Hamilton, Brandi

From: Brown, Christopher
Sent: Thursday, September 13, 2012 8:42 AM
To: Hamilton, Brandi
Subject: FW: Draft SFTRA presentation for review/comment
Attachments: SFTRA_ACRS_subcommittee_Sept-6-Rev2.pptx

From: Cook, John
Sent: Friday, September 07, 2012 8:33 AM
To: Brown, Christopher
Subject: Draft SFTRA presentation for review/comment

Good morning Christopher-

Thanks for offering to review our draft slide package (attached). Note that we are still doing some tweaking.

There are a total of 77 slides in the package; however, we have an "outline" slide that is repeated 7 times to delineate the current of the 7 presentation topics. We also have included 13 backup slides in the presentation within the topic where they might be used (and are shown with white, instead of blue, background), so we really have 55 content slides (not including the Title and Agenda slides). Note slide 32 has an embedded video clip, and another clip will be added to slide 46.

We appreciate your time in reviewing our presentation. We would greatly appreciate any suggestions or comments you might have. In particular:

- Should any of our backup slides be changed to presentation slides (change from white background to blue), or vice versa?
- We're thinking of moving (or perhaps copying) the finding and conclusion slides (#66 & 67) up to the beginning, perhaps after slide 7. Do you think this would be an improvement?
- Are any of the slides unclear?
- Are you aware of any particular topics of interest regarding SFTRA among the subcommittee members?

Thanks again.

-John

A|4

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

Presentation to the
Advisory Committee on Reactor Safeguards
Subcommittee on Radiation Protection
and Nuclear Materials

Sept. 18, 2012

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Agenda

Item	Topic	Presenter(s)	Time
1	Opening Remarks and Objectives	Dr. Michael Ryan, ACRS	8:30 – 8:35 a.m.
2	Draft NUREG-2125 Background	John Cook, NMSS	8:35 – 9:00 a.m.
3	Draft NUREG-2125 Method and Results	Dr. Douglas Ammerman, SNL	9:00 – 10:00 a.m.
4	Break		10:00 – 10:15 a.m.
5	Draft NUREG-2125 Method and Results (continued)	Dr. Douglas Ammerman, SNL	10:15 – 11:15 a.m.
6	Public Comment and Proposed Resolution	John Cook, NMSS Dr. Douglas Ammerman, SNL	11:15 – 11:45 a.m.
7	Committee Discussion	Dr. Ryan, ACRS	11:45 a.m. – 12:00 p.m.
8	Adjourn		12:00 p.m.

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Outline[j16]

- Background and introduction
- Risk analysis of routine transportation
- Cask response to impact accidents
- Cask response to fire accidents
- Risk analysis of transportation accidents
- Findings and conclusions
- Public comments and resolution
- Major differences from previous risk studies
- How SFTRA can be used

Slide 3

j16 For each slide, particularly in topics 2-5, need to add speaker notes on what the point of the slide is.
jrc1, 8/27/2012

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SFTRA Research and Review Teams

- NRC Project Manager – John Cook
- Sandia National Laboratory Research Team [9/06-9/12]
  - Doug Ammerman – principal investigator
  - Carlos Lopez – thermal
  - Ruth Weiner – RADTRAN
- NRC's SFTRA Technical Review Team
  - Gordon Bjorkman – structural
  - Chris Bajwa – thermal and overall content
  - Bob Einziger – fuels, source term
  - Anita Gray – health physics
- Oak Ridge National Laboratories External Peer Review Team [9/10-3/12]
  - Matt Feldman
  - Cecil Parks
  - et al.

SFTRA Purpose and Goals

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- 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
  - Method applicable to future shipments, may need to consider different casks, long-term aging of canisters, and high burn-up fuel
- SFTRA is a generic SNF transportion risk assessment and is not
  - 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

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SFTRA Basic Methods

- 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
    - 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

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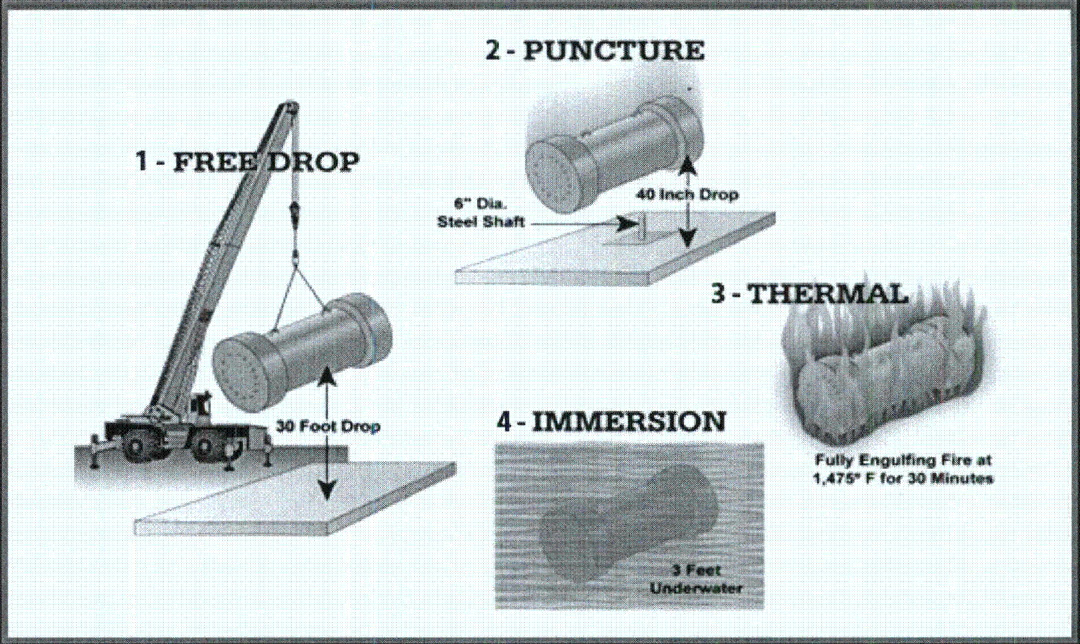
How did this study differ from previous NRC risk studies?

- This study utilized certified casks instead of generic casks.
- This study used updated accident event trees instead of relying on accident data from the 1970s.
- This study performed detailed 3D finite element analyses of the thermal events.
- This study used more detailed finite element models for the impact events.
- This study considered the accidents that do not damage the cask as long-duration stops.

Use of certified casks

- Prior generic risk assessments have used generic casks.
- This assessment uses casks that have been certified to meet the requirements of 10 CFR Part 71.



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Casks selected

- The Holtec HI-STAR 100, a steel-shielded rail cask transported with an inner welded canister
- The NAC STC, a lead-shielded rail cask transported with direct loaded fuel or with an inner welded canister
- The GA-4, a DU shielded truck cask
- These selections encompassed all the gamma shielding types, both common modes of transport, the use of inner canisters, three different cask vendors, and modern casks that could be used in any future large-scale transportation campaign

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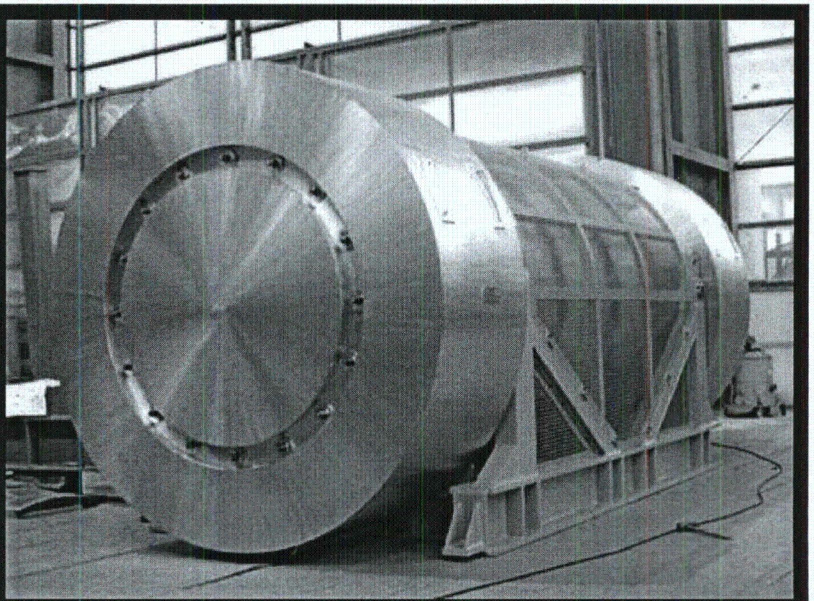
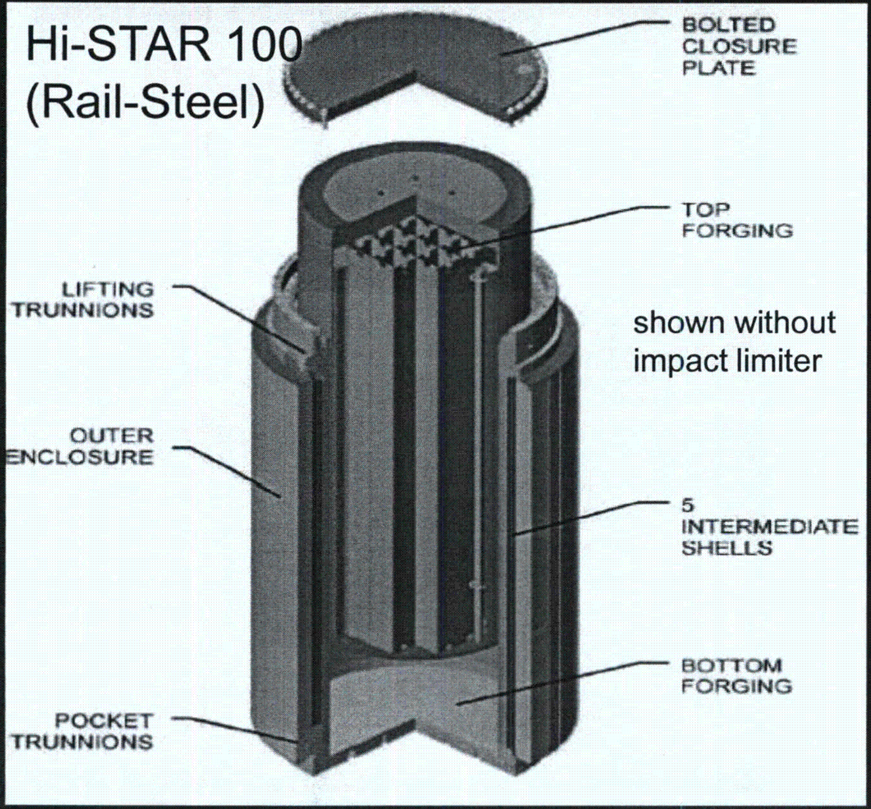
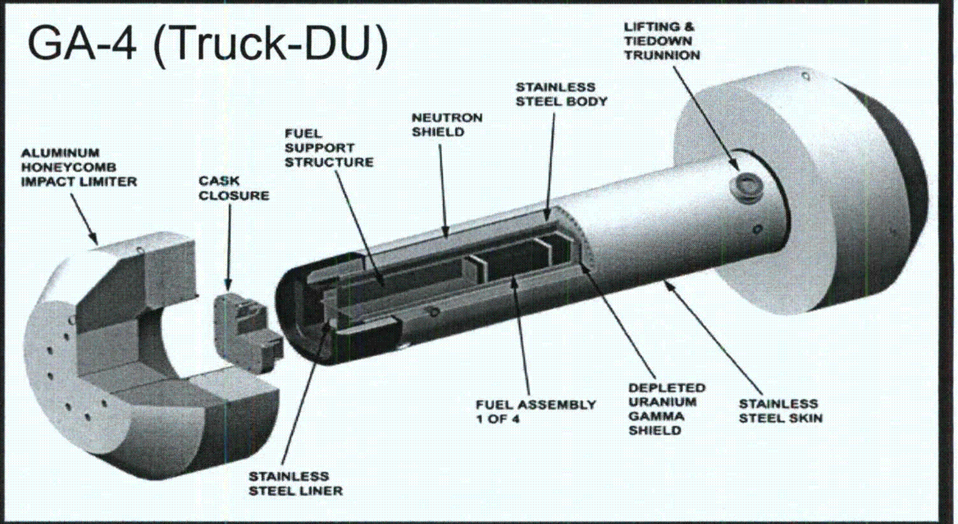
Cask illustrations

NAC STC
(Rail-Lead)







- Each cask represents a type (Rail-Lead, Rail-Steel, Truck-DU)
- Casks of the same type would perform similarly

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Investigated example routes

- Example routes do not represent current or planned transportation campaigns

Origin	Destination
Maine Yankee	ORNL
Kewaunee	Deaf Smith
Indian Point	Hanford
INL	Skull Valley

- WebTRAGIS routing code determines rail and highway routes and exposed populations
- Rail casks only by rail (no heavy haul or barge), truck casks by legal weight truck (no overweight truck or rail)

Report Structure and Format

- Audience
  - Public, state and tribal governments, elected officials, federal agencies, industry, and media
- Graded structure and content
  - Executive Summary and Public Summary - all audiences
  - Main body text - informed public, science media
  - Appendices - industry, other federal agencies
- Electronic and printed versions
  - NRC ADAMS Accession Number: **ML12125A218**
  - Printed Draft NUREG in black and white only (CD inside back cover contains color version)
  - Final NUREG in full color

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Outline

- Background and introduction
- **Risk analysis of routine transportation**
- Cask response to impact accidents
- Cask response to fire accidents
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External radiation from casks

- The maximum permitted dose rate is 10^{-4} Sv/hour at 2 meters from the cask, or about 1.4 x 10^{-4} Sv/hour at 1 meter (input to RADTRAN).
- The external dose rate at one meter from each of the casks was the maximum value from its Safety Analysis Report, 1.03 x 10^{-4} Sv/hour for the HI-STAR 100 and 1.4 x 10^{-4} Sv/hour for the other casks.
- The total dose to each receptor is calculated by RADTRAN.

