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HLWRS-ISG-01

United States Nuclear Regulatory Commission
NRC/NEI Meeting to Address Technical Issues on Final HLWRS-ISG-01
presented by NEI/EPRI at the ACNW December 12, 2006 Meeting
January 30, 2007

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Purpose

- Discuss Interim Staff Guidance (ISG), HLWRS-ISG-01 *Review Methodology for Seismically Initiated Event Sequences,* September 29, 2006

- Address technical issues presented by NEI & EPRI at the December 12, 2006 ACNW meeting

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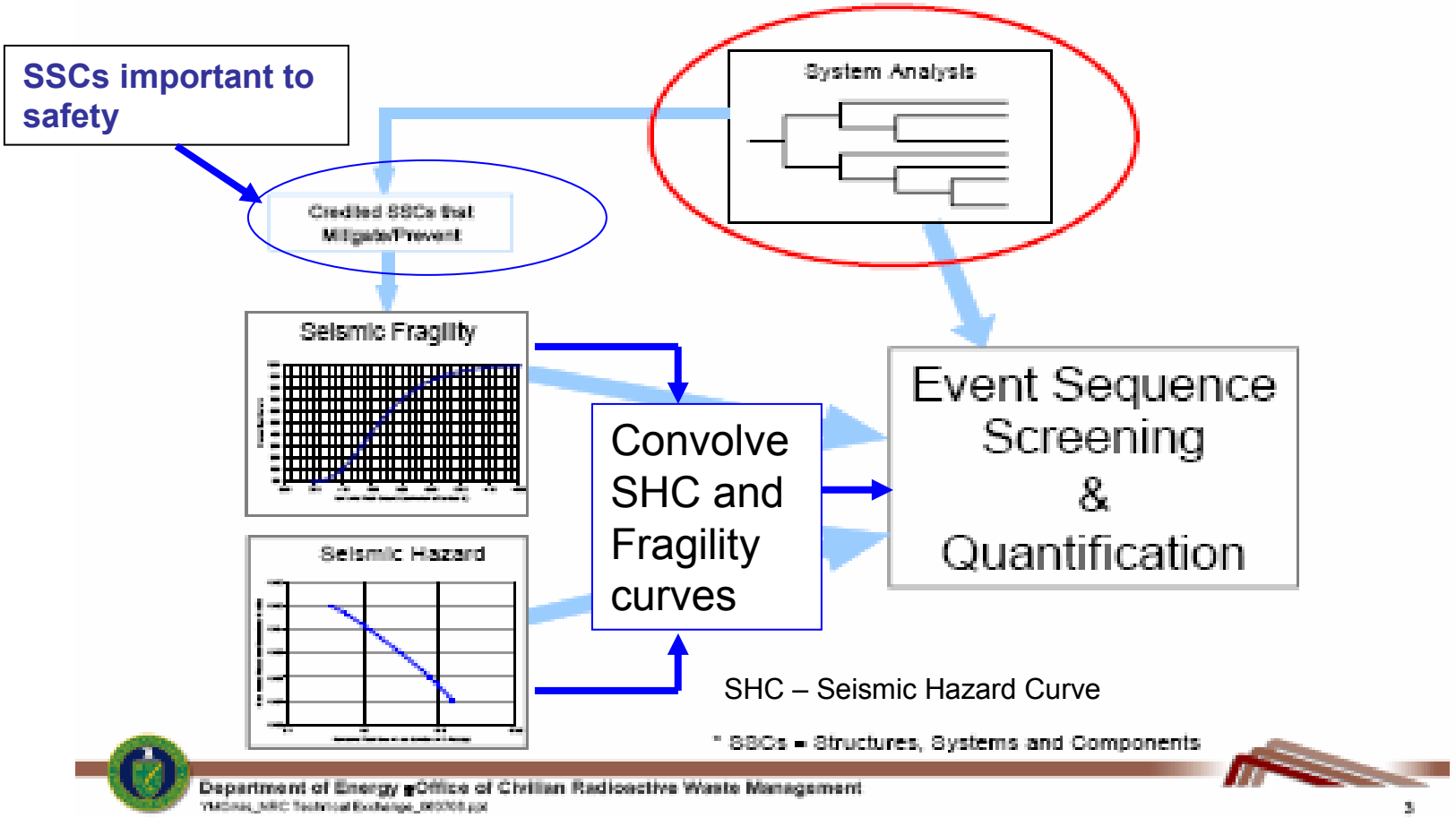
Seismic Preclosure Safety Analysis

