Near-Term Task Force Recommendations 2.1: Seismic Hazard Analysis for WUS Plants

June 19, 2013

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Timeline of Events

- Fukushima accident occurs March 2011
- NRC forms Near Term Task Force
- Near Term Task Force Publishes Report with key recommendations July 2011
- NRC issues Request for Information 50.54(f) letter March 2012
  - To all operating power reactor licensees
  - Establishes a timeline and actions on a number of key issues

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Seismic Recommendations

Ongoing	2.3	Walkdowns	11/2012 (+outages)	Walkdowns to assure plants are meeting licensing basis and to look for potential seismic issues. Reports due November 2012. Some equipment delayed until outage.
Ongoing	2.1	Hazard evaluation	3/2014 (CEUS) 3/2015 (WUS)	Hazard evaluation due in 2 years for NPPs within the CEUS region. 3 years for western US NPPs performing SSHAC level 3 studies. Plant-specific analyses specified.
		Risk evaluation	3 years after hazard	Full plant risk evaluations due 3 years after hazard results if reevaluated hazard exceeds plant design level.
		Regulatory Actions	Depends on findings	After receiving the information from the plant risk analyses, the NRC will determine appropriate regulatory actions.
Long term	2.2	10 year update	Rulemaking timeline	Rulemaking to require a reevaluation every 10 years.

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Recommendation 2.1 & 2.3 Team

- NRC Japan Lessons Learned Directorate
- NRC offices providing technical support with assistance from contractors

<u>Nilesh Chokshi – Overall Lead R2.1 & R2.3</u>

Cliff Munson – Seismic Team Lead
Annie Kammerer – R2.3 Technical Lead
Jon Ake – R2.1 Technical Lead

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R2.3 Seismic Plant Walkdowns

- Seismically qualified plant equipment inspected by each licensee
  - about 100 items and adjoining areas walked down
- Objective to confirm compliance with plant license and look for vulnerabilities
  - Equipment anchorage
  - Condition of equipment
  - Potential for equipment to interact during shaking
- Walkdown inspection reports submitted to NRC Nov 2012

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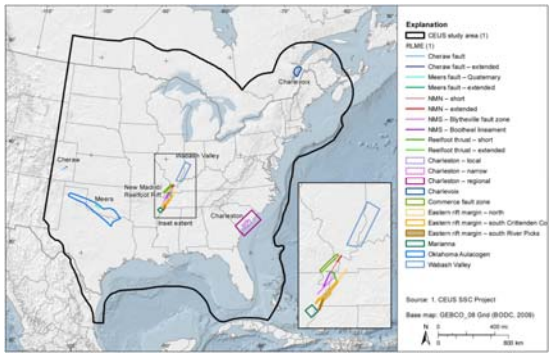
R2.1 Hazard & Plant Risk Reevaluation

- R2.1 divided into 2 phases
  - Phase 1 – Licensees perform hazard & risk evaluations
  - Phase 2 – NRC determines regulatory action
- Seismic hazard evaluations based on current practices for new reactors
- Risk evaluations are needed for NPPs whose reevaluated hazard exceeds design

R2.1 Seismic Hazard Reevaluation

- Licensees perform probabilistic seismic hazard analyses following NRC guidance (RG 1.208)
- CEUS licensees (96 units/59 sites)
  - **Regional** CEUS seismic source model
  - **Regional** CEUS ground motion model
  - Plant-specific site analyses
- WUS licensees (6 units/3 sites)
  - **Site-specific** *SSHAC Level 3 studies*
  - Plant-specific site analyses



