U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
*Protecting People and the Environment*

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**International Session – Post-Fukushima Research**

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## Following Fukushima Accident

- Commission established “Near Term Task Force” (NTTF)
- NTTF developed 12 recommendations
- Commission asked staff to develop plan and schedule to address recommendations
- Additional recommendations also evaluated
- Several recommendations require further research



- Mitigating Strategies
  - Filtered Containment Vents
  - Hydrogen Control
  - Station Blackout
- Aqueous Pathways
- Spent Fuel Pool Scoping Study
- Site Risk (Level 3 Probabilistic Risk Assessment)

## Filtered Containment Venting System

- Commission ordered reliable hardened vents for BWR Mark I and II plants (Order EA-12-050)
- Filtered containment vents identified as warranting further consideration (SECY-11-0137)
- Performed analyses of technical basis to support regulatory analysis of the need for filtered venting systems in BWR Mark I and Mark II containments
  - MELCOR
  - MACCS2
  - PRA

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## Hydrogen Control

- Fukushima NTTF recommended that NRC identify insights about hydrogen control and mitigation inside containment or in other buildings.

- Revisit H2 control in all containment types
- Assess H2 transport into surrounding buildings and evaluate consequences
- NRC/DOE Fukushima Forensic Analysis http://melcor.sandia.gov/docs/Fukushima_SAND_Report_final.pdf
- Planned involvement in OECD Working Group on Analysis and Management of Accidents activity related to hydrogen generation, transport and mitigation.

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## Station Blackout (SBO)

- Fukushima lessons learned identified need for revising SBO rule (10 CFR 50.63)
- Staff proposal is that plant should be able to be maintained in a safe condition indefinitely through three-phase approach
- Staff pursuing Station Blackout Mitigation Strategies Rulemaking
- Extended battery operation study at Brookhaven National Lab
  - Evaluate a typical commercial nuclear power plant batteries' response to SBO events outside the scope of the current SBO rule
  - Independently validate performance of typical licensee batteries

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## Research on Aqueous Pathways Resulting from Severe Accidents

- Aqueous release occurred during Fukushima accident
- Current models do not address aqueous release pathways
- RES is starting a program to assess:
  - Containment failure modes that could lead to aqueous releases
  - Source term modeling for aqueous pathways
  - Transport of contaminated water and its radiological consequences: surface water bodies, groundwater
- Expected outcome: whether potential aqueous releases warrant further mitigating action.



## Spent Fuel Pool Scoping Study (SFPSS)

- Study initiated to examine if there is potential benefit to moving older fuel to dry cask storage in an expedited manner, and to determine change in consequences from severe pool accident if old fuel was removed.
- Past SFP risk studies showed that rapid draindown of pool is most risk-significant
- Seismic hazard is considered the most prominent contributor to SFP fuel uncovery



## SFPSS Approach (continued)

- Analyzing earthquake impact on a representative operating cycle for a BWR Mark I (Peach Bottom)
  - Peak ground acceleration used – 0.71 g – beyond the seismic design basis for Eastern US plants
- Looking at relative differences in radiological consequences of an SFP accident between high density and low density loaded pool
- Study will inform a regulatory decision-making process guided by the “Tier 3” Japan Lessons-Learned item entitled Transfer of Spent Fuel to Dry Cask Storage.

## Site Level 3 Probabilistic Risk Assessment (PRA)

- Purpose: Assessment of site risk
  - Scope includes main site radiological sources (reactor, SFP, multiple units), all internal and external initiating events, all modes of operation
  - The study is for a single site – Vogtle Units 1 & 2 are participating in study
- Objectives:
  - reflect technical advances in PRA and severe accident modeling, and improvements in plant operations and safety;
  - enhance PRA scope and staff capability;
  - extract new insights to enhance regulatory decisionmaking;
  - and evaluate feasibility and cost of Level 3 PRAs
- Study to be completed over a 4-year period
- Current status – Reactor, Level 1, at-power, internal events model complete