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Your ref: Docket No. 52-006
Our ref: DCP/NRC2153

June 6, 2008

Subject: AP1000 Response to Requests for Additional Information (SRP3.12)

Westinghouse is submitting a response to the NRC requests for additional information (RAIs) on SRP Section 3.12. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in the response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

A response is provided for RAI-SRP3.12-EMB-01 through -03, as sent in an email from Mike Miernicki to Sam Adams dated April 16, 2008. This response completes three of five requests received to date for SRP Section 3.12. A response to RAI-SRP3.12-EMB-04 and -05, is scheduled to be submitted on June 20, 2008.

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
Licensing and Customer Interface
Regulatory Affairs and Standardization

/Enclosure

1. Response to Requests for Additional Information on SRP Section 3.12



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ENCLOSURE 1

Response to Requests for Additional Information on SRP Section 3.12

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP3.12-EMB-01
Revision: 0

***Question:***

What are the zero period acceleration (ZPA) and ZPA frequency cut-off for AP1000 design and the HRHF analyses, respectively? Section 3.7.3.7 of AP1000 DCD stated that "For the seismic response spectra analyses, the ZPA cut-off frequency is 33 Hz". Figures 6.3.2.1-3 & 6.3.2.2-3 have shown that the beginning of the rigid region occurs at much higher frequency than 33 Hz for both AP1000 design and HRHF design. The analysis in the TR-115 does not appear to use 33 Hz as the ZPA cut-off frequency as defined in DCD, resulting in inconsistency which needs to be addressed.

**Westinghouse Response:**

The AP1000 Certified Design Response Spectra was created to have high frequency input. These response spectra are based on Regulatory Guide 1.60 with an additional control point specified at 25 Hz. The spectral amplitude at 25 Hz is 30 percent higher than the Regulatory Guide 1.60 spectral amplitude. This increased seismic input at 25 Hz results in amplifications that occur above 33 Hz.

Both the AP1000 design spectra and HRHF spectra PIPESTRESS models were built with the automatic mass modeling option set to 99 Hz. In this sense, the PIPESTRESS models are identical: allowing for a 1:1 comparison of stresses. This allows the distinction between AP1000 design and HRHF analysis to be the input spectra only. Since a 33 Hz piping analysis model has fewer mass points than the corresponding 99 Hz model, the two cannot be compared directly. Therefore, the two models need to have the same mass modeling to allow for a complete comparison of results.

**Design Control Document (DCD) Revision:**
None

**PRA Revision:**
None

**Technical Report (TR) Revision:**
None

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP3.12-EMB-02
Revision: 0

***Question:***

What is the justification for stating that the two piping systems chosen are representative for all piping systems? For example, the floor response spectrum at Elevation 134.25' of the Containment Building has more exceedance in the high frequency region than those used in the demonstration. Floor Response Spectra should be taken into account in determining which packages envelope the complete piping design.

**Westinghouse Response:**

This problem has two facets: the comparison of response spectra at individual node locations vs. envelope of multiple locations, and the occurrence of both exceedances in response spectra and high frequency participation.

Looking at AP1000 vs. HRHF response spectra comparisons reveal several locations in which exceedances occur at individual node locations. However, when these comparisons are taken over multiple nodes that encompass a piping system, the AP1000 design response spectra tend to bound the HRHF response spectra. For example, the package APP-PXS-PLA-030 has node locations with exceedances as high as 200% in the high frequency region, see node 2247 for example. When these nodes are compared with other locations, these exceedances are muted, if not eliminated. Therefore, exceedances of the AP1000 design response spectra by the HRHF spectra at individual node locations do not properly reflect the response spectra applied to these piping systems for qualification.

Exceedances in the high frequency region are insignificant without participation. For the AP1000, the occurrence of the two is rare. The exceedance and participation comparison of APP-PXS-PLA-030 seems like a poor candidate. However, in comparison with other packages it is not a poor candidate for analysis, by contrast, a strong one. This comparison alone shows that the piping systems of the AP1000 are not aligned to high frequency excitation if the strongest candidate seems weak. Also, the comparison was not limited to 40 packages, many more isometrics were reviewed.

TR-115 states that to determine if the initial list of analysis packages was or was not a narrow representation, isometric drawings from the remaining unanalyzed piping analysis packages were reviewed. Piping layout was examined for vertical runs and valves with closely spaced supports. The packages with these vertical runs and valves were then further examined, along with the corresponding local high frequency seismic response spectra. This examination produced no further candidates for analysis.

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

**Design Control Document (DCD) Revision:**
None

**PRA Revision:**
None

**Technical Report (TR) Revision:**
None

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP3.12-EMB-03
Revision: 0

***Question:***

Why were two inconsistent methods (enveloped vs. multiple-level response) used for piping analysis comparison? In TR-115, the applicant used enveloped floor response spectra for AP1000 design and multiple level response spectra for HRHF analysis, respectively. This comparison does not demonstrate that ***normal design practices*** result in an AP1000 design that is considered to be **safer and more conservative** than that which would result if designed for the high frequency input. For AP1000, Table 3.7.1-1 of DCD states that independent support motion response spectra (i.e., multiple-level response spectra) analysis shall use either 2 percent or 3 percent damping, not the 5 percent damping used in TR-115. Staff requests that the applicant provides comparison between AP1000 design and HRHF analysis using the methodology called out in the DCD.

**Westinghouse Response:**

The purpose of this study is to compare the capabilities of the piping systems designed for AP1000 response spectra. The design basis analysis represents the capabilities of the piping system. The high frequency analysis represents the realistic conditions that may be seen by the piping system. Excessive conservatism was removed for the high frequency analysis, so that realistic conditions could be reflected. These two different purposes call for two different analyses. This study does not require the design analyses and high frequency analyses be identical to be meaningful.

Running an enveloped response spectra for the AP1000 design case is appropriate, since this is the way analyses are performed. Running multiple-level response for the HRHF case is appropriate because it more closely reflects the response spectra seen by the various segments of the piping system. The two can be directly compared because the purpose of this comparison is to reflect the high frequency results against the design capabilities of the piping systems.

**Design Control Document (DCD) Revision:**
None

**PRA Revision:**
None

**Technical Report (TR) Revision:**
None