

Risk-Informing Spent Fuel Storage and Transportation Regulatory Activities



Goals

- Focus regulatory efforts on storage at this time
- Develop a qualitative risk-informed framework to:
 - Better enable the staff to focus its regulatory efforts
 - Improve guidance and streamline casework activities
 - Evaluate requests for exemptions to regulations while maintaining appropriate margins of safety and security

Scope and Implementation

- Literature search of available information
- Define defense-in-depth
- Define decision metrics and acceptable risk criteria
- Develop a preliminary framework
- Pilot the preliminary framework
- Finalize framework
- Develop staff training

Literature Search



- **EPRI-100969**, “Probabilistic Risk Assessment (PRA) of Bolted Storage Casks”, 2004.
- **NUREG-1864**, “A Pilot Probabilistic Risk Assessment of a Dry Cask Storage System At a Nuclear Power Plant,” 2007.
- **Risk-Informed Decision making for Nuclear Material and Waste Applications**, (NMSS) Rev. 1, 2008.
- **NEI PRM 72-7**, “Spent Fuel Cask Certificate of Compliance Format and Content,” 2012.
- **NUREG-2150**, “A Proposed Risk Management Regulatory Framework”, 2012.
- **NUREG/CR-7016**, “Human Reliability Analysis-Informed Insights on Cask Drops,” 2012.
- **SECY-13-0132**, “U.S. Nuclear Regulatory Commission Staff Recommendation for the Disposition of Recommendation 1 of the Near-Term Task Force Report,” 2013.

Questions from Literature Search

- Will the risk from spent fuel dry storage continue to be low considering operating experience and uncertainties from aging and other unknowns?
- If yes, how can the licensing and certification process be adjusted in order to reflect the associated risk?

Defense-In-Depth

(Three Phases of Dry Spent Fuel Storage)

Loading and Transfer



Storage in ISFSI



Transfer and Unloading



Defense-In-Depth

(Three Main Safety Functions in Dry Spent Fuel Storage)

Protection against
release of radioactive
materials
(confinement)

Safety
Functions

Protection against
radiation exposure
(shielding)

Protection against
nuclear criticality
(fissile loading,
geometry, and
moderator)

Defense-in-Depth

(Three levels of safety)

Level 1, Prevention

- site selection
- engineered barriers (cladding, canister, overpack)
- procedures and monitoring

Level 2, Mitigation

- accident assessment
- perform remedial actions
- repair confinement

Level 3, Emergency Actions

- accident detection/assessment
- notification
- protective response

Possible Risk Assessment Approach

- Operational Phase [Storage]
 - Safety Function [Confinement]
 - Components of Defense [Canister]
 - Key Components [Primary Confinement]
 - Sub-components [Lid-to-Shell Weld]

» Data



- 1) Expert Opinion
- 2) Operating Experience
- 3) PRAs/HRAs



Failure Mechanism	Failure Frequency	Failure to Detect	Consequence	Risk
Delayed Hydrogen Cracking	Low	High	Low	Low

Path Forward

- Develop a qualitative approach informed by:
 - Quantitative data from previous PRAs and other sources
 - Operating experience
 - Uncertainties due to aging and other unknowns
 - Linking licensing and certification to the three principle safety functions
- Will include:
 - Developing a decision criteria
 - Developing implementation plan for a pilot
 - Collaboration with stakeholders