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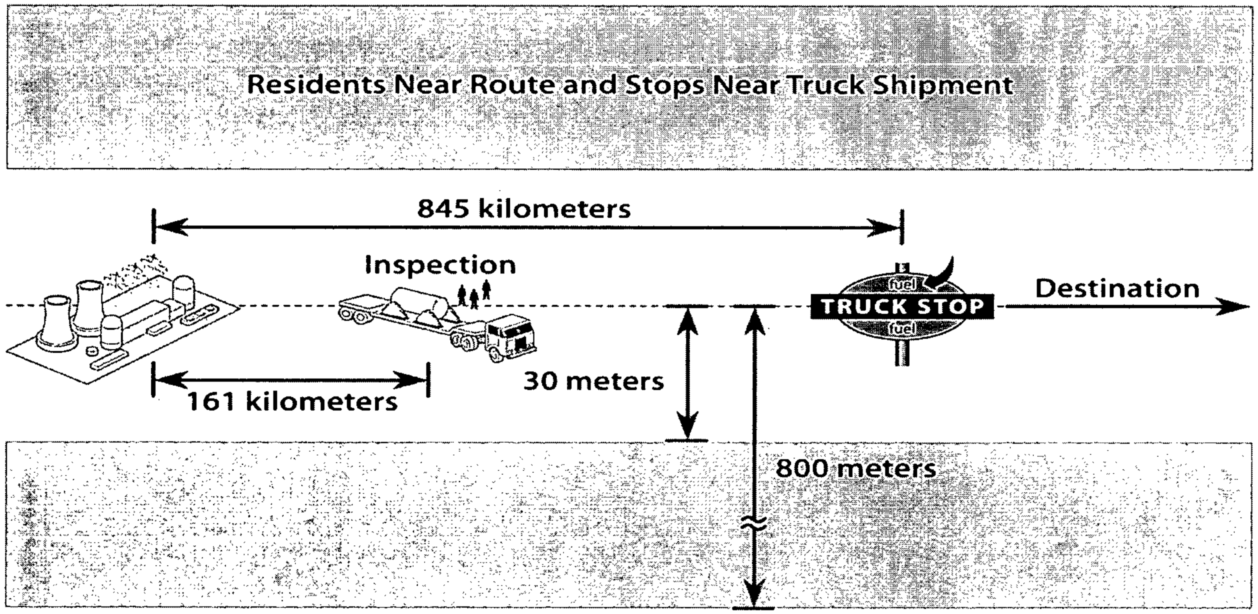
RADTRAN model for truck shipment



- Residents are uniformly distributed from 30 to 800m on either side of the route
- Vehicle inspections occur every 161 km, cask inspections occur at state boundaries, refueling stops occur every 845 km

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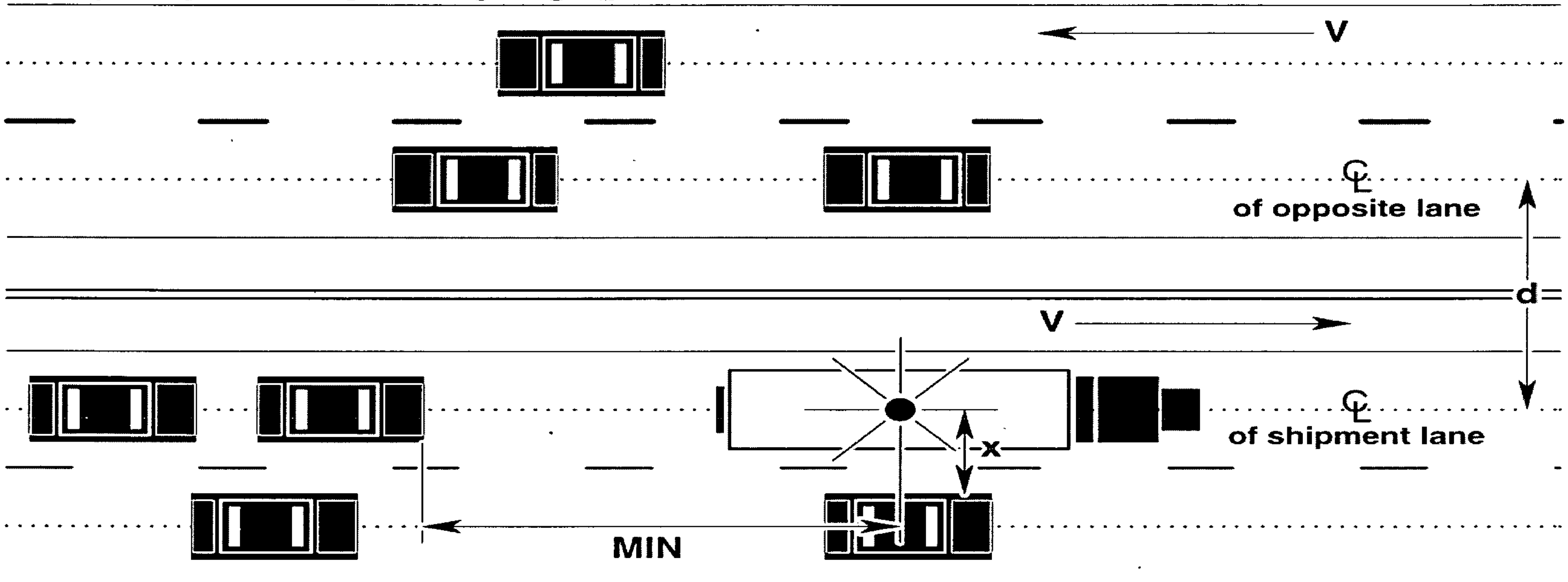
RADTRAN model for occupants of other vehicles



Legend

V - Traffic velocity
d - Distance fromRAM vehicle to traffic in opposite direction
x - Distance from RAM vehicle to passing vehicle
MIN - Minimum following distance

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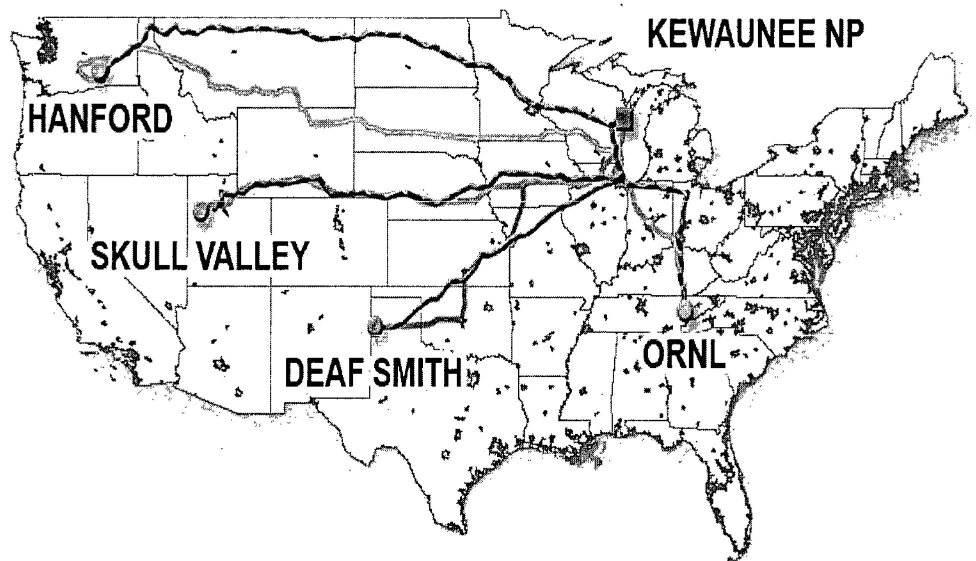
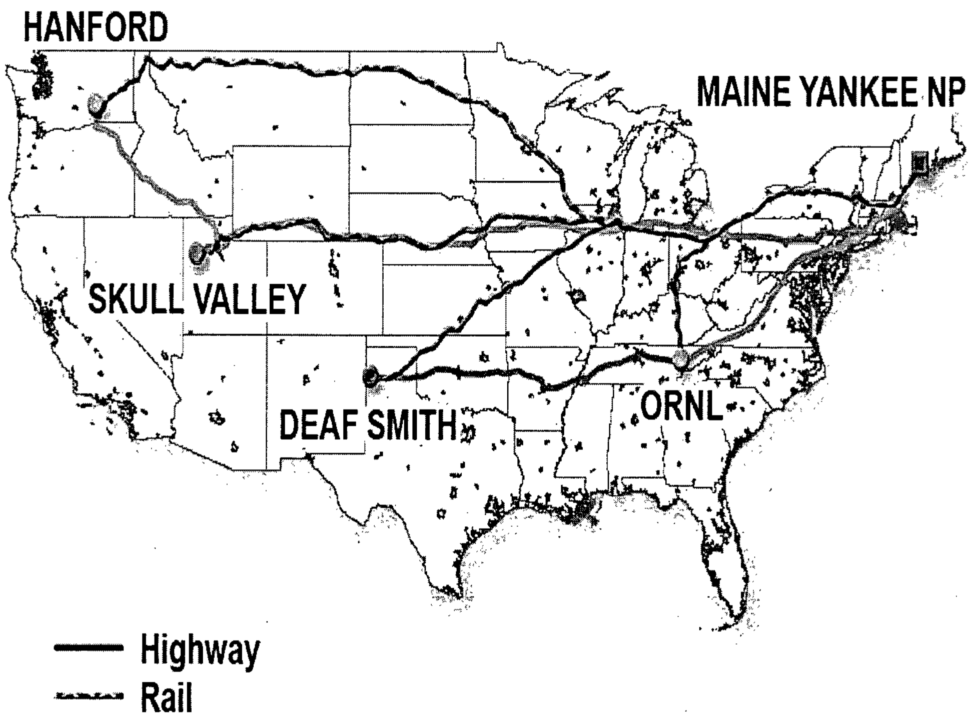
Example Routes

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.