DOE Slide from Seismic Technical Exchange 6-7-2006

Schematic of Seismic Probability Analyses



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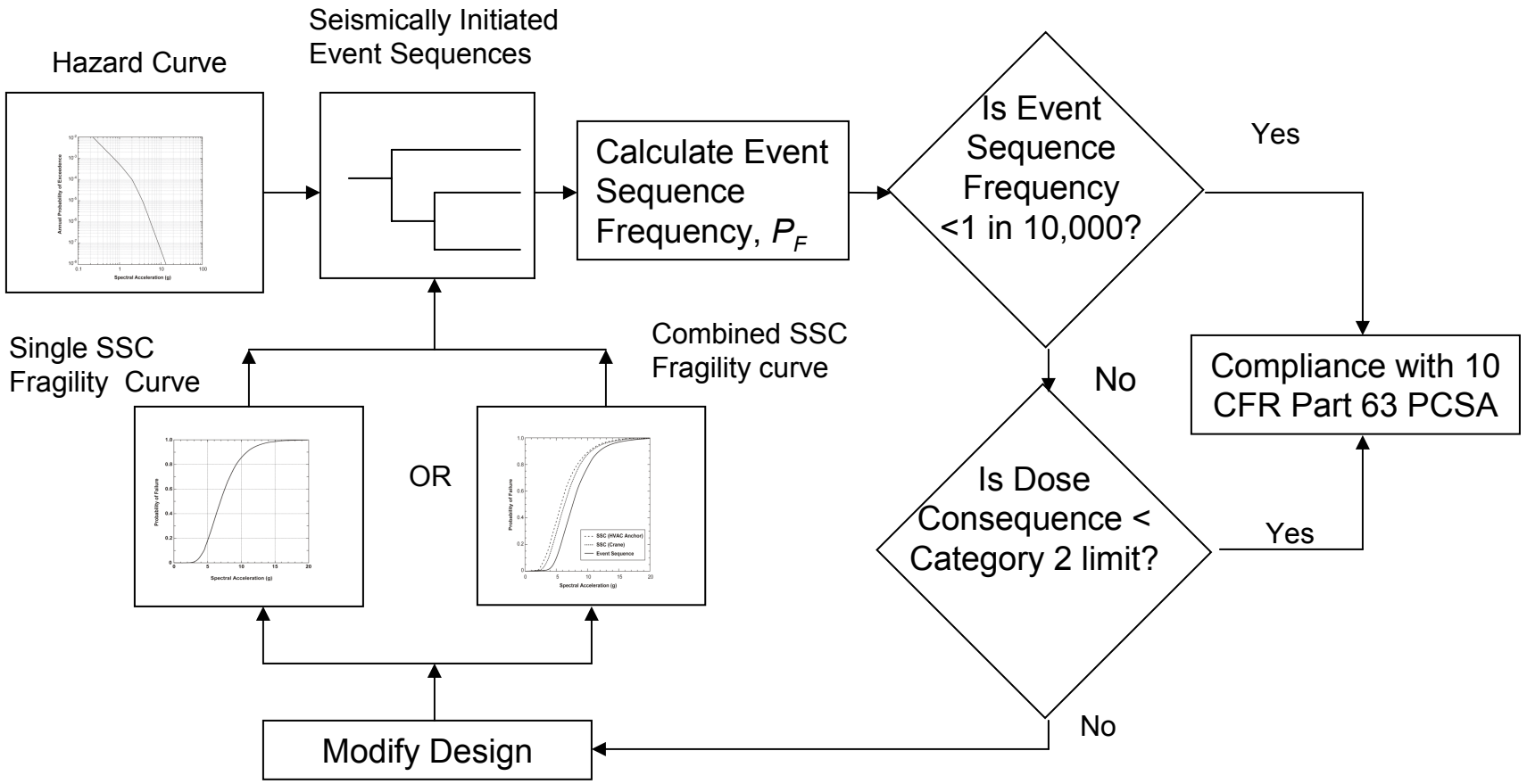
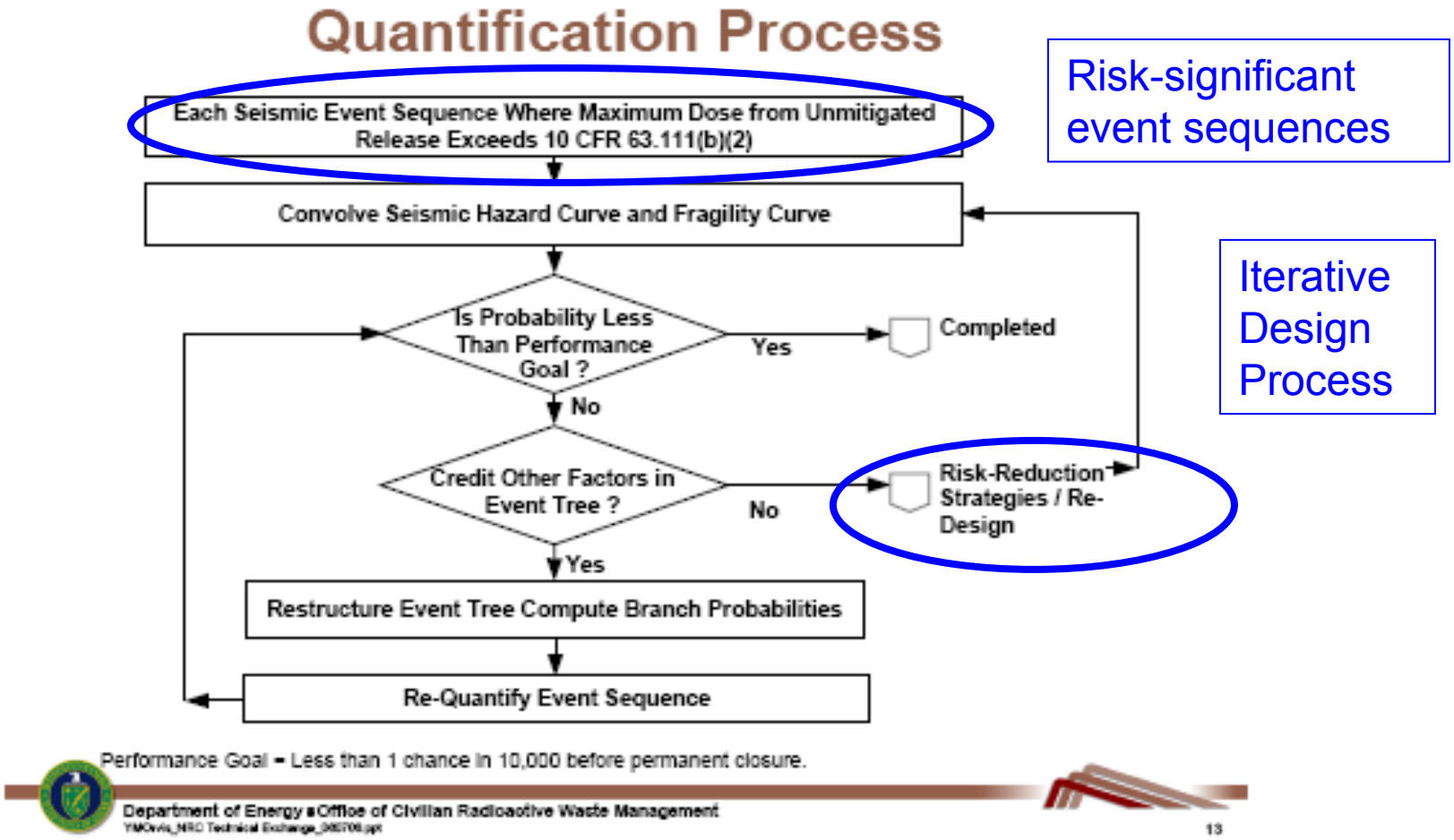
Overview of Seismic Design Methodology



