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# PWROG Risk Aggregation Pilot

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# Overview

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- Purpose
- Pilot Effort
- Initial Lessons Learned
- Schedule

# Purpose

- Current and planned Risk-Informed Applications need structured process to properly aggregate risk and assess risk insights from multiple hazards and plant states
  - Decisions should not be biased by excessive conservations or uncertainties
  - Different hazard/plant state models vary in conservatism and extent of uncertainties
- PWROG is piloting high level framework contained in EPRI-Report 3002003116 “An Approach to Risk Aggregation for Risk-Informed Decision-Making”
  - Demonstrate feasibility of approach
  - Provide feedback to EPRI on the documented approach
  - Developed initial implementation guidance

# Stakeholders

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- Nuclear Energy Institute (NEI)
- Electric Power Research Institute (EPRI)
- Nuclear Regulatory Commission (NRC)
- Boiling Water Reactor Owners Group (BWROG)
- CANDU Owners Group (COG)

# Pilot Plants

- Pilot plants have different capabilities with regards to hazards/plant state models
  - Variety/vintage of quantitative vs. qualitative risk assessment for different hazards
  - External hazards (e.g., seismic, high winds, etc. may be IPEEE vintage or being currently revised)
  - Variety of risk-informed applications in place at the pilots that can be exercised

# Pilot Models

Hazard	Plant #1	Plant #2
Internal Events CDF/LERF	Yes	Yes
Internal Flood CDF/LERF	Yes	Yes
Fire (method and CDF/LERF)	Yes	Yes
Seismic (method and CDF/LERF)	SMA	Yes
High Winds CDF/LERF	Screened	Yes
External Flood CDF/LERF	Screened	Yes
Other External Events	All screened	All screened
LP/SD	No	No

# Pilot Scope

Application	Pilot 1	Pilot 2
Base Model Characterization	Yes	Yes
SDP	Yes	Yes
Risk Informed Completion Time	Yes	Yes
Maintenance Rule (a)(4)	Yes	No
Time Critical Operator Actions	No	Yes

# Initial Lessons Learned

- Uncertainty an important element of the EPRI approach
- Characterization of the different PRA hazard groups is needed to understand dominant contributors to risk with insights on uncertainty, conservatisms, assumptions, etc.
- Parameters to support aggregation may not be equally accessible for each hazard group
- Well documented, systematic uncertainty analysis expedites the effort
- Process for handling importance measures of dependent human error probabilities (HEPs) is needed



# Initial Lessons Learned

- Existing PRA software results may require additional calculations, e.g.,
  - Containment failure modes
  - Seismic accident sequences
- Model uncertainty across hazard groups may not be at the same level of detail
  - Increases burden to identify risk drivers
- External hazards and data general use more conservative approaches and data than internal events models

# Additional Considerations

- Explore sensitivity analyses and their implications
  - are there new sensitivity analyses that should be evaluated?
- Explore how to “credit” non-quantitative results (e.g., from an SMA)
- Explore the most useful importance measure(s) for understanding risk drivers (e.g., RAW versus F-V)
- Explore the process for interpreting assumptions, uncertainties, etc. (e.g., heuristic versus systematic)

# Pilot Schedule

Activity	Date
Base Model Characterization	July 2016
Application 1	July 2016
Application 2	August 2016
Application 3	September 2016
Draft Report	October 2016
Final Report	December 2016