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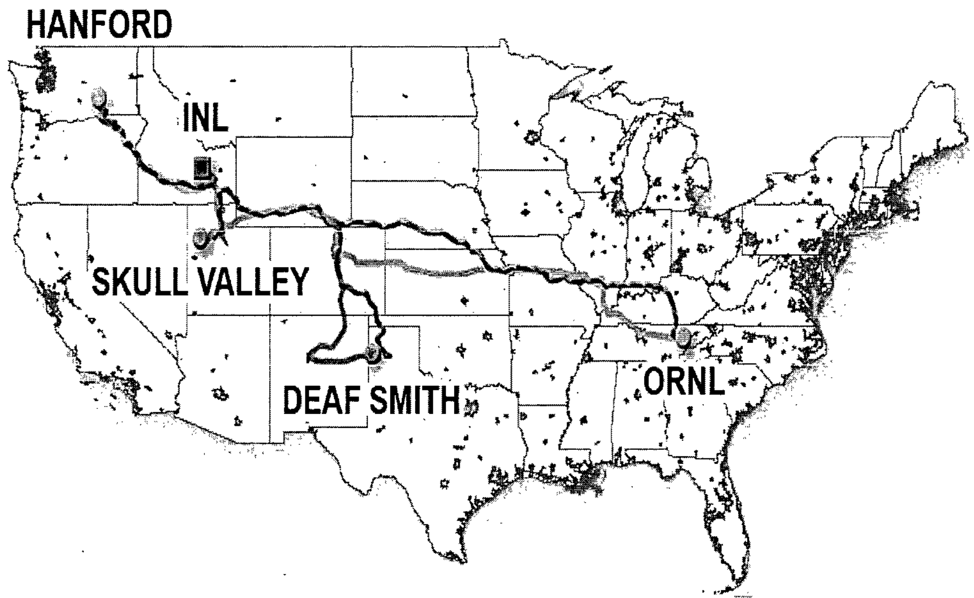
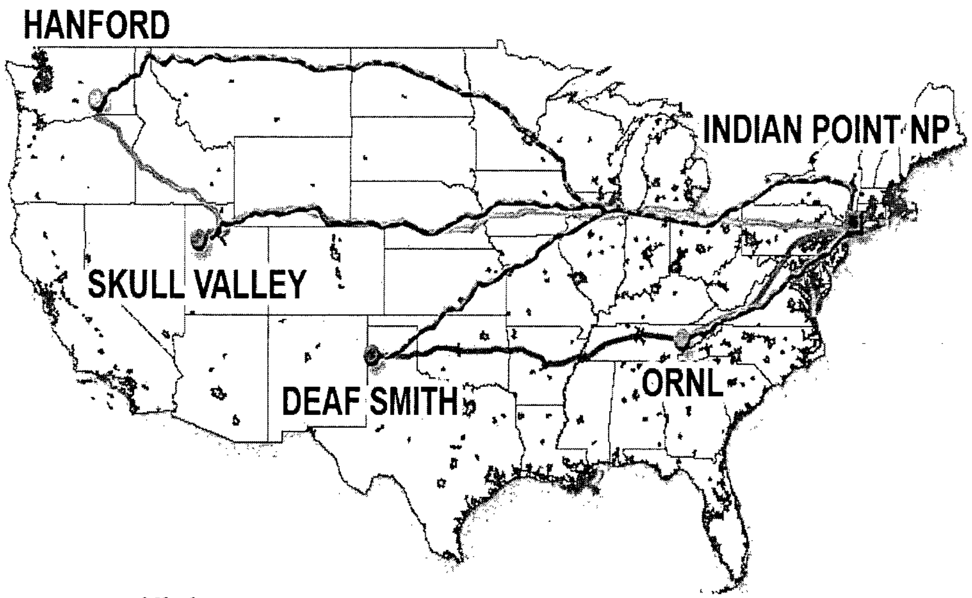
Example Routes (continued)

Idaho National Laboratory Routes



Indian Point NP Routes



— Highway
- - - Rail

- INL included as an origin because spent fuel is stored there.

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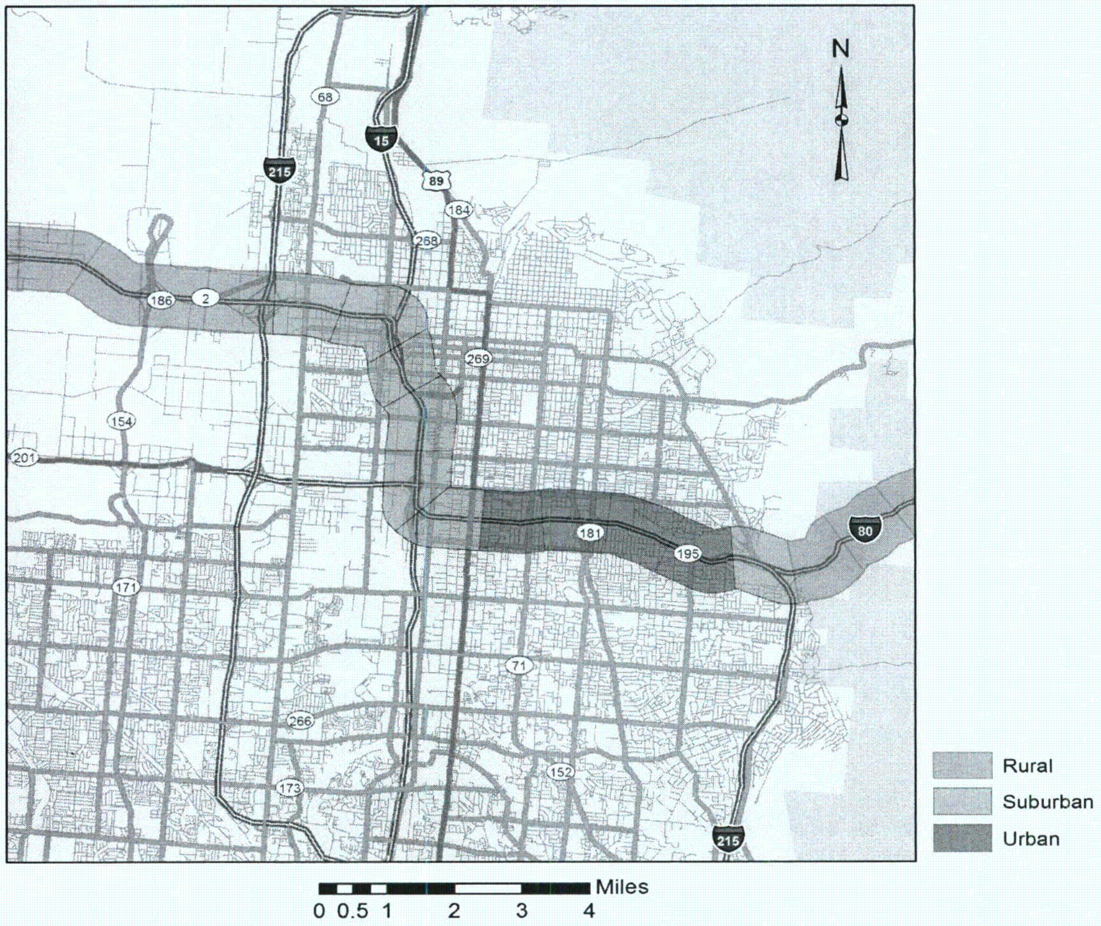
The routes studied

- The destinations include
  - two proposed repository sites (Deaf Smith, TX, and Hanford, WA)
  - the proposed private fuel storage facility (Skull Valley, UT)
  - ORNL
- SFTRA's road and rail routes span many states and thousands of miles through rural, suburban, and urban areas across the country, and are adequate to represent other routes.
- No SNF shipments are planned from any of SFTRA's points of origin to any SFTRA destination.

Routine Conditions: Truck Route Segments

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

I-80 Corridor
Salt Lake City



Factors affecting routine doses

- Exposure time
  - Speed of the vehicle
  - Stop times and number of stops
  - Number of inspections
- Number of people exposed
  - Population density
  - Traffic density
  - Number of people per vehicle
- Dose
  - Shielding provided by housing
    - 0% for rural, 13% for suburban, 98% for urban
  - Distance from cask at stops

Types of exposed populations

- Residents along the route
- Occupants of vehicles sharing the route
- Residents near stops
- People sharing the stop
- Crew of the transport vehicle (truck or train)
- Inspectors

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Maximally Exposed Individual (MEI)

- A member of the public who is at a distance of 30 meters from the route.
- Vehicle is moving at 24 kph for both truck and rail.

Cask (mode)	Dose, Sv (rem)
Rail-Lead (rail)	5.7×10^{-9} (5.7×10^{-7})
Rail-Steel (rail)	4.3×10^{-9} (4.3×10^{-7})
Truck-DU (truck)	6.7×10^{-9} (6.7×10^{-7})

- These doses are about the same as 1 minute of average background: 6.9×10^{-9} Sv.

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Sample Collective Doses for Routine Truck Transportation

Origin	Destination	Residents Along Route	Occupants of Vehicles Sharing Route	Residents Near Stop	Persons Sharing Stop	Crew/ Truck Stop Worker	Total
MAINE YANKEE	ORNL	9.6×10^{-5}	4.6×10^{-4}	1.2×10^{-5}	8.6×10^{-4}	6.8×10^{-4}	2.1×10^{-3}
	Deaf Smith	1.4×10^{-4}	7.3×10^{-4}	1.8×10^{-5}	9.2×10^{-4}	1.4×10^{-3}	3.2×10^{-3}
	Hanford	1.2×10^{-4}	8.3×10^{-4}	1.4×10^{-5}	1.3×10^{-3}	1.9×10^{-3}	4.2×10^{-3}
	Skull Valley	1.1×10^{-4}	7.0×10^{-4}	1.4×10^{-5}	1.1×10^{-3}	1.6×10^{-3}	3.5×10^{-3}

Total Collective Dose (Person-Sv)

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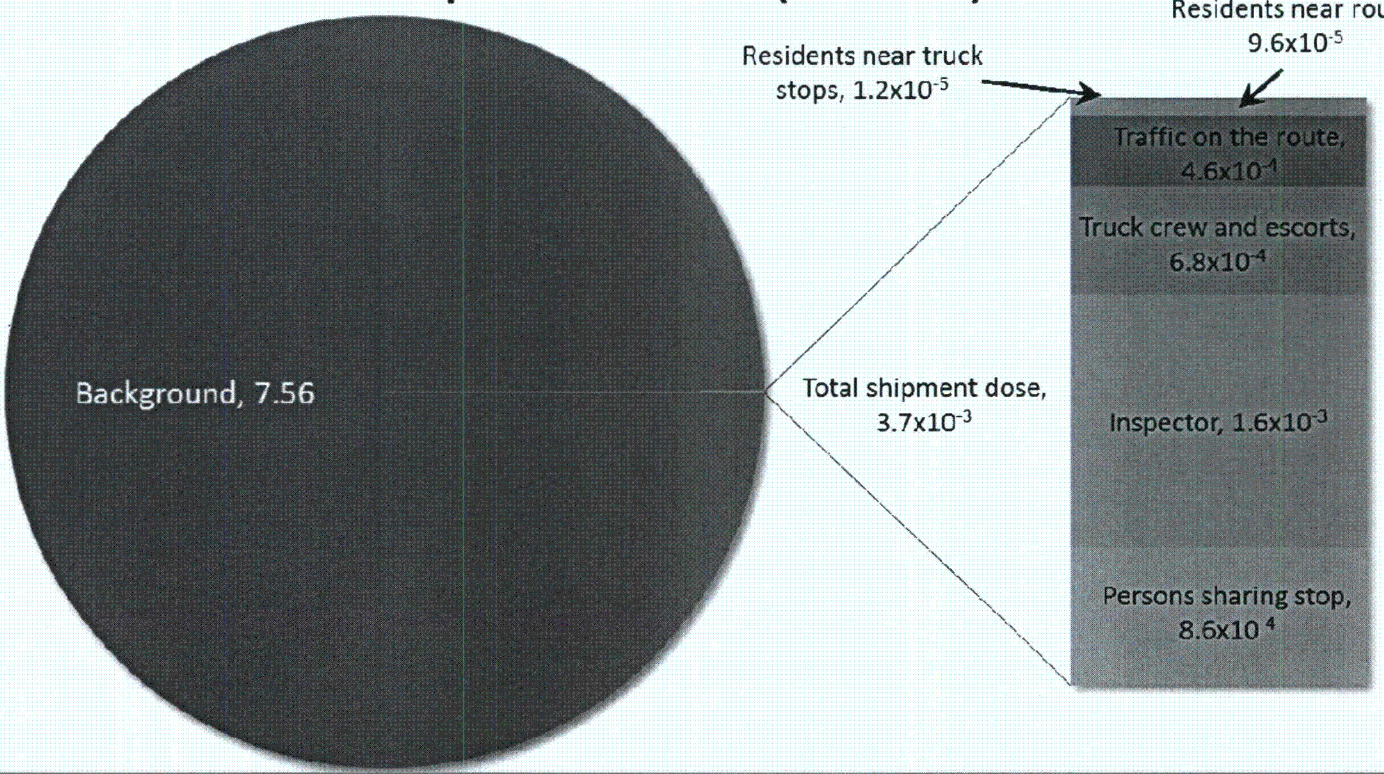
Results from Routine Transportation:
Example for Maine Yankee to ORNL truck shipment

Collective Doses from Background and from a Truck Shipment of Spent Nuclear Fuel (Person-Sv)



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Routine transportation summary

- Individual and collective doses are calculated for a single shipment and are very small.
- Maximum individual doses are comparable to background doses.
- Collective doses from routine transportation are orders of magnitude less than the collective background dose.

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Response to regulatory impacts

- Casks are required to withstand a free fall from 9 meters (impact velocity of 48 kph) onto a flat, essentially unyielding, target in the most damaging orientation.
- The NRC requires conservative approaches in demonstrating the casks withstand this impact.
  - Materials
  - Material properties
  - Allowable stresses
- This assures the cask will survive more severe impacts.

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Finite element analyses of casks

- The response of the two rail casks studied to impacts of 48, 97, 145, and 193 kph (30, 60, 90, 120 mph) onto rigid targets.
- The responses were determined using the nonlinear transient dynamics explicit finite element code PRESTO.
- In the cask models, the fuel region was treated as a homogenized mass.
- The response of the truck cask was inferred based on finite element calculations carried out for other projects.

