U.S.NRC RIC 2016

RIC Session T12 "Understanding the NRC's Review and Approval Process for New Fuels"

Regulatory Requirements for Spent Fuel Storage and Transportation

Meraj Rahimi
Chief of Criticality, Shielding, and Risk Assessment Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission

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OUTLINE

- Regulations
- Principle Safety Requirements
- Fuel Safety Functions
- Structural Loads
- Thermal Loads
- Shielding and Radiation Protection
- Criticality Safety
- Summary

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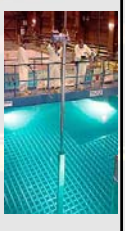
REGULATIONS

- 10 CFR 50 – Domestic Licensing of Production and Utilization Facilities
- 10 CFR 72 - Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste
- 10 CFR 71 - Packaging and Transportation of Radioactive Material



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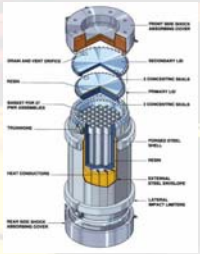
PRINCIPLE SAFETY REQUIREMENTS FOR CASKS/PACKAGES

- Containment/Confinement of Content
  - Spent fuel cladding and structural performance
  - Casks material and structural performance
- Radiation Shielding/Protection
  - Spent fuel source strength and geometry
  - Adequate cask shielding
- Criticality Safety
  - Spent fuel isotopic contents and geometry
  - Cask criticality control system
    (e.g., basket, neutron poison)



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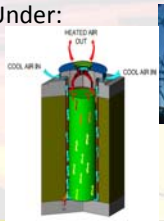
POTENTIAL SAFETY FUNCTIONS ASSIGNED TO SPENT FUEL ASSEMBLIES

Confining Spent fuel Pellets and Maintaining Assembly Geometry Under:

- Mechanical loads

- Thermal loads



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MECHANICAL LOADS ON SPENT FUEL

- Vibration
- Shock
- Cask Tip Over
- Cask Drops

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THERMAL LOADS ON SPENT FUEL

- Transient Under Cask Loading
- Passive Decay Heat Removal in Storage and Transportation
- Off Normal Events (e.g., heat transfer blockage)
- Accidents (e.g., fire)

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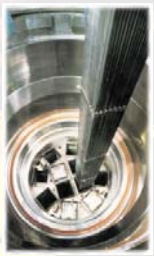
Spent Fuel Shielding

- Source Term Characteristics
- Source Configurations From
  - Mechanical loads
  - Thermal loads



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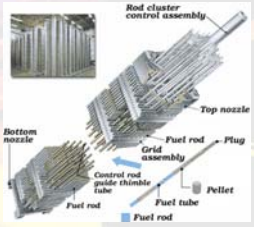
SPENT FUEL CRITICALITY SAFETY

- Fresh Fuel Assumption
- Burnup Credit Assumption
  - Reactor operating conditions
    - Power history
    - Radial and axial burnup profiles
    - Exposure history to
      - control rods
      - burnable poison rods
    - Core boron concentration history
    - Moderator density history
    - Fuel temperature history
  - Isotopic benchmarking



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SUMMARY

- Spent Fuel Safety Functions
  - Confinement
  - Shielding
  - Criticality safety
- Mechanical and Thermal Loads From
  - Normal
  - Off normal
  - Accident

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