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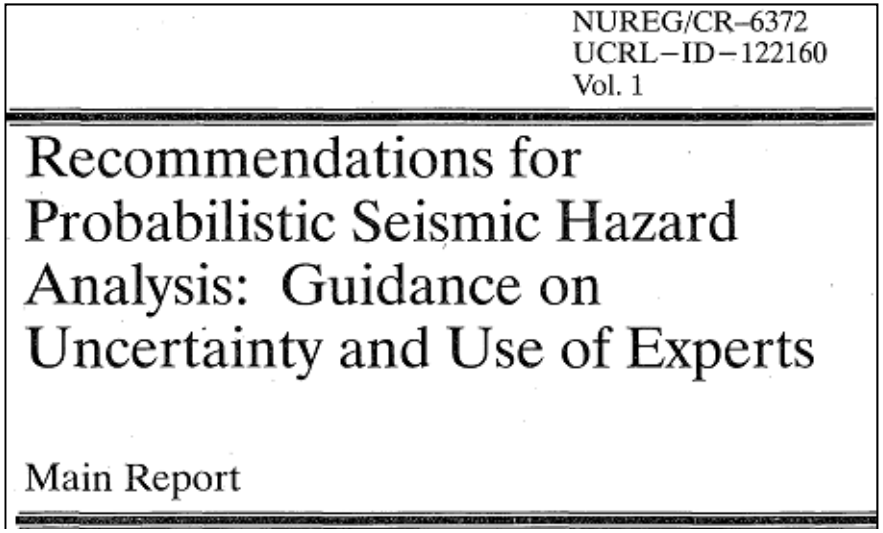
What is SSHAC Process?

A structured framework and procedure for conducting multiple-expert assessments for input to seismic hazard analyses



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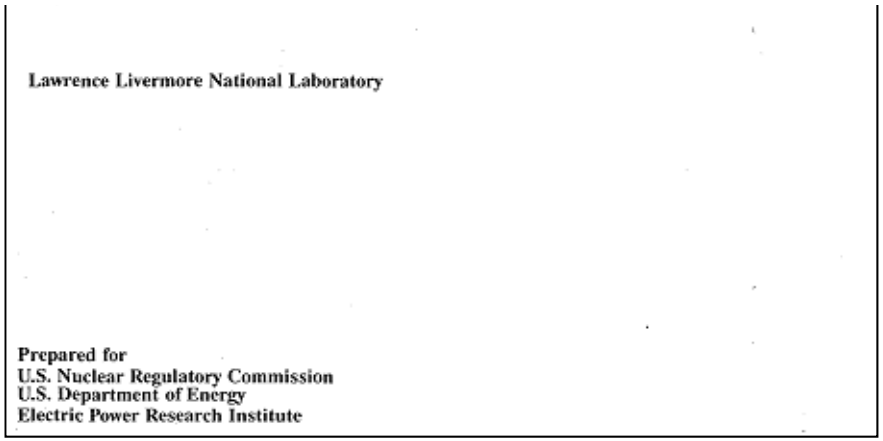
Recommendations for Probabilistic Seismic Hazard Analysis: Guidance on Uncertainty and Use of Experts

Main Report

Prepared by
Senior Seismic Hazard Analysis Committee (SSHAC)
R. J. Budnitz (Chairman), G. Apostolakis, D. M. Boore, L. S. Cluff, K. J. Coppersmith, C. A. Cornell, P. A. Morris

Procedures defined by the Senior Seismic Hazard Analysis Committee (SSHAC)



Lawrence Livermore National Laboratory

Prepared for
U.S. Nuclear Regulatory Commission
U.S. Department of Energy
Electric Power Research Institute

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Key Features of SSHAC Process

- Comprehensive collection and assessment of available data, models and methods
- Structured interactions among participants in formal workshops
- Objective to create a model that incorporates the range of views that are present in the broader technical community
- Rigorous peer review of entire process