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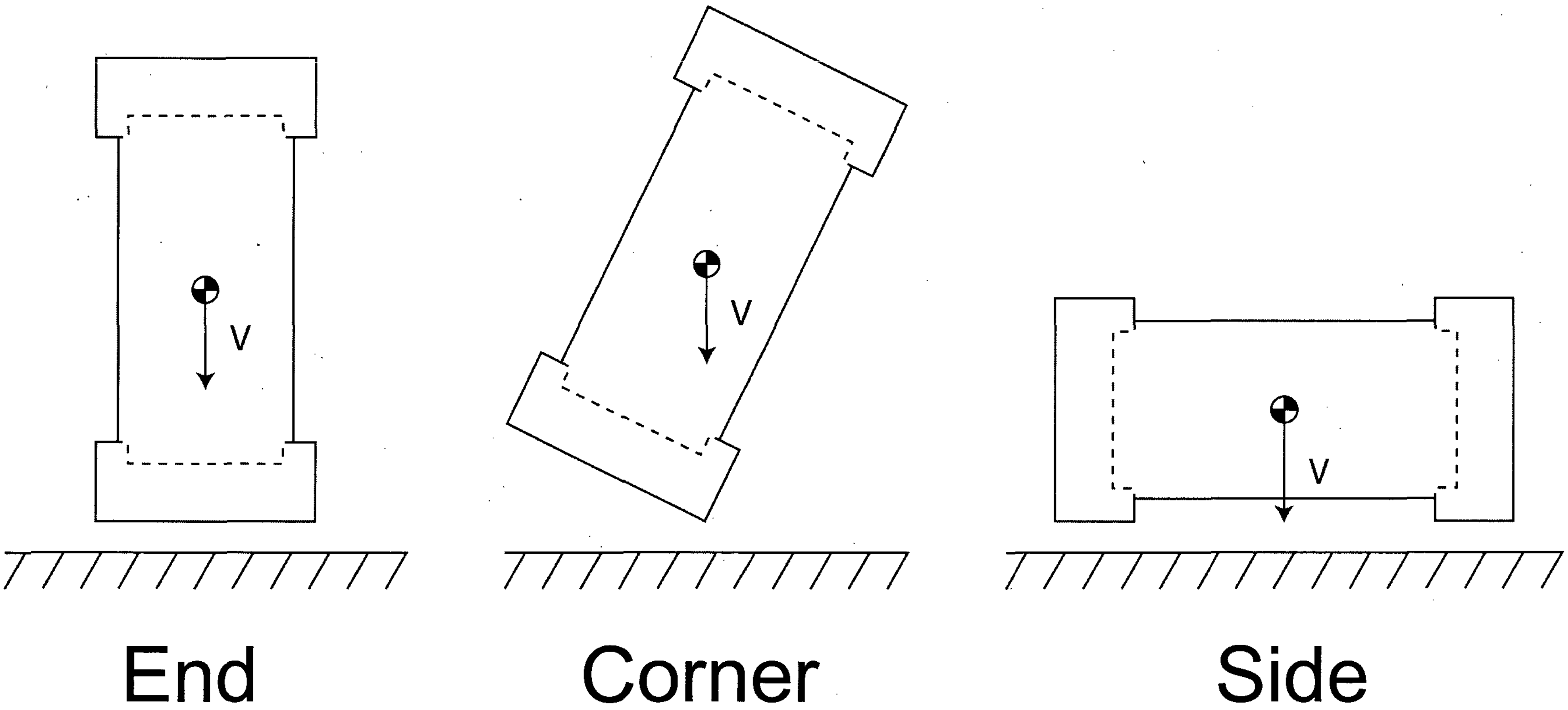
Impact orientations



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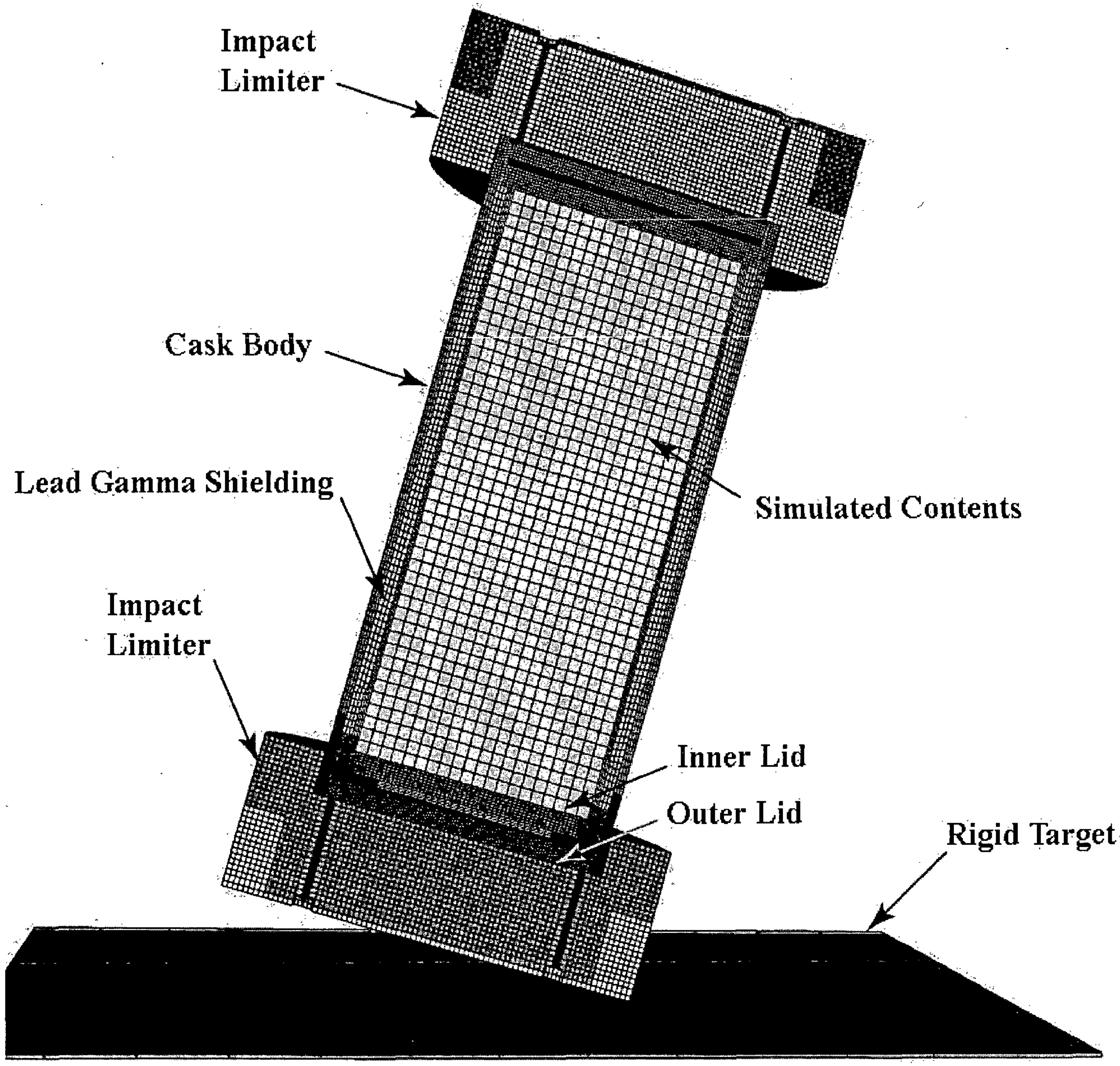
Finite element model of the rail-lead cask

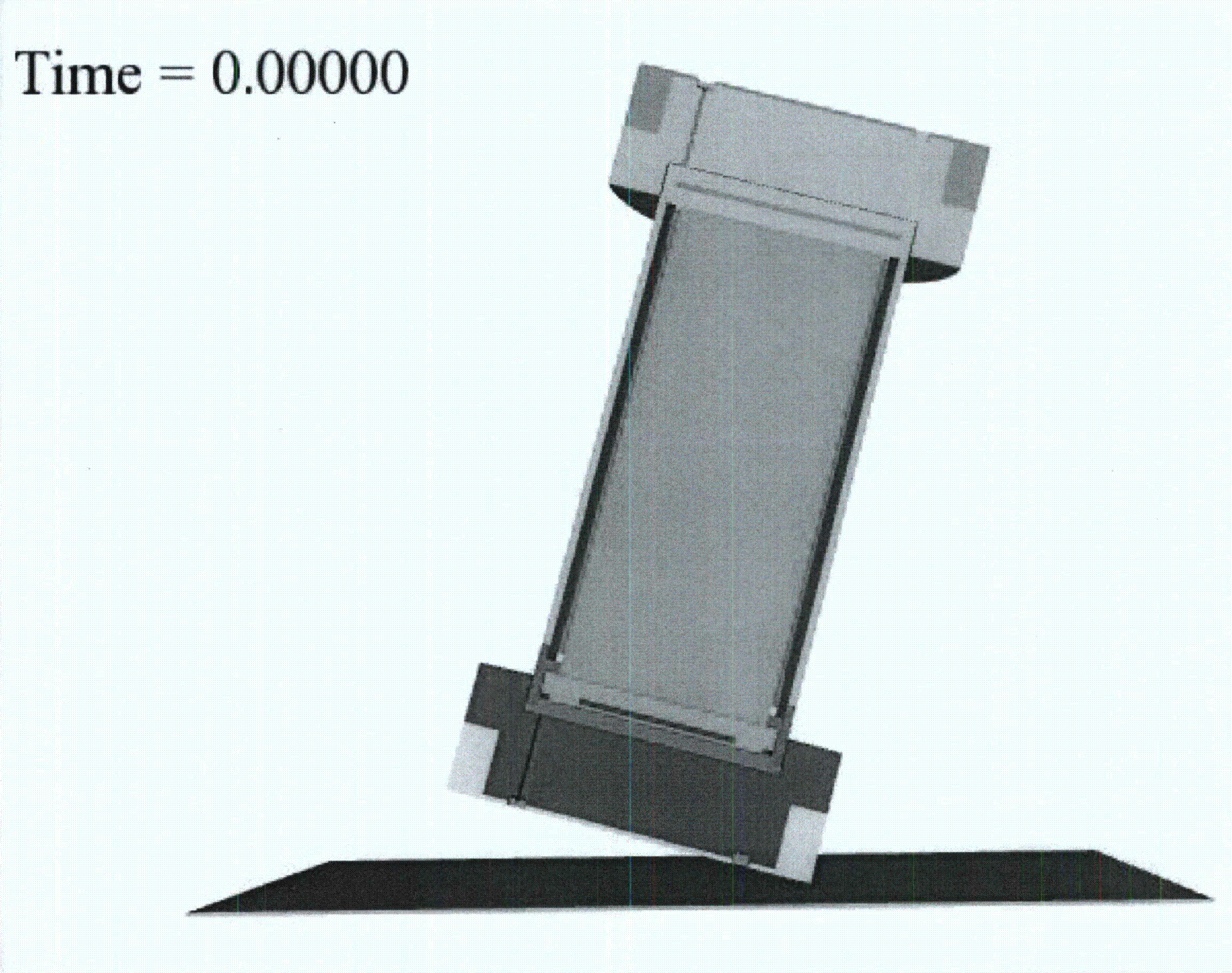


Rail-lead cask impact analysis

- Deformed s
rail-lead cas
the 120 mph
a rigid targe
corner orien

- No leak-pat
there is no
contents

- Lead slump
a loss of ga
shielding in
assessmen



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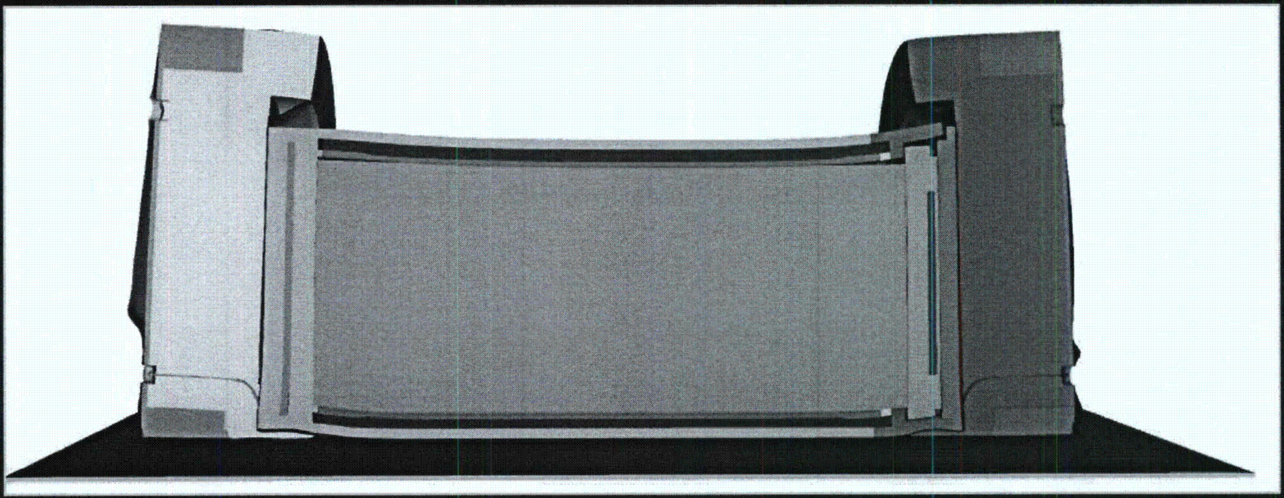
Rail-lead cask impact analysis

- **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**

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Impacts onto yielding targets

- When a cask impacts a "real" target the impact energy is absorbed by both the cask and the target.
- The amount of energy absorbed by the target depends on the relative strength and stiffness of the target and the cask.
- Because of the energy absorbed by the target, the impact velocity required to produce the same damage as an impact onto a rigid target is greater.