Evaluation of Risk-significant Event Sequences

DOE Slide from Seismic Technical Exchange 6-7-2006



Risk-significant event sequences

Iterative Design Process

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Scope of HLWRS-ISG-01

- Focused on a review methodology for seismically initiated event sequences within the overall preclosure safety analysis (PCSA)

- PCSA is a systematic examination of the site, and the design, potential hazards, initiating events and event sequences, and their consequences (e.g., radiological exposures to workers and the public)

- PCSA is a top-down holistic approach, starting with event sequences, to identify important to safety (ITS) structures, systems, and components (SSCs)

Scope of HLWRS-ISG-01(contd.)

- Scope does not include the iterative design process within the PCSA, because the License Application is expected to have the PCSA for the final design

- Scope does not include potential actions (e.g., recovery, repair, etc.), for mitigation of consequences. DOE may consider these actions in PCSA

- Scope does not include review methodologies for consequence analysis, or development of the Yucca Mountain seismic hazard curve

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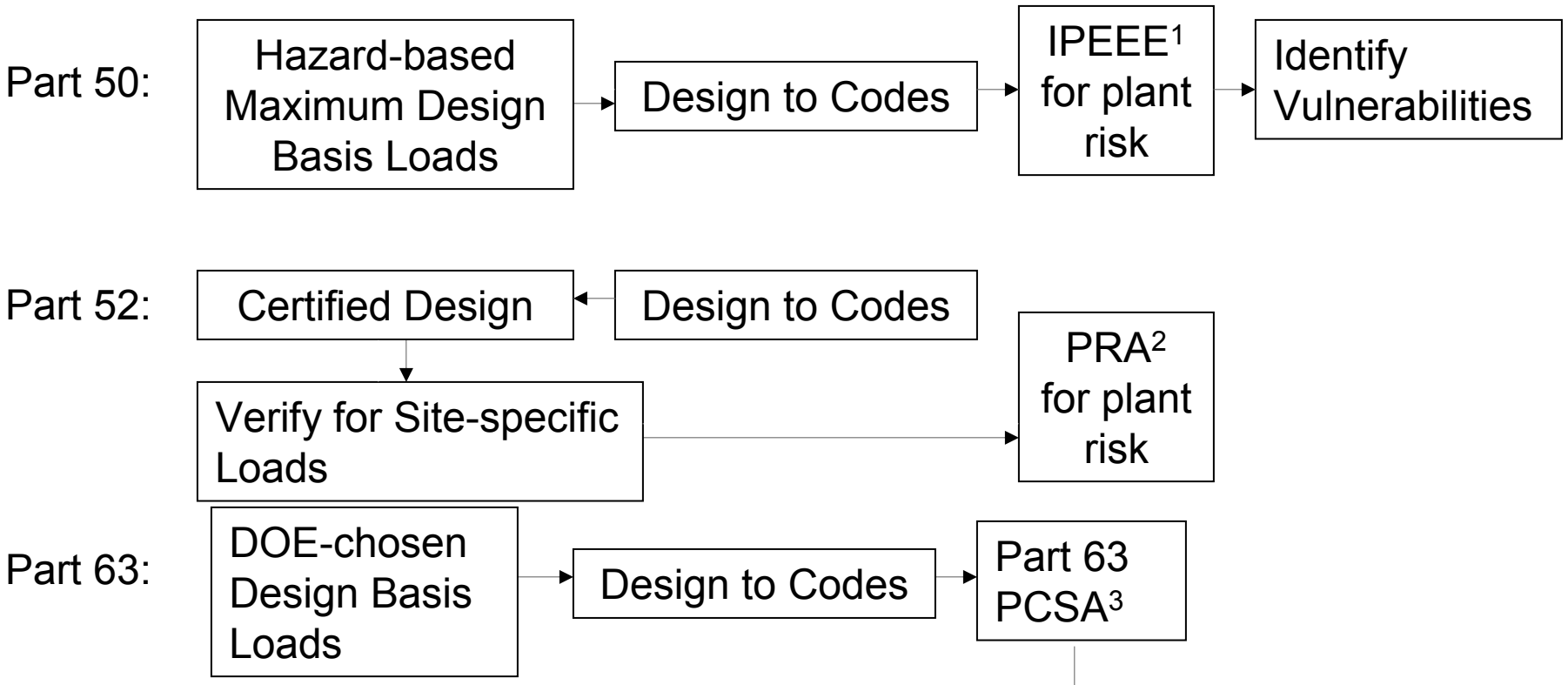
Comparison of the Seismic Design Process