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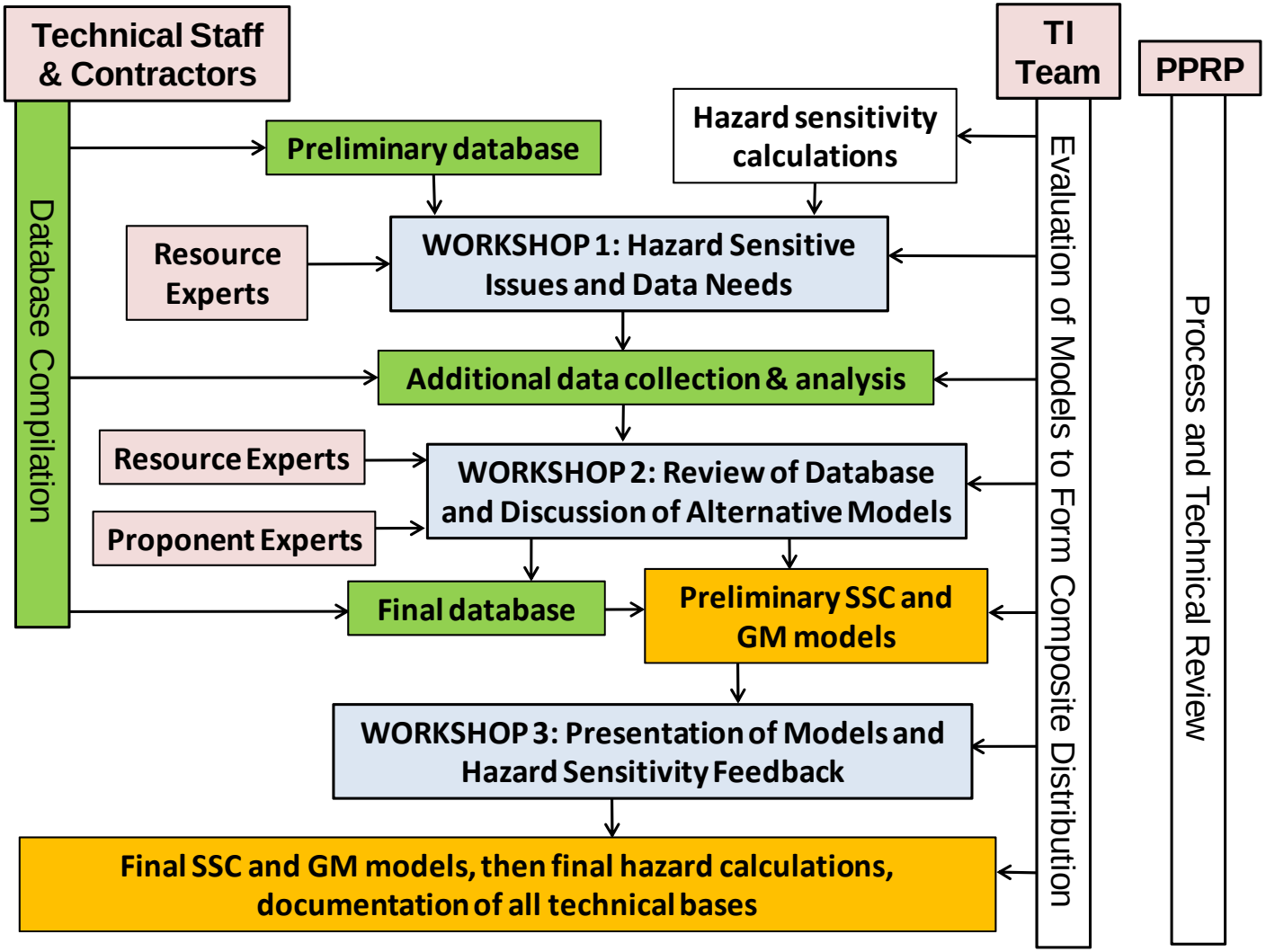