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Contact forces for impacts onto a rigid target for the rail-lead cask

Orientation	Speed, kph (mph)	Acceleration (g)	Contact Force (Millions of Pounds)	Contact Force (MN)
End	48 (30)	58.5	14.6	65.0
	97 (60)	111.6	27.9	123.9
	145 (90)	357.6	89.3	397.1
	193 (120)	555.5	138.7	616.8
Corner	48 (30)	36.8	9.2	40.9
	97 (60)	132.2	33.0	146.8
	145 (90)	256.7	64.1	285.1
	193 (120)	375.7	93.8	417.2
Side	48 (30)	76.1	19.0	84.5
	97 (60)	178.1	44.5	197.8
	145 (90)	411.3	102.7	456.7
	193 (120)	601.1	150.0	667.4

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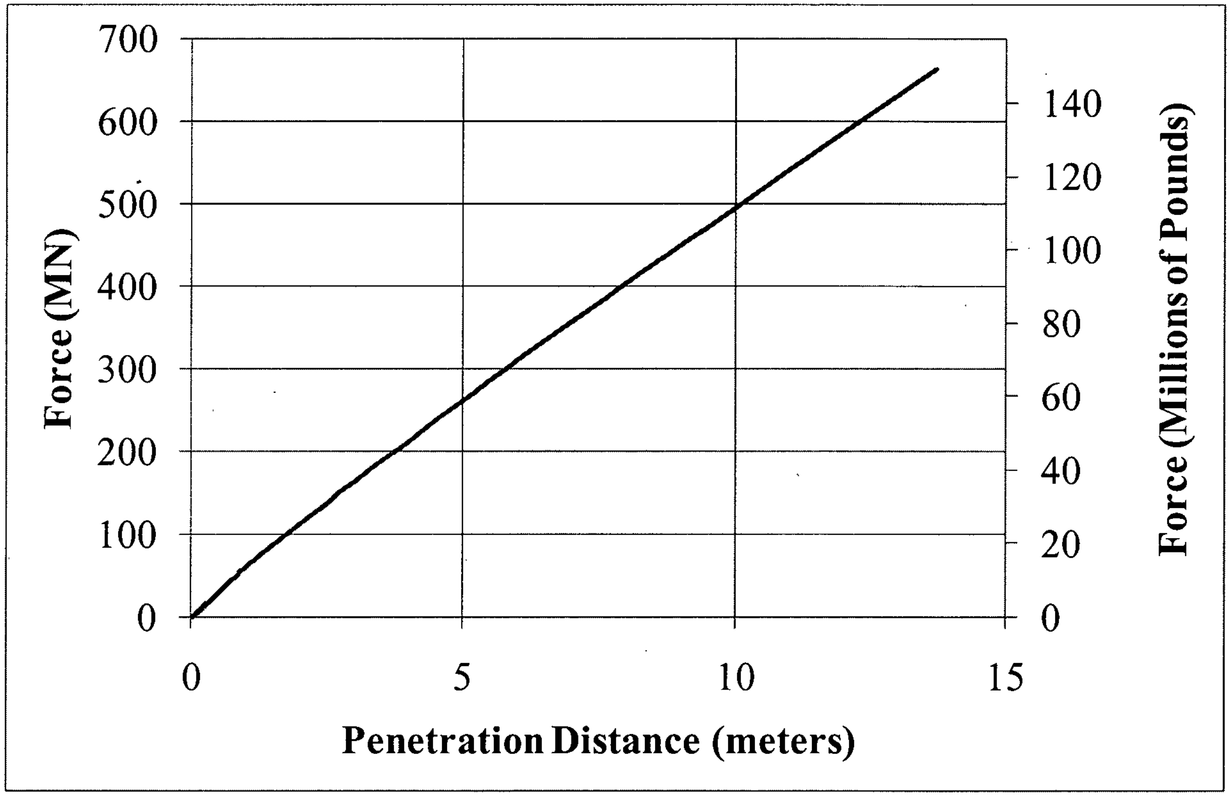
Impacts onto soil



- Force generated by the Rail-Lead cask penetrating hard desert soil

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Velocities onto various targets for equivalent damage for the rail-lead cask

Orientation	Rigid (or hard rock), kph (mph)	Soil, kph (mph)	Concrete, kph (mph)
End	48 (30)	102 (63)	71 (44)
	97 (60)	205 (127)	136 (85)
	145 (90)	>250 (>155)	>250 (>155)
	193 (120)	>250 (>155)	>250 (>155)
Corner	48 (30)	73 (45)	70 (43)
	97 (60)	236 (147)	161 (100)
	145 (90)	>250 (>155)	>250 (>155)
	193 (120)	>250 (>155)	>250 (>155)
Side	48 (30)	103 (64)	79 (49)
	97 (60)	246 (153)	185 (115)
	145 (90)	>250 (>155)	>250 (>155)
	193 (120)	>250 (>155)	>250 (>155)

Shaded cells represent the equivalent velocity from the regulatory impact

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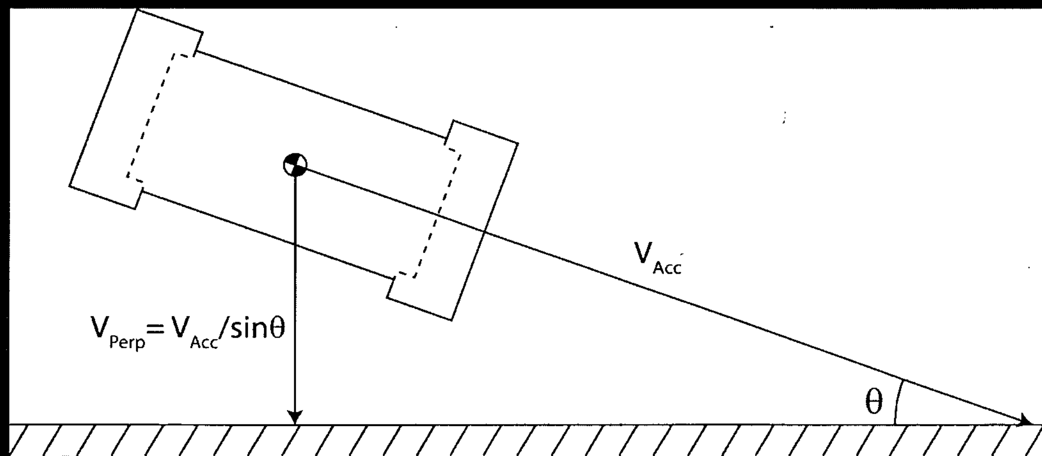
Affect of impact angle

Angle	V_{Acc} so V_{perp} = 97 kph (60 mph)	Probability
0 - 10	556 (345)	0.2000
10 - 20	282 (175)	0.1778
20 - 30	193 (120)	0.1556
30 - 40	150 (93)	0.1333
40 - 50	126 (78)	0.1111
50 - 60	111 (69)	0.0889
60 - 70	103 (64)	0.0667
70 - 80	98 (61)	0.0444
80 - 90	97 (60)	0.0222



Impact accident summary

- Only 1 in 2000 accidents is more severe than the regulatory hypothetical accident.
- Due to conservatisms in cask design, only 1 in a billion accidents is severe enough to cause release or loss of gamma shielding.
- A rail cask with an inner welded canister results in no release.
- An impact speed onto a rigid target greater than 60 mph is required to cause seal failure in a rail cask.

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Impact accident summary (continued)

- A 60 mph side impact onto a rigid target
  - produces a force of 45 million pounds
  - is equivalent to a 115 mph impact onto a concrete roadway or abutment
  - is equivalent to a 153 mph impact onto hard soil

- For impacts onto rock that is hard enough to be able to resist these large forces, impacts at angles less than 30 degrees require a speed of more than 120 mph to be equivalent.

Outline

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- Cask response to impact accidents
- **Cask response to fire accidents**
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Response to regulatory fires

- Casks are required to withstand a fully-engulfing hydrocarbon fuel fire for 30 minutes.
- Generally demonstrated by analysis using a prescribed boundary condition of 800°C.
- Real fires have temperatures that vary with both time and location – but the average heating is similar to that from the uniform thermal boundary condition.
- Regulatory review requires seal temperatures and fuel temperatures stay below their failure thresholds.

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Fire simulations

- A 30-minute regulatory fire was analyzed with
  - the regulatory thermal boundary conditions using P-thermal (a finite element analysis code)
  - the Cask Analysis Fire Environment (CAFE), a 3D coupled heat transfer / computational fluid dynamics code

- All accident fires were analyzed using CAFE.

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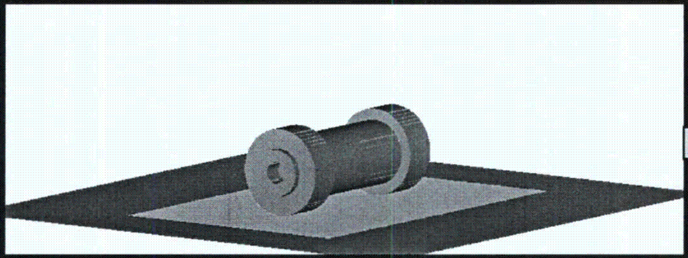
Fire cases analyzed for rail casks

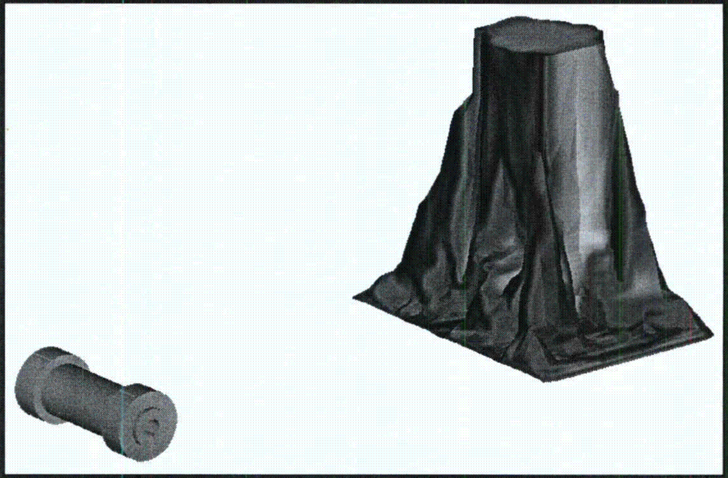
All pools are 46 ft x 29.5 ft and burn for 3 hours



Cask in the middle of flammable liquid fuel pool region (shown in orange) before the fire starts

Fire engulfing the cask

Cask offset from the flammable liquid fuel pool by 3 meters (10 feet)



Cask offset from the flammable liquid fuel pool by 18 meters (60 feet)

