

The Institute for Nuclear Materials Management
30th Spent Fuel Management Seminar
January 12 – 14, 2015

Storage and Transportation of Spent Nuclear Fuel
“Understanding the Regulatory Boundaries”




**Spent Fuel Transportation
Campaigns**
JANUARY 14, 2015


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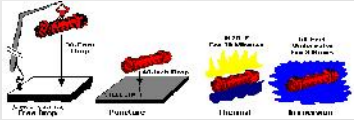
Overview

- Regulatory Structure
- Package-specific Requirements
- Decommissioned Sites
- Spent Fuel Transportation Risk Assessment
- High-burnup Fuel
- Questions

 **Regulatory Structure**



- **10 CFR Part 72 – Storage**
 - Storage can be approved for a site or by general license
 - General design criteria
 - Provide reasonable assurance that spent fuel can be received, handled, packaged, stored, and retrieved without undue risk to the health and safety of the public
 - Protection against environmental conditions and natural phenomena (earthquakes, tornadoes, lightning, hurricanes, floods, tsunami, and seiches)
 - Protection against fires and explosions
 - Protection against external man-induced events
 - Acceptance criteria
 - Nuclear criticality safety – maintained subcritical
 - Radiological protection – dose limits to individual worker and to individual located beyond the controlled area boundary (≤ 25 mrem annual dose)
- **10 CFR Part 71 – Transportation**
 - Type B Fissile packaging required for transport of spent fuel
 - Subject to Normal Conditions of Transportation and Hypothetical Accident Conditions tests
 - 30-ft Free Drop
 - Puncture
 - Thermal (30-min, 800° C, fully engulfing fire)
 - Immersion, equivalent to 50-ft head of water
 - Acceptance criteria after the accident conditions tests
 - Remain subcritical
 - No escape of radioactive material exceeding a total A_2 in one week
 - External dose rate may not exceed 1 rem/hr at 1 m from the external surface of the package
 - Harmonized with IAEA requirements for transportation



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 **Package-specific Requirements - Transportation**

Transportation is performed in the public domain


- **Subcriticality**
 - Transportation regulations require analysis of multiple packages (limiting the number of packages that can be shipped together)
 - Transportation regulations require consideration of water in-leakage
- **Radiation Protection**
 - Transport limit is 10 mrem/hr at 2m from the outer lateral surfaces/vertical planes of the vehicle (including top and underside)
- **Temperature**
 - The temperature of accessible surfaces may not exceed 185° F as prepared for transport

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U.S.NRC
United States Nuclear Regulatory Commission

Decommissioned Sites

- Shutdown plants
 - Trojan
 - LaCrosse
 - Rancho Seco
 - Yankee Rowe
 - Humboldt Bay
 - Connecticut Yankee (Haddam Neck)
 - Maine Yankee
 - Big Rock Point
 - Ft. St. Vrain
- Storage systems have an associated transportation certificate
 - Confirmation the as-loaded contents meet the certificate
 - Inspection of the components for transportation against the certificate
 - Fabrication of some transport components (impact limiters, transport overpack)
 - Possible revisions to the transport certificate to evaluate and incorporate any design or content changes



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Spent Fuel Transportation Risk Assessment (NUREG-2125)

- Published in January 2014
- Radiation emitted from a cask during transportation is a fraction of the natural background radiation
- The risk from accidental release is extremely low
- Regulations are adequate to protect the public against unreasonable risk

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

<div style="background-color: yellow; border: 1px solid black; border-radius: 50%; width: 100px; height: 100px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"> <p>Background 7.56</p> </div>	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Total Shipment Dose: 0.0037</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="background-color: #e6f2ff;">Traffic on the route, 0.00046</td> <td style="font-size: small;">Residents near stops, 0.000012</td> </tr> <tr> <td style="background-color: #ffffe6;">Truck crew and escorts, 0.00068</td> <td></td> </tr> <tr> <td style="background-color: #e6f2ff;">Inspector, 0.0016</td> <td style="font-size: small;">Residents near route, 0.000096</td> </tr> <tr> <td style="background-color: #e6f2ff;">Persons sharing stop, 0.00086</td> <td></td> </tr> </table>	Traffic on the route, 0.00046	Residents near stops, 0.000012	Truck crew and escorts, 0.00068		Inspector, 0.0016	Residents near route, 0.000096	Persons sharing stop, 0.00086	
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High-Burnup Fuel (HBF)

- High burnup fuel
 - > 45 GWd/MTU
- Cladding integrity –
 - Storage and transportation
 - Degradation
- Regulatory Issue Summary (RIS)
 - Developed by taskforce in Division of Spent Fuel Management
 - High-level background and guidance on possible licensing approaches for HBF for storage and transportation
 - Expected to be issued for public comment in February 2015



Questions?