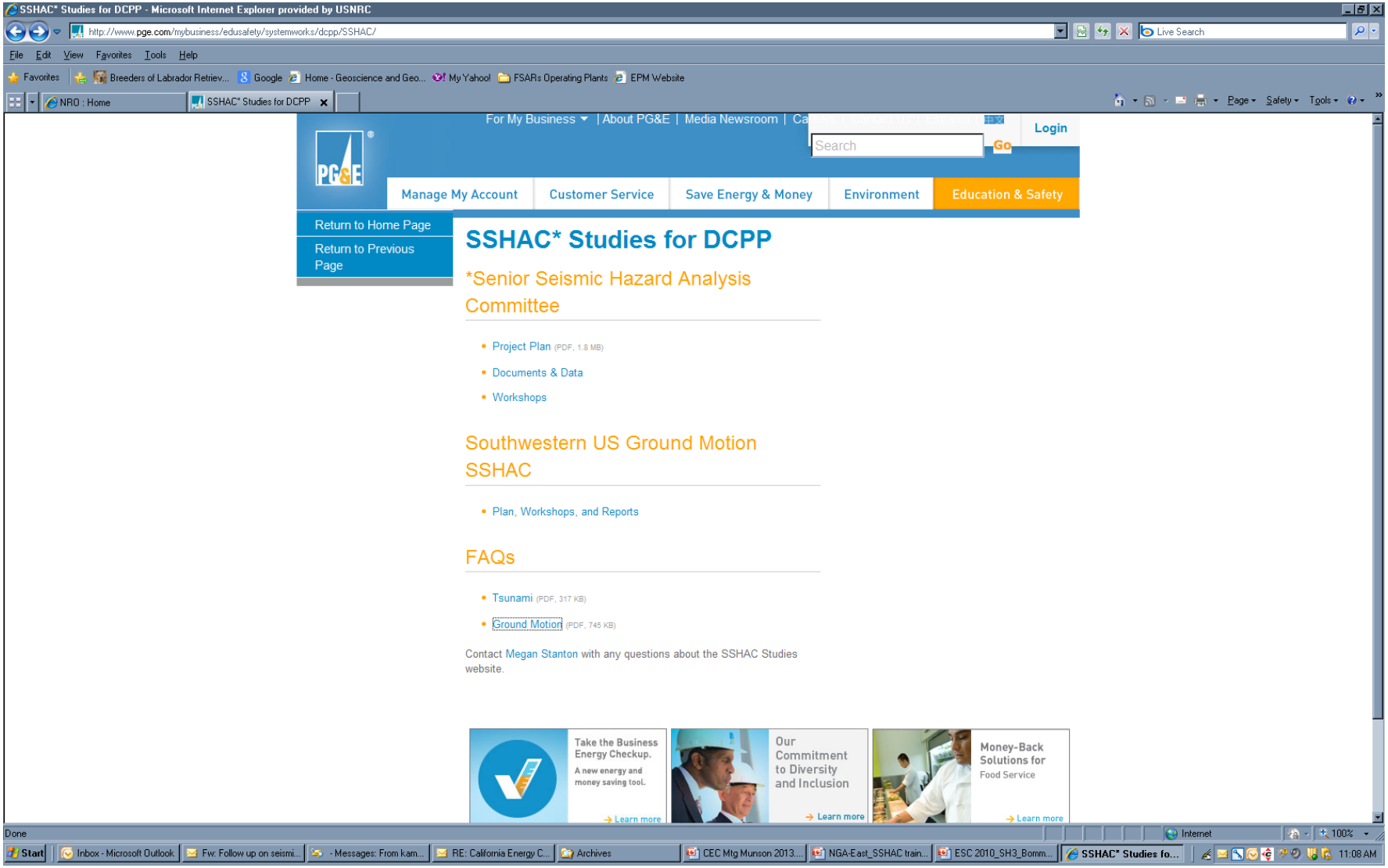
SSHAC Level 3 Process