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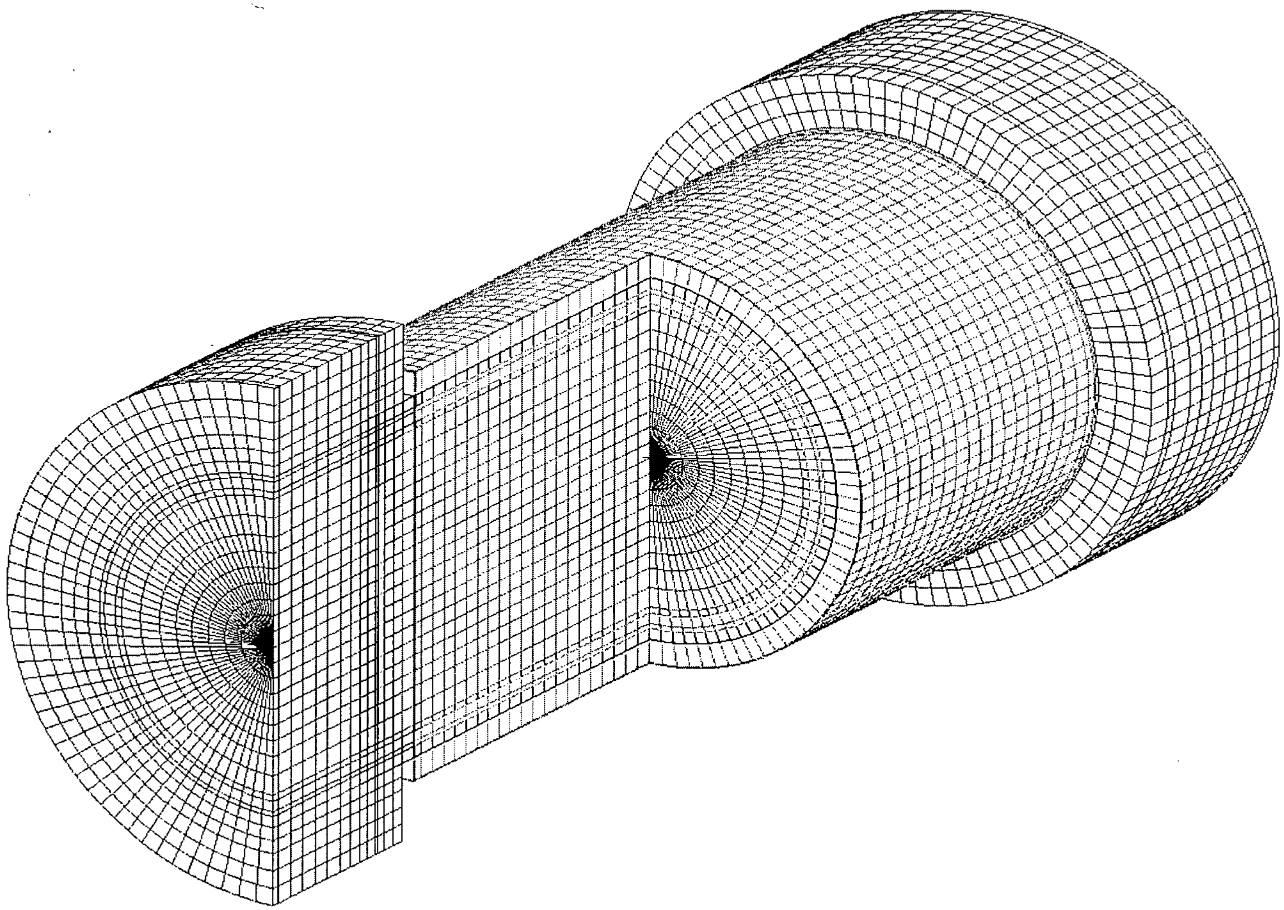
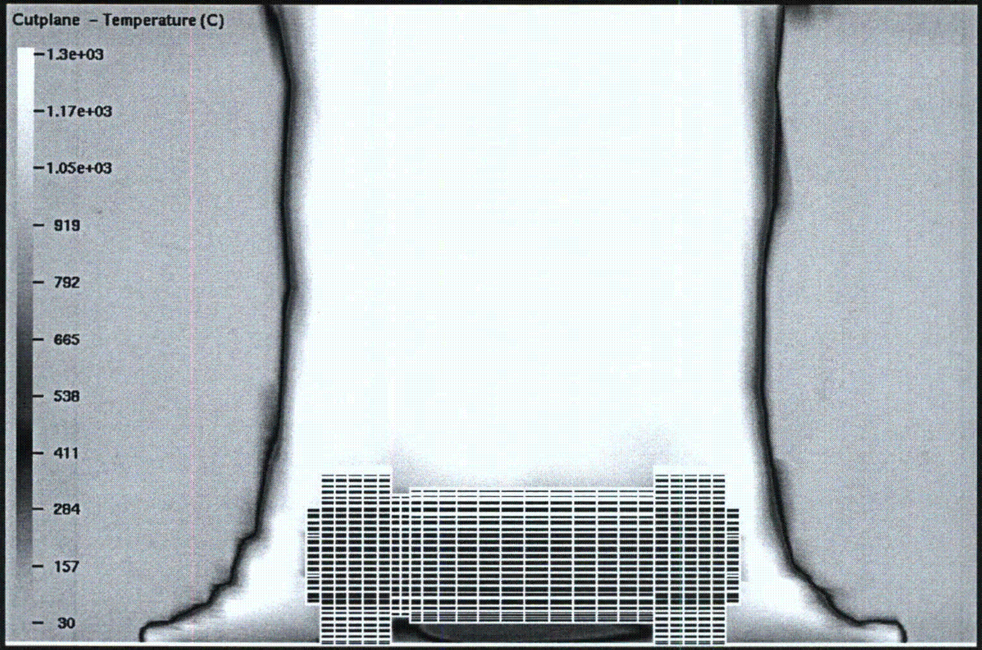
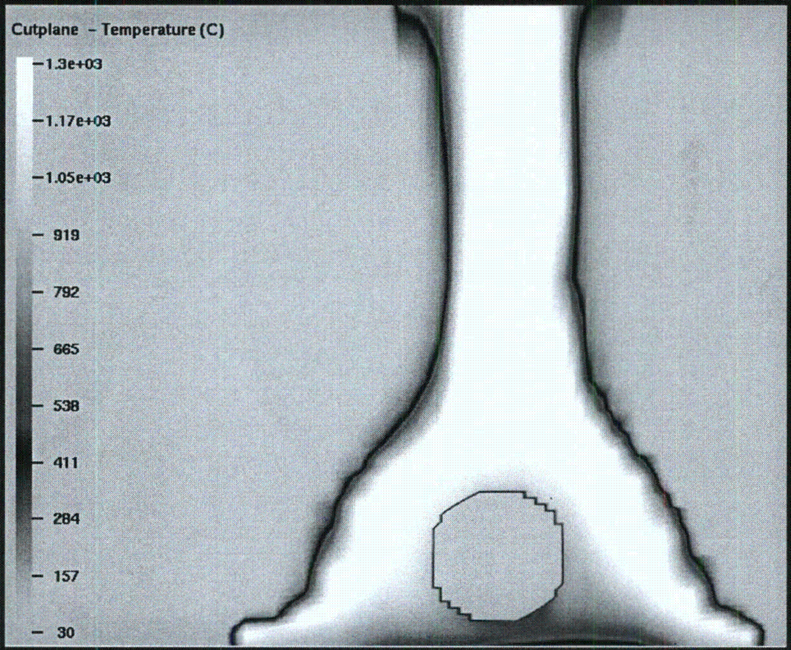
Finite element mesh of the rail-lead cask



Flame temperatures





Fully engulfing pool fires have temperature variations both spatially and temporally.

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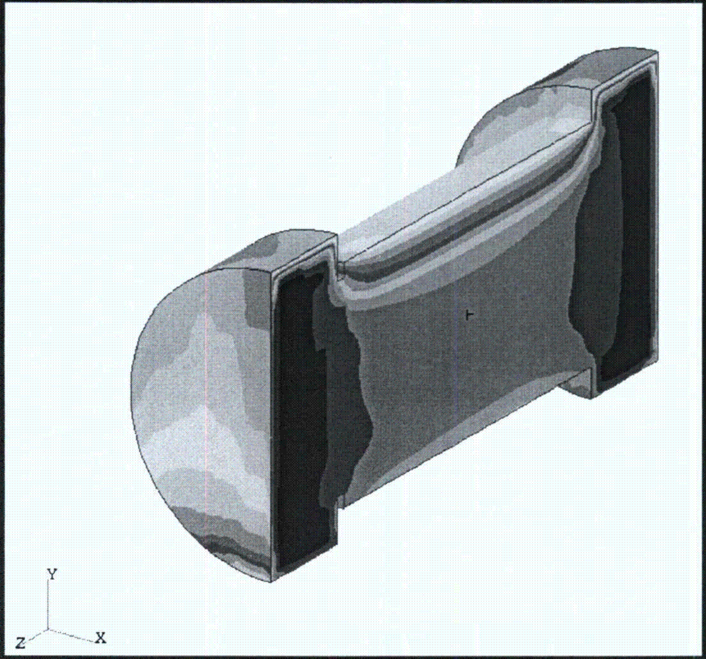
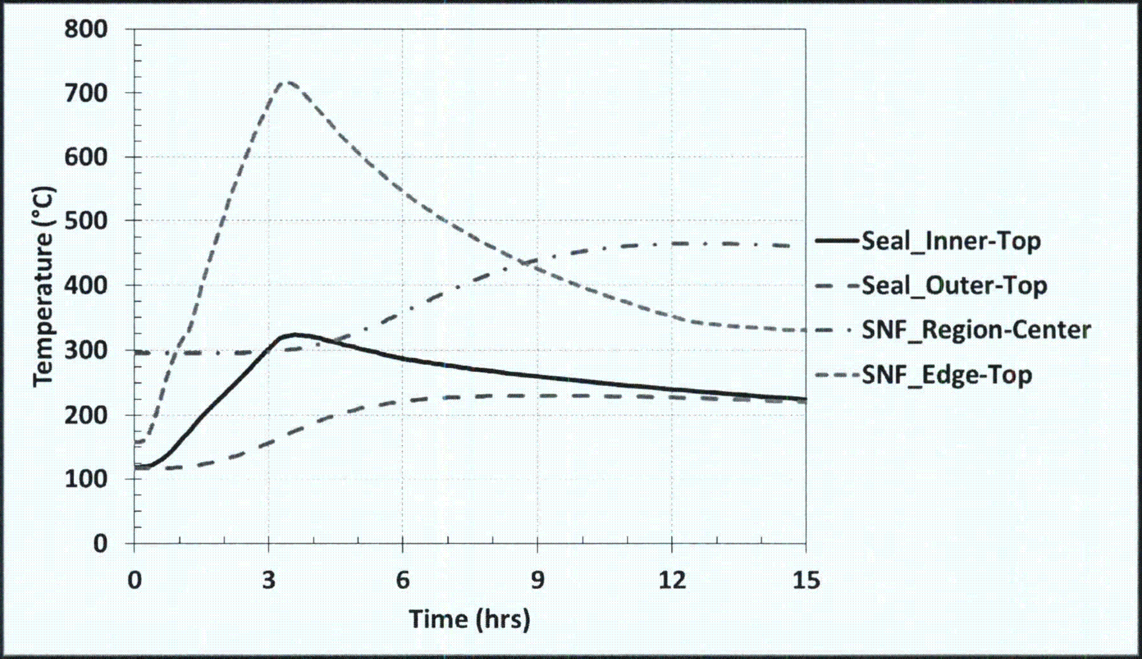
Rail-lead cask fire accident
After 3-hour concentric fire:

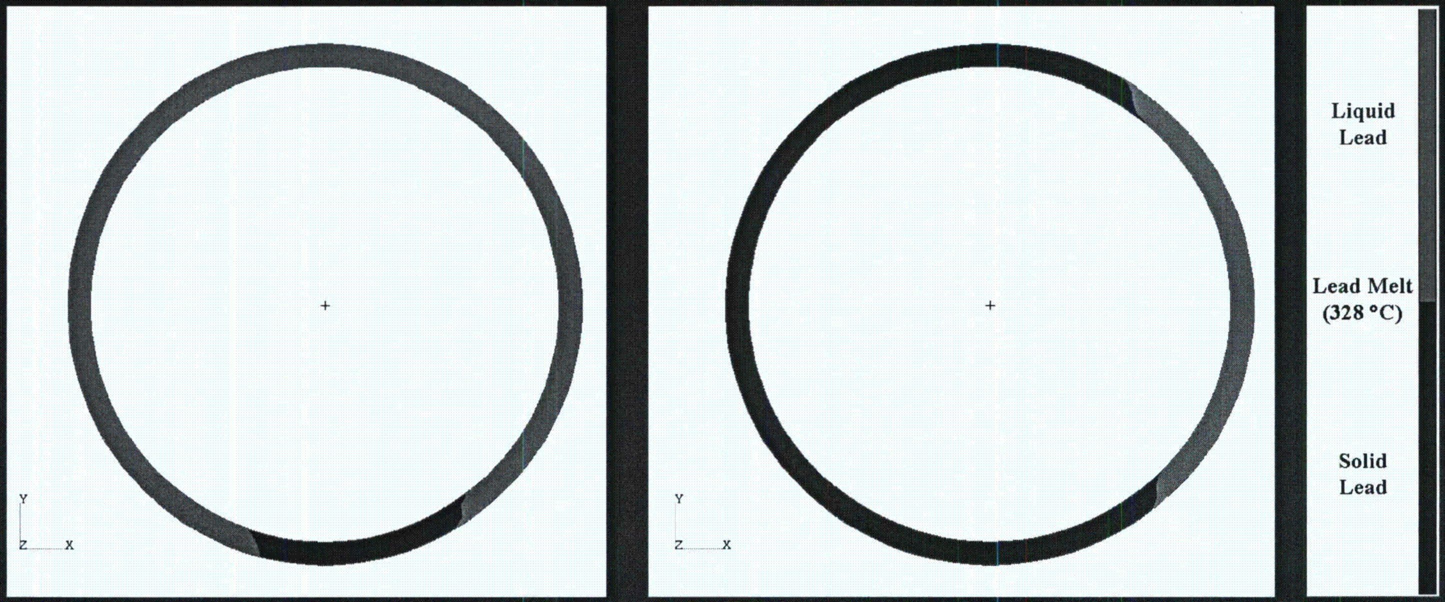




- Seal temperature is below its failure temperature of 350°C.
- Spent fuel temperature is below the rod-burst temperature of 750°C.

