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Status of the Spent Fuel Pool Scoping Study (SFPSS)

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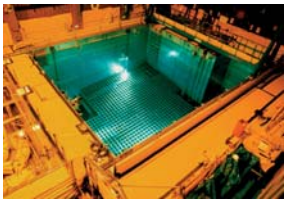
U.S. Spent Fuel Pools



- Spent fuel rods stored in spent fuel pools (SFPs) under at least 20 feet of water
- Typically ~ 1/3 to 1/2 of fuel in reactor replaced with fresh fuel every 18 to 24 months
- Spent fuel stored in pools for a minimum of 5 years

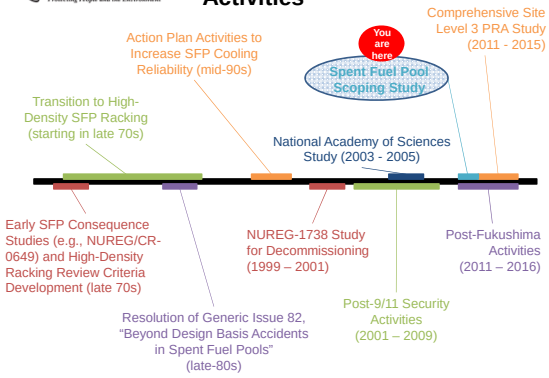
2

Spent Fuel Safety

- SFPs were originally designed for limited storage of spent fuel until removed off-site
- Safety of spent fuel in pools achieved primarily by maintaining water inventory, geometry, and soluble boron (pressurized water reactors only)
- Drain down could lead to uncovered fuel, heat-up, and the release of radionuclides

3

Timeline of Major SFP-related Activities



4

Risk of Large Release

- SFP risk is low, due to the low frequency of events that could damage the thick reinforced pool walls
  - Frequency of fuel uncovery; 6E-7 to 2E-6/yr – NUREG-1738
  - Consequences have been assessed to be large due to the potential for heat-up of all the fuel in the pool
  - Heat-up of the fuel in the pool can lead to "zirconium fire" initiation and propagation
  - Large inventory of Cs-137
- The above prompts stakeholders to ask if older fuel should be moved to casks

5

Motivation for Focusing on SFP Seismic Hazards

Spent fuel storage considerations include:

- SFP Seismic Hazards
- Dry Cask Storage Risk *(e.g., NUREG-1864)*
- Cask Drop Hazards for SFPs *(e.g., NUREG-1738)*
- Repackaging For Transportation
- Fuel Storage Infrastructure *(e.g., 2010 EPRI study)*
- Worker Dose *(e.g., 2010 EPRI study)*
- Emergency Preparedness *(e.g., NUREG-1738)*
- Part 50, 72 & 73 Regulatory Requirements
- Multi-Unit Risk *(e.g., SECY-11-0089 project)*
- Design/Operation Differences Between Sites
- Boraflex Degradation & Inadvertent Criticality
- Protection Against Malevolent Acts *(e.g., post-9/11 security assessments)*
- Other SFP Hazards *(e.g., NUREG-1353)*
- Actions in Response to Japan Events *(e.g., Near-Term Task Force Recommendation 7)*

SFP Seismic Hazard

Past studies have indicated that SFP seismic hazard is an important piece of overall spent fuel risk.

For this reason, SFP seismic hazard is the logical place to start in probing the continued applicability of past studies and developing insights for the current spent fuel storage situation.

Depending on the results gained from the study, additional work might be necessary to obtain a more holistic answer.

6

Overview of Spent Fuel Pool Scoping Study (SFPSS)

- Focus: reexamination of the potential advantages associated with moving older fuel stored in the SFP to dry cask storage in an expedited manner
- Emphasis is given to acquiring timely results to support ongoing deliberations and respond to external stakeholder interest. The project is using:
  - Available information / methods
  - A representative operating cycle for a BWR Mark I
  - Past studies to narrow scope
- Plan finalized: July 2011
- Study to be completed by: Summer 2012

7

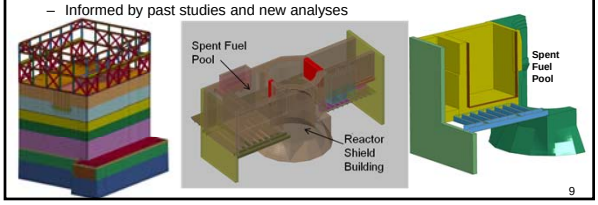
Technical Approach

- Two conditions to be considered:
  - Representative of the current situation for the selected site (i.e., high-density loading and a relatively full SFP)
  - Representative of expedited movement of older fuel to a dry cask storage facility (i.e., low-density loading)
- Will consider situations with effective and ineffective accident mitigation
- Elements of the study include
  - Seismic and structural assessments based on available information to define initial and boundary conditions
  - SCALE analysis of reactor building dose rates
  - MELCOR accident progression analysis (effectiveness of mitigation, fission product release, etc.)
  - Emergency planning assessment
  - MACCS2 offsite consequence analysis
  - Probabilistic considerations

8

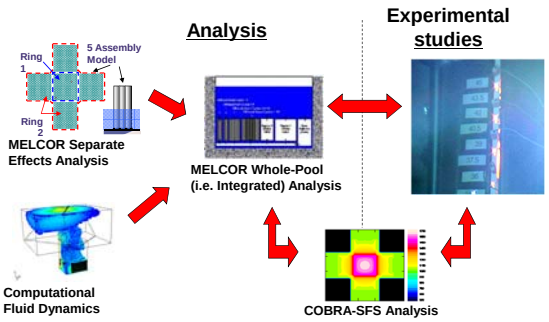
Seismic and Structural Inputs

- Seismic Event
  - Challenging but very low frequency of occurrence event (greater than the design basis for Central and Eastern US plants)
  - Updated ground motion characterization models (United States Geological Survey, 2008)
- Structural Assessment
  - To determine starting point for accident progression analysis
  - Assesses performance of SFP structure and liner, SFP penetrations, reactor building structure above the SFP, racks and fuel, relevant reactor shutdown systems and other relevant structures
  - Informed by past studies and new analyses



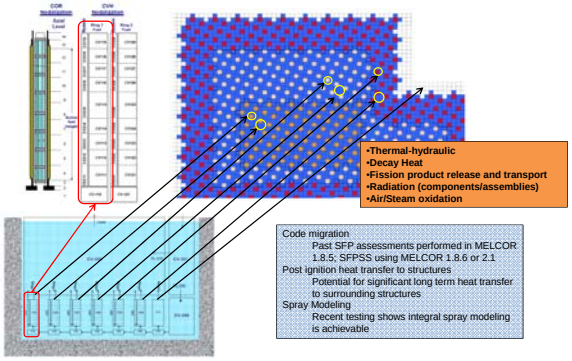
9

Use of MELCOR for SFP Analysis



10

High-Density Post-Outage SFP MELCOR Model



11

Wrap-Up

- Specific examination of the pool loading configuration (high-density vs. low-density) for contemporary SFP loading and requirements
- First NRC evaluation of SFP beyond-design-basis accident (BDBA) seismic /structural response since essentially late 1980s
- Updated SFP BDBA accident progression analysis and consequence estimates
  - including treatment of mitigation strategies put in to place since September 11th, 2001

12