PG&E SSHAC Studies



NRC Participation at SSHAC Workshops

- NRC staff geologists and seismologists have attended each of the SSHAC workshops
- NRC staff participating as observers to ensure conformance with NRC guidance
- Formal evaluation by NRC after submittal of seismic hazard analyses in March 2015

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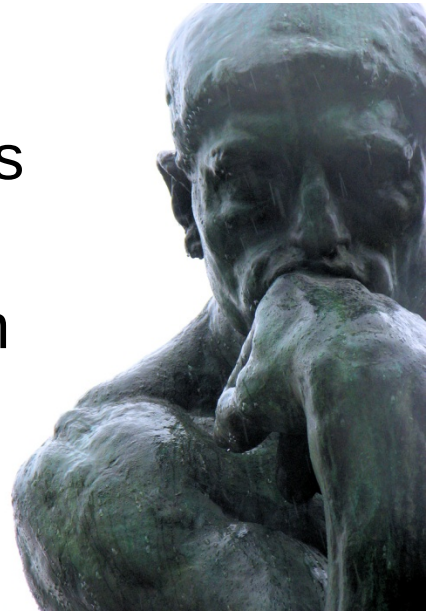
Key Issues for NRC Evaluation of SSHAC Studies

- SSHAC studies conducted following NRC guidance?
  - all available data, models and methods thoroughly considered
  - selection and inclusion of models and parameters in a logic tree with their weights adequately explained and justified
  - technical bases for all decisions have been comprehensively documented



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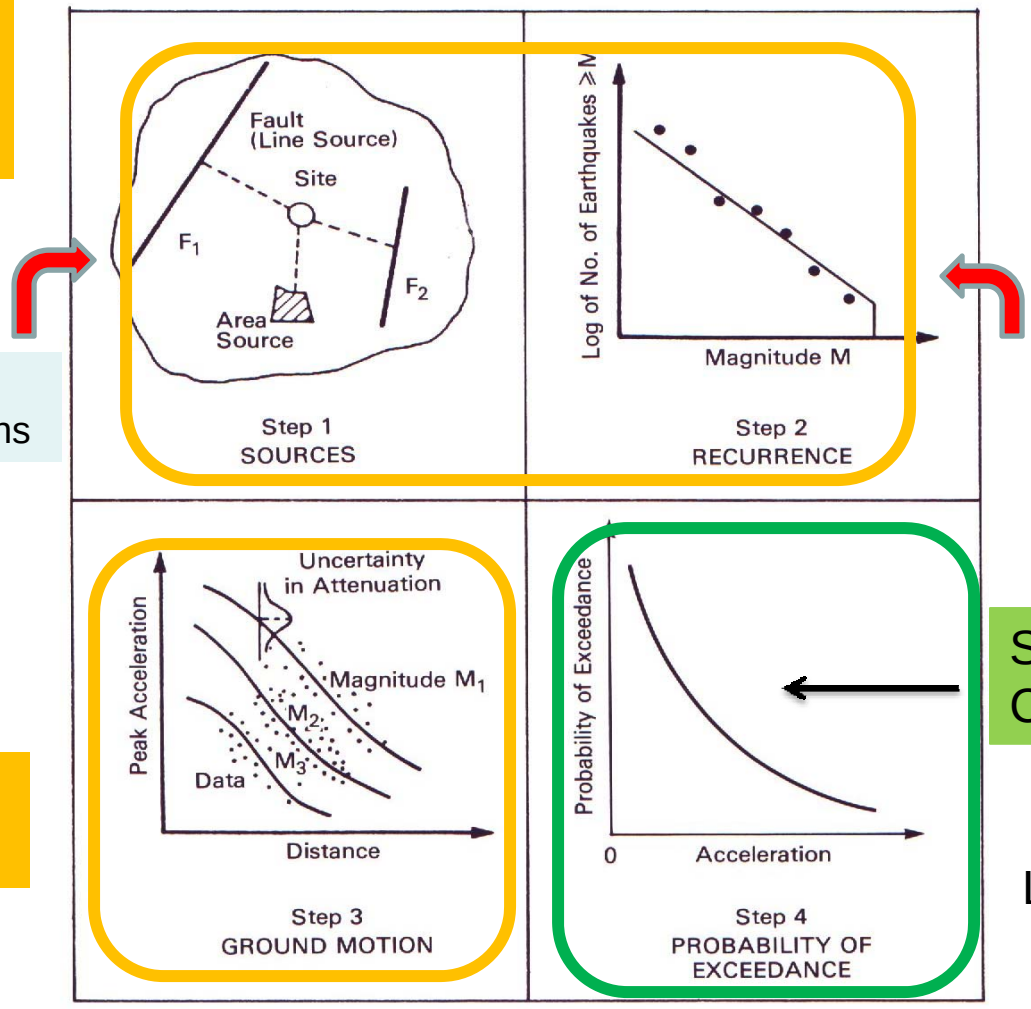
SSHAC Studies for Probabilistic Seismic Hazard Analysis