Lead melt

When lead melts it expands and deforms the lead cavity. When it solidifies, it shrinks, leaving a gap.



Concentric fire | 3m offset fire

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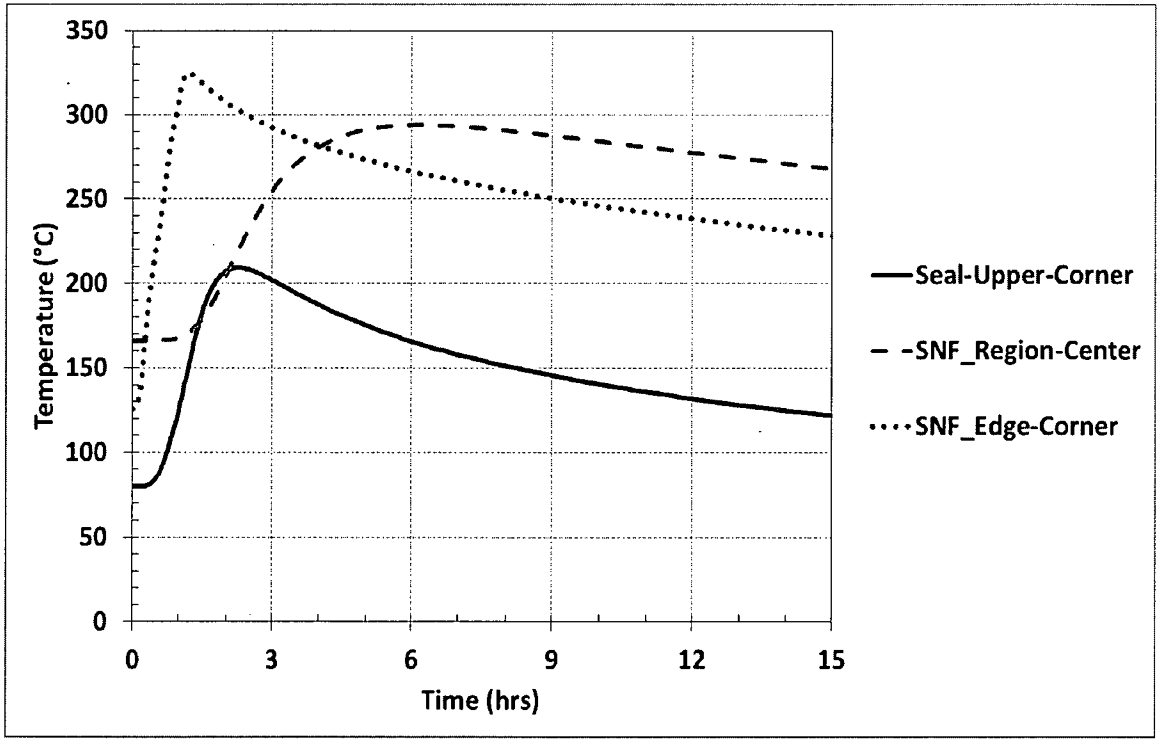
Thermal analysis of the truck cask

- Similar to the engulfing fires for the rail casks, except for a 1-hour duration



- There is no seal failure and no rod burst, therefore no release

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Fire accident summary

- No cask loses containment in the fires analyzed.
- The fuel rods do not fail in the fires analyzed.
- Reduction in neutron shielding is likely for many fires (this is assumed in the certification of the casks).
- Reduction in gamma shielding is possible for very severe fires with lead shielded casks.
  - exposure to a concentric fire that burns longer than 65 minutes
  - exposure to a fire offset by 10 feet that burns longer than 2.25 hours
- Confined fires, such as tunnel fires or fires under overpasses, were not analyzed because other NRC studies have evaluated these environments.

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Types of accidents and incidents

- Accidents in which the spent fuel cask is not damaged or affected, but the shipment is delayed
- Accidents in which the spent fuel cask is affected
  - Accidents resulting in loss of neutron or gamma shielding, but no release of radioactive material
  - Accidents resulting in release of radioactive material

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Probabilities of all accident types

- Highway and railroad accident statistics are maintained by DOT's Bureau of Transportation Statistics.
- The average probability of an accident is
  - 1.9×10^{-6} per km for heavy trucks (3.1×10^{-6} per mi)
  - 1.1×10^{-7} per km for railcars (1.8×10^{-7} per mi)
- Accident severities are categorized using an event tree with conditional probabilities.
  - For trucks, the event tree was developed at Sandia National Laboratories.
  - For rail, the event tree was developed at the Volpe National Transportation Systems Center.

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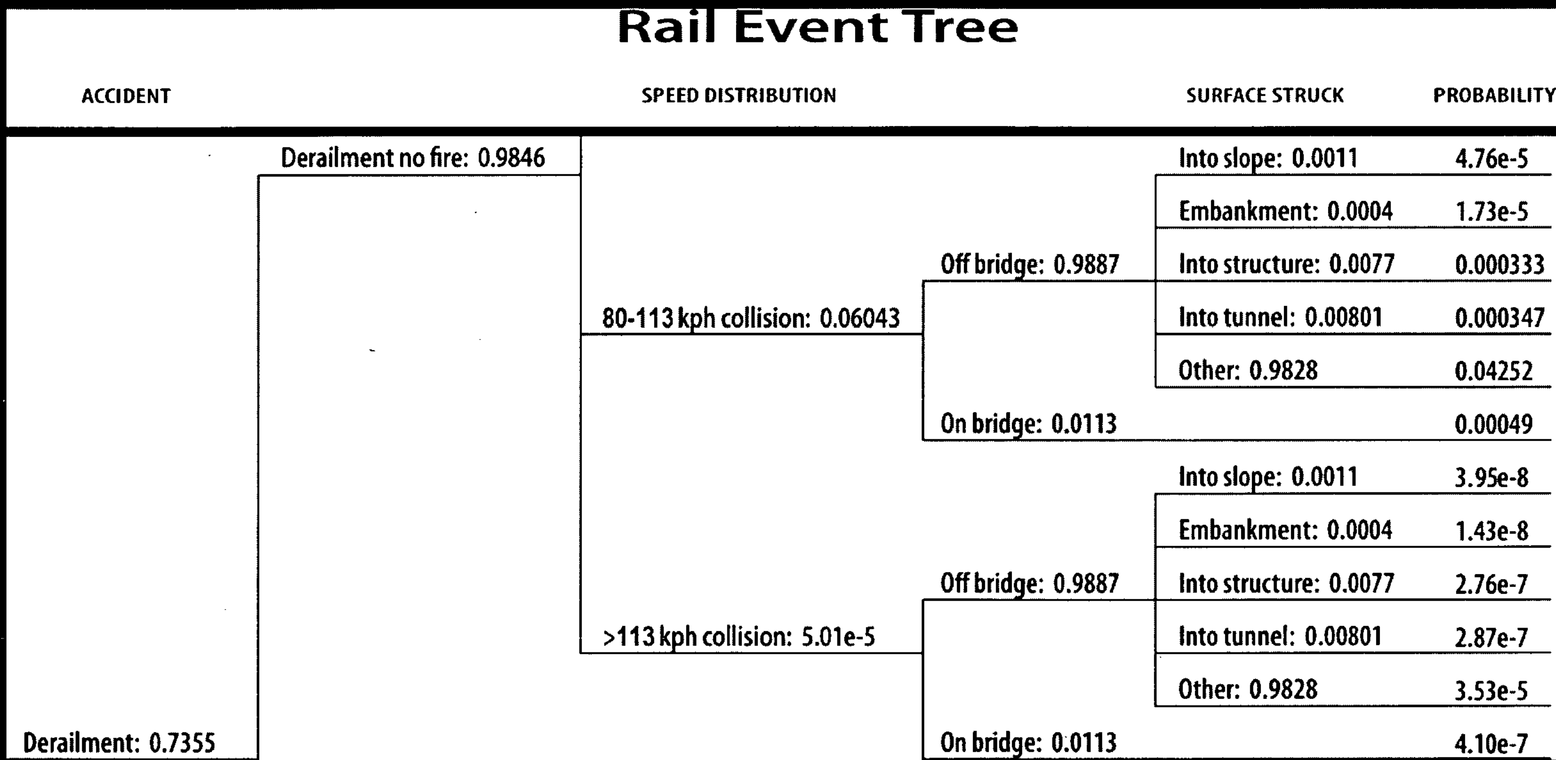
Accident Conditions: U.S. DOT Rail Accident Event Tree Segment



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Additional probabilities included in analyses

- The rail event tree does not include target hardness, so the distribution from the truck event tree was used.
- Neither event tree includes impact angle or orientation, so conservative engineering judgments of angle and orientation distributions were assumed.
- The truck event tree does not include impact velocity, but since impacts at even the highest velocity analyzed did not result in release, this was not needed.
- The rail event tree does not divide accident speeds greater than 113 kph (70 mph), so it is assumed that 95% of them are between 113 and 145 kph (90 mph), and 5% are above 145 kph (needed for lead slump dose risk calculations).

Accidents without loss of shielding or release

- Almost all accidents will fall into this category.
- Dose depends on the external dose rate of the cask.
- A 10-hour stop time is assumed for all accidents of this type.
- Collective doses are calculated using the average rural, suburban, and urban population densities for each route.
- 10 hour dose to an emergency responder at a 2 meter distance from the cask is ~0.001 Sv (100 mrem).
- Collective population dose risk to nearby residents is ~7 x 10^{-5} person-Sv (7 x 10^{-3} person-rem).

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Accidents with loss of gamma shielding but no release

- Less than one in a billion impact accidents is severe enough to cause a loss of lead gamma shielding resulting in a dose rate greater than the regulatory post-accident dose rate.
- Because these accidents are so rare, the collective dose risk is much smaller than that from the no loss of shielding case, about 10^{-13} person-Sv (10^{-11} person-rem).

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Accidents with release

- Only rail casks without an inner welded canister have release.
- Dose depends on
  - the inventory (quantity and physical form), assumed in this study to be the maximum the casks are certified to transport (9-year cooled 45 GWD/MTU burn-up).
  - the exposure pathway, which includes rod-to-cask release fraction, cask-to-environment release fraction, and dispersion

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Release fractions

	Cask Orientation	Side	Side
	Rigid Target Impact Speed, kph (mph)	193 (120)	145 (90)
	Seal	elastomer	elastomer
Cask to Environ-ment Release Fraction	**Gas**	0.80	0.80
	Particles	0.70	0.70
	Volatiles	0.50	0.50
	CRUD	0.001	0.001
Rod to Cask Release Fraction	**Gas**	0.12	0.12
	Particles	4.8×10^{-6}	4.8×10^{-6}
	Volatiles	3.0×10^{-5}	3.0×10^{-5}
	CRUD	1.0	1.0
	Conditional Probability	1.79×10^{-11}	3.40×10^{-10}

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Conditional Probability Example

- Impact in side orientation at 145 kph into hard target
- Fire example

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Doses from release

- Dominated by inhalation
- Includes resuspension, cloudshine, groundshine, and ingestion
- Because of thermal loft due to the elevated temperature of the cask interior, the maximum dose occurs 21 meters downwind from the accident.
- Maximum individual dose to a hypothetical person at this location is 1.6 Sv (160 mrem).
- Collective dose risk is 10^{-12} person-Sv (10^{-10} person-rem).

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Accident risk summary

- The overall collective dose risks are very small.
- The collective dose risks for the two types of extra-regulatory accidents (accidents involving a release of radioactive material and loss-of-lead-shielding accidents) are negligible compared to the risk from a no-release, no-loss-of-shielding accident.
- There is no expectation of release from spent fuel shipped in inner welded canisters from any impact or fire accident analyzed.
- The collective dose risk from loss of lead shielding is comparable to the collective dose risk from a release, both are very small.
- These accidents occur with extremely low probability (less than one in a billion accidents).

