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Your ref: Docket No. 52-006
Our ref: DCP_NRC_002586

August 6, 2009

Subject: AP1000 Response to Proposed Open Item (Chapter 19)

Westinghouse is submitting a response to the NRC open item (OI) on Chapter 19. This proposed open item response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following proposed Open Item(s):

OI-SRP19.0-SPLA-12 R1

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

Robert Sisk, Manager
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/Enclosure

1. Response to Request for Additional Information on SRP Section 19

DO63
NRO

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ENCLOSURE 1

Response to Request for Additional Information on Chapter 19

AP1000 DCD SER Open Item REVIEW

Open Item Resolution

OI Response Number: OI-SRP19.0-SPLA-12
Revision: 1

Question:

Open Item OI-SRP19.0-SPLA-12 from Safety Evaluation with Open Items from Chapter 19, "Probabilistic Risk Assessment, " of NUREG-1793, Supplement 2 – AP1000 Design Certification Amendment.

The applicant must confirm that an acceptable seismic margin is maintained for HRHF sites.

Westinghouse Response:

Westinghouse has worked with industry and the NRC to address the seismic issues related to high frequency ground motion. Westinghouse has participated in public meetings related to the "Interim Staff Guidance on Seismic Issues Associated with High Frequency Ground Motion in Design Certification and Combined License Applications." Recognizing the need to evaluate the high frequency seismic input, Westinghouse introduced Appendix 3I into the AP1000 Design Control Document. In this appendix the evaluation procedure, screening criteria, and testing requirements are described along with identification of equipment with the potential to be sensitive to high frequency seismic inputs.

Following the methodology given in Appendix 3I, a Technical Report (Reference 1) was prepared and issued to the NRC. The purpose of this report is two fold: (1) to confirm that high frequency seismic input evaluated is not damaging to equipment and structures qualified by analysis for the AP1000 Certified Seismic Design Response Spectra (CSDRS); and (2) to demonstrate that normal design practices result in an AP1000 design that is safer and more conservative than that which would result if designed based on the high frequency input. The results reported in Appendix 3I demonstrated that the structural integrity demands resulting from the Hard Rock High Frequency (HRHF) excitations are enveloped by those resulting from the CSDRS. As a result, the structural integrity seismic margin assessment for the HRHF is bounded by that for the CSDRS, and no further assessment is required.

A seismic margin evaluation is performed on safety-related equipment required to bring the plant to a safe shutdown to demonstrate seismic margin when exposed to an earthquake beyond the plant design basis safe shutdown earthquake (SSE). Seismic margin is expressed in terms of the earthquake motion level that could compromise plant safety which could lead to core damage or containment failures. Seismic margin is defined as the High Confidence, Low Probability of Failure (HCLPF) capacity of the plant safe shutdown systems relative to the design basis SSE expressed in terms of peak ground acceleration. The U.S. NRC has approved a HCLPF capacity equal to 1.67 times the Design Basis SSE ground motion acceleration for a seismic margin evaluation (Reference 2).

AP1000 DCD SER Open Item REVIEW

Open Item Resolution

The goal of the seismic margin evaluation is to demonstrate a minimum seismic margin of 1.67 between the equipment plant level SSE seismic demand and the seismic qualification SSE capacity. Contributors to seismic margin are the margins in industry standards and requirements for seismic qualification testing of equipment (e.g. IEEE 323, IEEE 344), generic enveloping (plants and locations), and design margin over the seismic demand. Seismic qualification testing of equipment is performed based on design and qualification criteria that often take into account generic applications (multiple plant locations and multiple plants) and margins also resulting from over-testing. These seismic margin contributors will produce SSE seismic qualification level which will meet or exceed the 1.67 seismic margin factor on a plant specific application. If the equipment seismic qualification capacity falls below the 1.67 times the SSE (plant level seismic demand) then further evaluation needs to be performed. For the AP1000 program the minimum acceptable HCLPF capacity is 0.5g (1.67 x 0.3g) using the Certified Seismic Design Response Spectra (CSDRS).

As part of the Seismic margins evaluation a systems analysis is performed to identify the principal equipment with the potential to contribute to the risk of core damage frequency caused by an earthquake beyond the Design Basis SSE. The list of safety-related equipment necessary to implement the success path determined through a plant systems evaluation and their seismic response are identified in Table 19.55-1 of AP1000 Design Control Document (DCD) Chapter 19. The AP1000 equipment design process produces includes robust equipment that reflects substantial margin beyond the design basis as demonstrated by the values given in Table 19.55-1.

A High Frequency screening test is performed after completion of seismic qualification testing to demonstrate that potential high frequency sensitive equipment can perform their safety-related function during a SSE earthquake without adversely effecting plant safety. Equipment determined to be high frequency sensitive are screened out and replaced with more robust equipment which are at least as strong as previous safety-related equipment. Since the High Frequency screening test was not meant to be a qualification test but a test to determine if the equipment was high frequency sensitive it is unclear that an additional seismic margin factor should be applied. If seismic margins for HRHF sites need to be addressed then the following contributing sources and minimum magnitudes need to be considered:

- Amplification factor of 1.3 being added to AP1000 HRHF in-structure response spectra by testing at 5% critical damping to the 3% critical damping profile.
- Seismic test margin factor of 1.1 required by IEEE Std 323.
- Seismic test margin factor of 1.1 - 1.25 factor for over testing (TRS vs. RRS)
- Amplification factor of 1.1 - 1.15 factor for enveloping of multiple plant locations to generate the RRS

- Amplification factor of 1.1 - 1.20 factor for multiple plant locations (HRHF ground response spectra vs. plant ground response spectra)

Summing the above seismic margin contributing factors can lead to a seismic margin factor in the range of 1.9 to 2.5. Therefore, based on the above we believe there is sufficient seismic margin associated with the CSDRS qualification process and the HRHF screening for potential high frequency sensitive equipment.

References:

1. APP-GW-GLR-115, "Effect of High Frequency Seismic Content on SSCs," Rev.1, October 6, 2008, Westinghouse Electric Company LLC.
2. NRC Policy Issue SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," April 2, 1993. [As amended by the Commissioners response letter from the U.S. NRC Office of the Secretary dated July 21, 1993.]

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None