Seismic Source Characterization Model

Seismic Sources
Magnitudes & Locations

Ground Motion Model



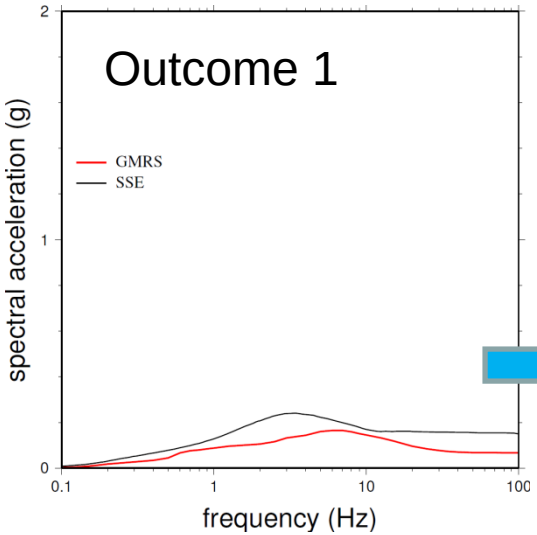
Earthquake Recurrence

Seismic Hazard Curves

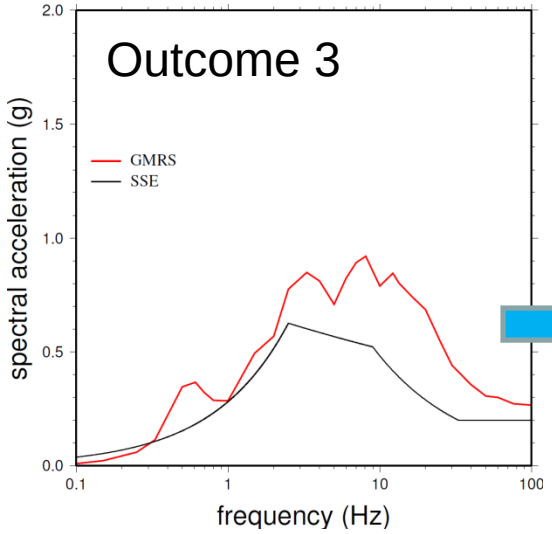
Local Site Response

GMRS

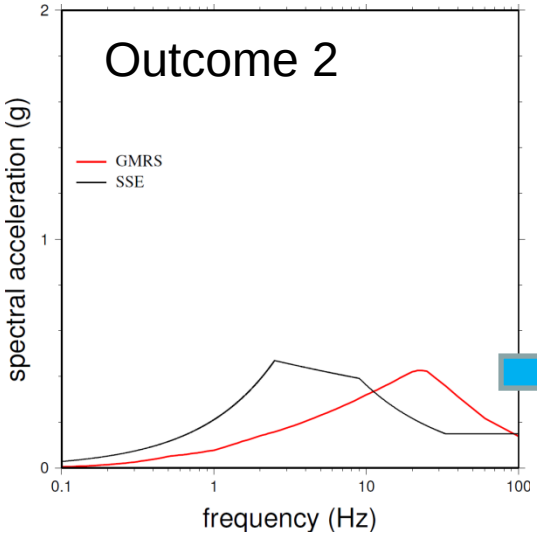
R2.1: Seismic Hazard Reevaluation Outcomes



No Further Analysis



Plant Risk Evaluation Needed



Industry Testing Program for High Frequency Sensitive components

Seismic Plant Evaluations

- Two seismic plant evaluations required if hazard exceeds plant design
- Expedited Plant Evaluation
  - Licensees conduct while longer complete plant risk evaluations are underway
  - Evaluation and modification (as appropriate) of subset of plant equipment needed to protect reactor core following beyond design basis seismic event
- Complete Plant Risk Evaluation
  - Systems/accident sequence analysis
  - Seismic fragility analysis of plant equipment and structures
  - Seismic risk quantification for plant

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Schedule for Seismic Hazard and Risk Evaluations

- Hazard Analyses
- Enhanced Interim Actions
- Risk Evaluations