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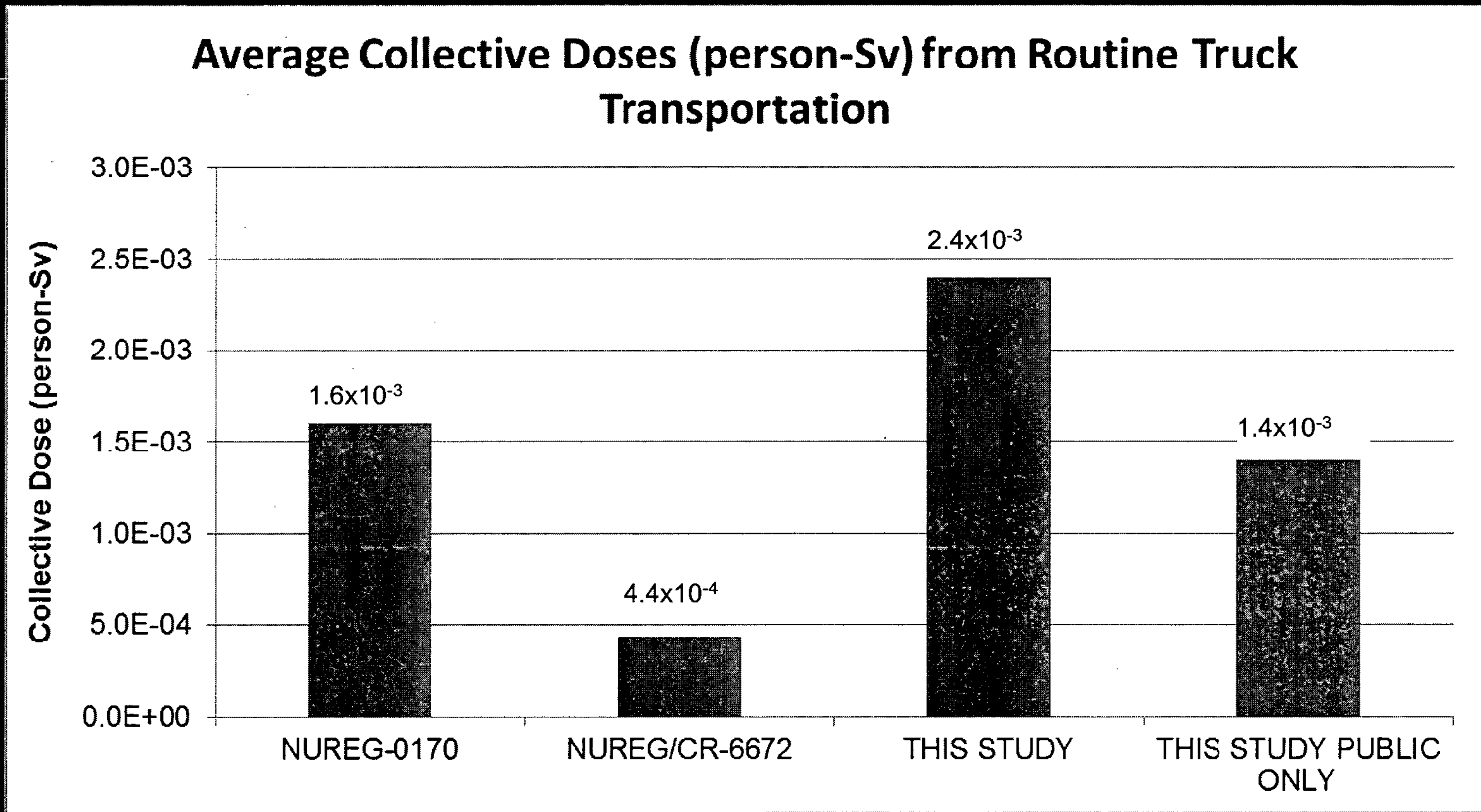
Routine Transportation Results Comparison:



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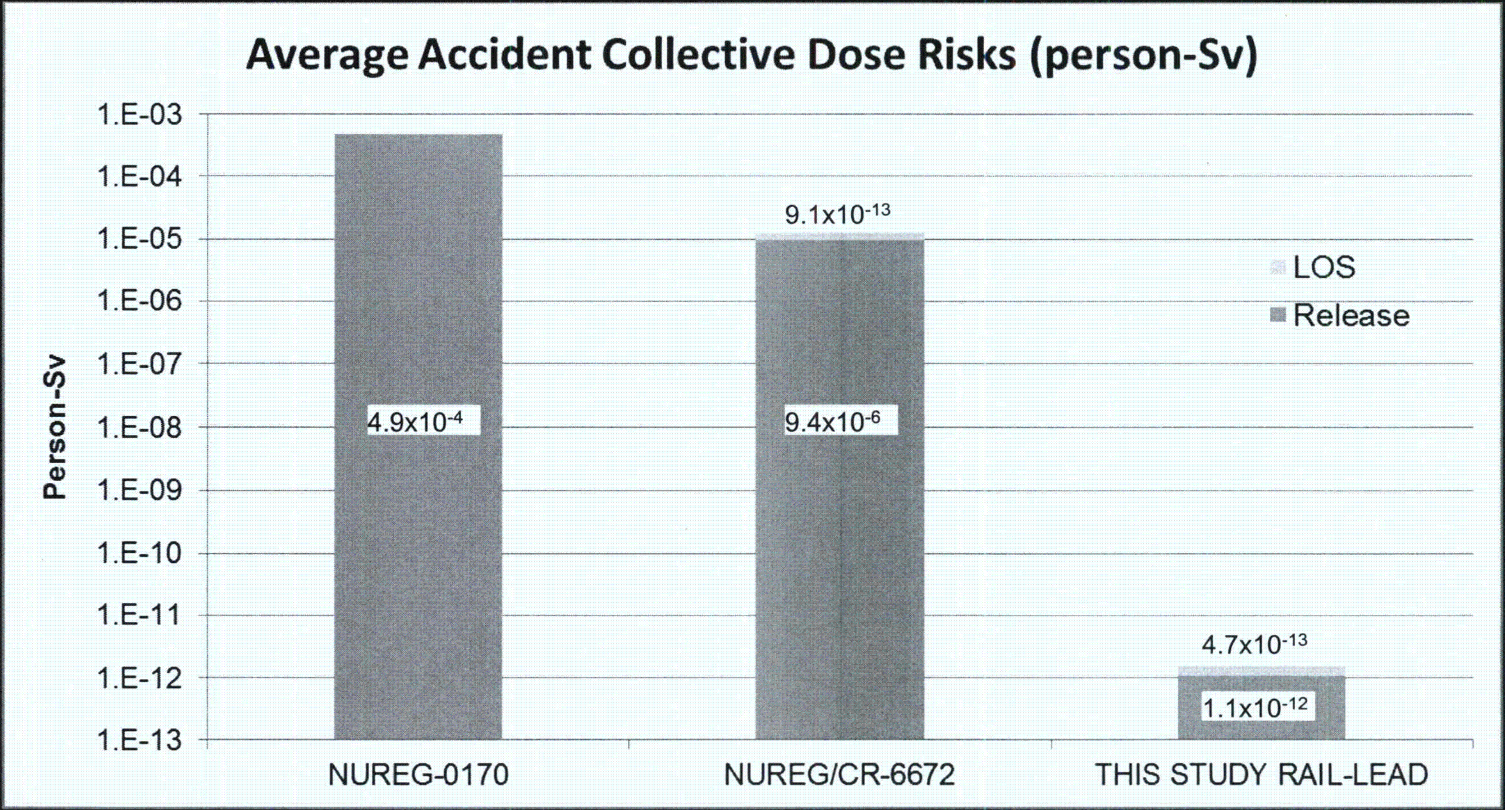
Accident Results Comparison:

Accident collective dose risks from release and loss of gamma shielding (LOS) accidents. The LOS bars are not to scale.



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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.
- There was little variation in the risks per kilometer over the routes analyzed.
- 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.
  - If there were an accident during a spent fuel shipment, there is less than one in a billion chance the accident would result in a release of radioactive material.
  - If there were a release of radioactive material in a spent fuel shipment accident, the dose to the maximum exposed individual would be non-fatal.

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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.

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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 15, 2012
- Comments received from
  - The State of Nevada
  - The State of Oregon
  - Western Interstate Energy Board
  - Nuclear Energy Institute

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Sample comments and response

Comment: 60 day comment period is inadequate/extension request

- Response
  - The staff did not consider the draft reports mentioned in establishing the 60-day comment period for Draft NUREG-2125. The 60-day period was considered adequate considering the length and complexity of Draft NUREG-2125. The comment period for the much broader transportation EIS (NUREG-0170) was only 90 days. No substantive technical errors were identified in the request to extend.
- No changes to Draft NUREG-2125

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Comment: NRC must assess the impact on the Yucca Mountain FEIS

- Response
  - One of the possible uses of NUREG-2125 is to provide information for future transportation environmental assessments. NUREG-2125 is a generic, technical study of potential radiological impacts from spent fuel transport under routine and accident conditions. It is not an environmental impact assessment for any specific facility. Like its predecessor generic risk studies, NUREG-2125 may be used to support environmental assessments for a wide variety of transportation campaigns.
  - DRAFT NUREG-2125 did not consider or assess SNF shipments to Yucca Mountain. However, the results indicate the FEIS is conservative with respect to potential accident impacts and similar for routine transportation. Therefore, the general conclusions of the FEIS are consistent with the results of DRAFT NUREG-2125.
  - The implications of DRAFT NUREG-2125 to other ongoing or future NRC actions is beyond the scope of this activity, but should be addressed by the activities supporting those actions. In the event that the Yucca Mountain licensing proceedings resume, the NRC would take into consideration any new information concerning transportation, including the SFTRA, as it continues the next steps of the formal EIS adoption process (the licensing proceedings).
- No changes to Draft NUREG-2125

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Comment: 16 example routes are insufficient to represent a large-scale campaign

- Response
  - NUREG-0170, the environmental impact statement for all radioactive material transport, (not just spent fuel) by all modes, used a single standard shipment model to assess impacts. DRAFT NUREG-2125's road and rail routes span many states and thousands of miles through rural, suburban, and urban areas across the country. These thousands of miles are adequate to represent other routes.
  - The staff believes the routes used are representative of SNF shipment routes; that the doses for the included routes are similar; and inclusion of additional routes would not change the conclusions, which are supported by the analyses.
- No changes to Draft NUREG-2125

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Comment: Accident scenarios underestimate potential fire durations and temperatures

- Response
  - The probability, given an accident, of the most severe fire considered in DRAFT NUREG-2125 is 10^{-14} as explained in Section E.3.1.2. While it is possible to envision a more severe fire accident; such events would have an even lower probability and would not affect the overall risk of spent fuel transportation unless they had a release of more than 10,000, which is not feasible.
- Changes to Draft NUREG-2125
  - Add discussion on Caldecott and Baltimore Tunnel Fires and MacArthur Maze Fire, including their probabilities, and show it does not change the risk results.

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Comment: Calibration of finite element models

- Response
  - The report provides an example of a comparison between finite element analysis and test results for a large fire test in Appendix D. Similar comparisons have been made for regulatory and extra-regulatory impact analyses. There have been many physical tests on casks and cask components that have been compared to finite element predictions of the tests. Many spent fuel casks are certified by a combination of testing and analysis, where the testing is used to validate the finite element analysis.
- Changes to Draft NUREG-2125
  - References on comparison between test and analyses for impact analyses will be added to the report.

Hanford should not be an example destination

- Response
  - Transportation risk assessments require designation of shipment points of origination and destinations. Currently, there are no planned spent fuel shipping campaigns. DRAFT NUREG-2125's shipment points of origination and destination were selected to illustrate long-haul geographic diversity. We believe the disclaimer "The routes shown are for illustrative purposes only, and no SNF shipments are planned from any of these points of origination to any of these destinations" makes this clear. While other origination/destination pairs are possible, the DRAFT NUREG-2125 pairs are adequate for the stated purposes of the study. Also, the report makes clear that DRAFT NUREG-2125 is a generic spent fuel transportation risk assessment, and is not intended as a facility- or site-specific environmental assessment.
- Changes to Draft NUREG-2125
  - Repeat existing DRAFT NUREG-2125 disclaimer at least once in chapter 2, chapter 5, chapter 6, appendices B, E, and F

Comment: Results should be used to risk inform 10 CFR Part 71

- Response
  - NUREG-2125 will be available for consideration in NRC's risk management activities.
- No changes to Draft NUREG-2125