The purpose of this material is to provide a summary of the positions on ISG-20, Implementation of a Probabilistic Risk Assessment- Based Seismic Margin Analysis for New Reactors, provided by NRC, and to form a basis upon which a technical discussion could proceed.

This summary attempts to provide an introduction to what a PRA based Seismic Margin Assessment is about and then pick up with the impact on Equipment Qualification (in red). Keep in mind that, for the most part, this was prepared by the structural group in NRC.

ISG 20 Provides Guidance on-

1- a PRA-based seismic margin analysis method and its implementation for DC,

2- site and plant-specific updates of the DC PRA-based seismic margin evaluation (SMA) for COL applications,

3- post-COL verification of as-designed and as-built plant seismic margin capacity preceding initial fuel load, and

4- documentation of findings.

Key elements of a Seismic PRA-

1- the seismic hazard analysis used to estimate the frequencies of occurrence of different levels of ground motion at a particular site,

2- the seismic fragility evaluation used to estimate the conditional probability of failure of important SSCs whose failure may lead to core damage and/or a large release, and

3- the plant response analysis.

Seismic PRA not Practical at DC and COL

- Not practical for a DC to do a Seismic PRA due to lack of site specific hazard information

- Alternative is a PRA Based Seismic Margin Analysis, per SECY-93-087, Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light Water Reactor Designs.

- Estimates the design specific plant seismic capacity in terms of sequence level HCLPF capacities and fragility for all sequences leading to core damage or containment failures up to 1.67 times the SSE

- Objective of the analysis is to demonstrate low seismic risk

Seismic Fragility Evaluation (DC)

- Screening of rugged SSCs can be performed on the basis of the DC's Certified Seismic Design Response Spectra (CSDRS) with its PGA scaled by a factor of 1.67.

- A Seismic Equipment List should document the SSCs associated with the accident sequences that will require seismic fragility evaluation.

- Justification of applicability to the SSCs in the Certified Design Scope is required when using generic test data

Impact on Seismic Qualification of Equipment

- For equipment to be qualified by seismic qualification tests, Section E.5 of EPRI Report 1002988, Seismic Fragility Application Guide (2002) is acceptable

- The TRS should be specified at the 99% confidence level to account for test uncertainties

- The seismic demand is defined in terms of the CSDRS based (or HRHF, if applicable) seismic input, and account for structural amplifications including Soil Structure Interaction.

- Incorporate an additional seismic margin factor, as appropriate, such as the 1.4 factor from ASCE 43-05.

- The design specific plant level HCLPF value should be demonstrated to be equal to or greater than 1.67 times the CSDRS PGA

COL Applicant

- A COL applicant must describe the plant specific PRA and results in the FSAR

- Must use the PRA information referenced in the DC application

- Must update with site specific effects (slope failure, soil liquifaction, etc.) and, site specific safety related structures

- When seismic fragility analysis is performed considering site specific effects and plant specific features, the response spectrum shape should be the COL site specific ground motion response spectra.

- If plant level HCLPF capacity is less than 1.67 time site specific ground motion response spectra, 1) upgrade the SSC affected, or 2) perform a full convolution of sequence fragility for all sequences to demonstrate acceptably low risk (i.e. a seismic PRA, not a seismic margins assessment)

Prior to Fuel Load

- A full verification analysis is required