1 Individual Plant Examination for External Events (not required by regulations)

2 Probabilistic Risk Analysis

3 Preclosure Safety Analysis

ISG-01 and ASCE/SEI 43-05

- ISG-01 methodology to calculate the likelihood of unacceptable performance, or probability of failure of an ITS SSCs, in the PCSA, is based on the American Society of Civil Engineers (ASCE) standard ASCE/SEI 43-05

- The probability of failure of an ITS SSC in the event sequence is calculated by convolving a seismic hazard curve with the ITS SSC fragility curve

- Similar approach is used for multiple ITS SSCs in an event sequence, i.e., the seismic hazard curve is convolved with combined fragilities of ITS SSCs

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ISG-01 and the Mixed-Oxide (MOX) Facility

- During licensing of the MOX facility under Part 70, selected SSCs were evaluated using the same methodology, as in the ISG-01, to determine their ability to perform at beyond design levels

- Part 63 metric to ensure safety is based on performance objectives, whereas MOX was licensed based on design bases loads, supported by performance evaluation of individual SSCs

NEI Technical Issues

Issue 1: NEI/EPRI state that ISG-01 methodology

- would result in "examining fragilities for all the components regardless of importance"
- is a "bottoms-up approach" and is "very resource-intensive"
- "is component/sequence-based as opposed to facility-based"
- "imposes alternative design requirements"

Response:

- Examine fragilities only for those SSCs ITS for Category 2 Event Sequences

- ISG-01 methodology is used within the overall PCSA, which is a top-down holistic approach to performance and is applicable to review of all potential seismically-initiated event sequences in the facility

- ISG methodology is staff guidance and does not impose any requirements, including design requirements

NEI Technical Issues (contd.)

Issue 2: NEI/EPRI state that ISG-01

- "forces a method that is not consistent with the majority of seismic probabilistic risk assessments, or analyses", and
- "methodology is not widely demonstrated"

Response:

- 10 CFR Part 63 is a risk-informed and performance-based regulation, in which safety is demonstrated through a PCSA

- ISG-01 uses applicable aspects of seismic PRA methods to evaluate seismically initiated event sequences within the context of the PCSA

- The essential element of the methodology, convolving fragility with hazard, is based on ASCE/SEI 43-05, which is a consensus industry standard, and was developed for use on DOE nuclear facilities

NEI Technical Issues (contd.)

Issue 3: NEI/EPRI state that

- "ISG-01 imposes screening criteria without consideration of, for example, the commensurate threat – 1 in 10,000 over preclosure period [e.g., significantly lower (more than a factor of 100) than safety goal for operating reactors]"

Response:

- Screening criterion (1 in 10,000 over preclosure period) is required by Part 63 for categorization of Category-2 event sequences, and not "imposed" by the ISG-01

- The rule provides DOE with flexibility to choose methods to meet the performance objectives for event sequences
  - DOE can optimize the systems in the PCSA, e.g., DOE can choose which SSC are relied on for safety

NEI Technical Issues (contd.)

Issue 4: NEI/EPRI state that

- "application of the ISG-01 methodology will lead to a more stringent standard for Yucca Mountain surface facilities than exist for higher hazard facilities, namely reactors"

Response:

- Application of the ISG-01 does not impose any standard

- Part 63 PCSA is based on evaluation of event sequences to meet the performance objectives, not performance of individual SSCs to meet a performance goal

NEI Technical Issues (contd.)

Issue 5: NEI is concerned that

- "ISG-01 appears more risk-based than risk-informed"

Response:

- ISG-01 is consistent with the risk-informed performance-based requirements of Part 63

- DOE has the flexibility to comply with the regulation based on dose-consequence calculations or frequency evaluation

NEI Technical Issues (contd.)

Issue 6: NEI is concerned that

- Seismic hazard curve for Yucca Mountain may result in unrealistic SSCs designs, which is "an artifact of analysis techniques as opposed to a physical reality (e.g., expert judgment and uncertainty)"
- "Tails of the distribution will drive design in the face of extreme uncertainty."

Response:

- Development of the seismic hazard curve was not addressed in ISG-01; DOE should develop seismic hazard representative of the site conditions

- Uncertainty need not be extreme (for the seismic hazard curve or SSCs fragility curves), but should be within the context of reasonable assurance

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Summary

ISG-01 provides NRC staff with an example methodology to review seismically initiated event sequences, in the context of the PCSA, for compliance with Part 63 performance objectives