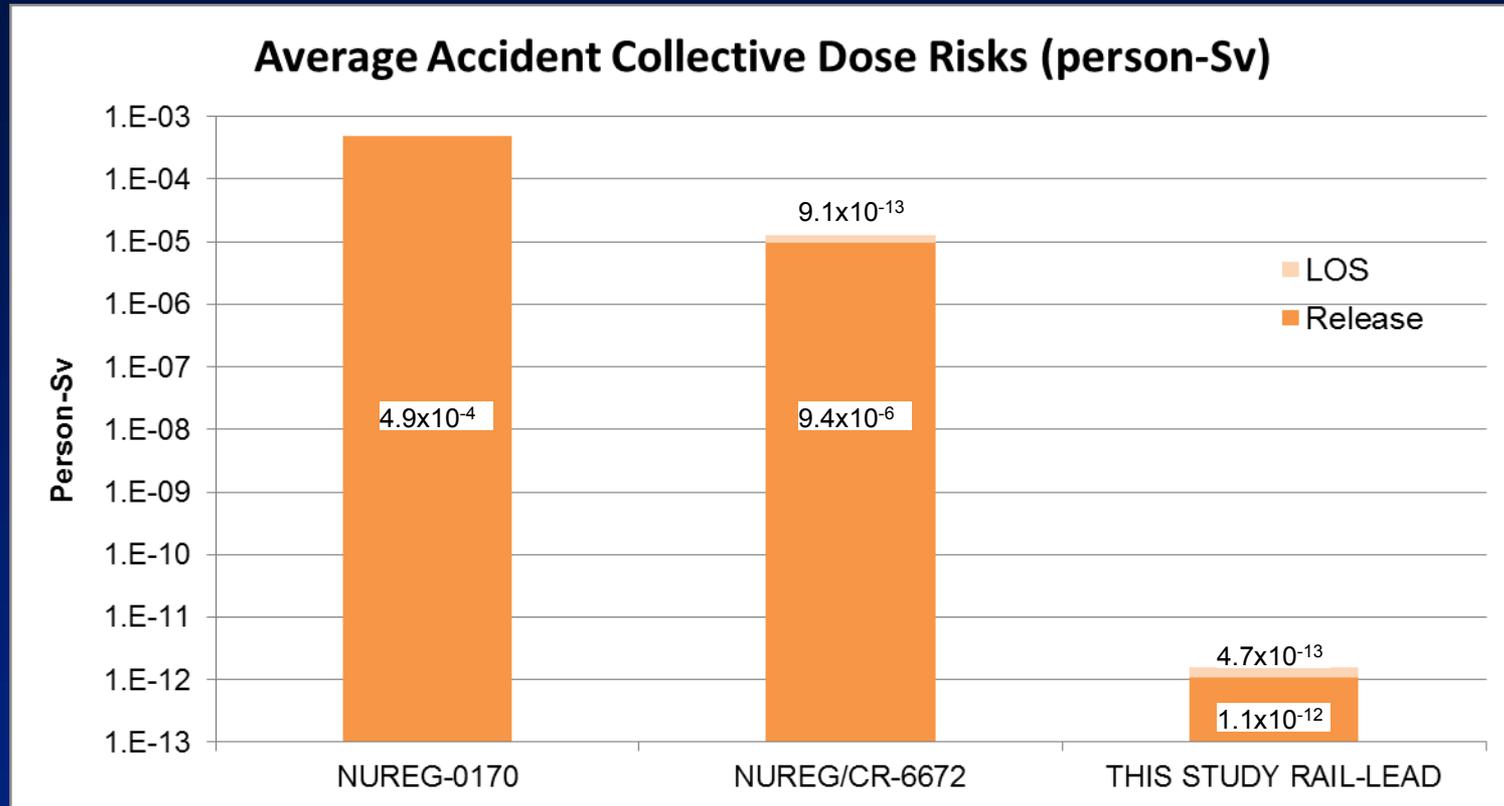
Rail Event Tree								
ACCIDENT	SPEED DISTRIBUTION		SURFACE STRUCK	PROBABILITY				
Derailment: 0.7355	Derailment no fire: 0.9846	80-113 kph collision: 0.06043	Into slope: 0.0011	4.76e-5				
			Embankment: 0.0004	1.73e-5				
			Off bridge: 0.9887	Into structure: 0.0077	0.000333			
			Into tunnel: 0.00801	0.000347				
			Other: 0.9828	0.04252				
			On bridge: 0.0113		0.00049			
			Derailment: 0.7355	Derailment no fire: 0.9846	>113 kph collision: 5.01e-5	Into slope: 0.0011	3.95e-8	
						Embankment: 0.0004	1.43e-8	
						Off bridge: 0.9887	Into structure: 0.0077	2.76e-7
						Into tunnel: 0.00801	2.87e-7	
Other: 0.9828	3.53e-5							
On bridge: 0.0113		4.10e-7						

Routine Transportation Results Comparison:



- Increase for “THIS STUDY” is due to more frequent and longer stops for fueling; greater density of people sharing the stop; increased population densities, and increased vehicle densities.
- “PUBLIC ONLY” dose excludes inspectors, crew, and stop workers.

Accident Results Comparison



- Lower dose risks in this study are due to better performance of certified casks vs. generic casks; a correction to the resuspension model leading to lower resuspension dose; and updated event trees reflecting fewer severe accidents.

- Casks with welded inner canister have no release (not depicted).

SFTRA Findings

- The collective dose risks from routine transportation are very small. These doses are about four to five orders of magnitude less than collective background radiation dose over the same time period and exposed population as the shipment.
- Radioactive material would not be released in an accident if the fuel is contained in an inner welded canister inside the cask.
- Only rail casks without inner welded canisters would release radioactive material, and only then in exceptionally severe accidents.
 - Given an accident during such shipment, there is about a one in a billion chance the accident would be severe enough to result in a release of radioactive material.
 - If there were a release, the dose to the maximum exposed individual would be non-fatal.



SFTRA Conclusions

- This study reconfirms that estimated radiological risks from spent fuel transportation *conducted in compliance* with NRC regulations are low, in fact generally less than previous estimates, which were already low.
- Accordingly, for spent fuel transportation, the regulations for transportation of radioactive material are adequate to protect public health and safety.
- No changes are needed to the regulations for spent fuel transportation.



Draft NUREG-2125 published for comment

- Federal Register Notice: **77 FR 28406**, May 14, 2012
 - ADAMS Accession Number for Draft NUREG-2125 : **ML12125A218**
 - Public comment period closed on July 13, 2012
- 95 Comments from 4 commenters
 - Mostly non-technical
 - Many not specific to SFTRA or beyond its scope
 - One error identified
 - Comment resolution underway



Next steps

- Presentation to Advisory Committee on Reactor Safety (ACRS) Subcommittee on Nuclear Materials September 18, 2012
- Presentation to ACRS (full committee) on December 6, 2012
- Publication of Final NUREG-2125 in early 2013
- NUREG-2125 may assist staff's future efforts to consider risk-informing regulatory procedures and guidance