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Your ref: Docket No. 52-006
Our ref: DCP/NRC2503

May 27, 2009

Subject: AP1000 Response to Request for Additional Information (SRP 3)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 3. This RAI 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 RAI(s):

RAI-SRP3.8.2-CIB1-01 R1
RAI-SRP3.10-EMB-08 R2

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
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/Enclosure

1. Response to Request for Additional Information on SRP Section 3

D063
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 3

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP3.8.2-CIB1-01
Revision: 1

Question:

Tier 2, Section 3.8.2.6 of the AP1000 DCD, describes the materials used to fabricate the containment vessel. The material selected satisfies the lowest service metal temperature requirement, established by analysis for the portion of the vessel exposed to the environment when the ambient air temperature is -40 °F. Westinghouse Technical Report APP-GW-GLN-113 (TR-113), "AP1000 Containment Vessel Shell Material Specification," Revision 0, submitted by Westinghouse letter dated May 11, 2007, revised this section by replacing the material specification Supplementary Requirement S17 with Supplementary Requirement S1 concerning the material fabrication process. However, Revision 16 to AP1000, Section 3.8.2.6 was changed to specify the lowest service temperature of -18.5 degrees F instead of -15 °F which was previously stated in Revision 15 of the AP1000 DCD. TR-113 did not specify the change to the service temperature nor provided any justification for this change in service temperature as required by 10 CFR 52.63(a)(1). In NUREG-1793, Section 3.8.2.6, the NRC staff approved -15 °F as the lowest service temperature based on the staff review of Westinghouse calculation APP-PCS-M3C-002, Revision 1, "AP1000 Containment Shell Minimum Service Temperature." Therefore, provide the reason and justification for the change in minimum service temperature of the containment vessel in accordance with 10 CFR 52.63(a)(1), and the analysis that supports the new service temperature proposed in Revision 16 of the AP1000 DCD.

Additional Question (Revision 1)

In a letter dated July 22, 2008, Westinghouse stated that an additional scenario was postulated for the containment vessel shell analysis, which determined that the containment vessel will be subjected to a service metal temperature of -18.5 °F. This evaluation postulated that an SSE event occurred in conjunction with -40 °F outside temperature and inadvertent actuation of active containment cooling. Westinghouse Technical Report APP-GW-GLR-005 (TR-9) only describes the analysis, and inadvertently did not include the corresponding service metal temperature.

Since TR-9 does not include the analysis or the service metal temperature, the NRC staff cannot confirm that -18.5 °F is the lowest service metal temperature of the containment vessel shell, which is fabricated from SA-738 Grade B material. This material must meet the requirements of NE-2000 for fracture toughness (Charpy V-notch test) in the as-welded condition for thicknesses up to and including 1.75 inches, and in the post-weld heat treated condition for thicknesses greater than 1.75 inches. The minimum service temperature is used to determine the testing temperature for the Charpy V-notch tests required by ASME Code, Section III, Subsections NE-2300 and NE-4300. Previously, Westinghouse stated in its letter dated April 22, 2003, that the SA-738, Grade B plate material will be procured using the service metal temperature of -15 °F (i.e., -55 °F Charpy V-notch test temperature as required by ASME

Code, Section III, Subsections NE-4335.2(b)(2) and Tables NE-4622.7(b)-1, note (2)(b)(1) in order to account for degradation during welding of the heat affected zone in the base material). In addition, Westinghouse stated in a letter dated March 13, 2003, that the previous analysis added an 8 °F conservative factor to obtain a minimum service metal temperature of -15 °F.

Therefore, the NRC staff requires additional information to verify the minimum service metal temperature. This information includes the details of the analysis (e.g., calculation methodology, assumptions made, similarities/differences from previous analysis, etc.) to confirm that -18.5 °F is the lowest service metal temperature to ensure that the material will be tested to have adequate toughness for the design and environment the containment shell will experience. Also, clarification is needed of whether the conservative factors described in the Westinghouse letter dated March 13, 2003, were also used in this analysis. Otherwise, justification for not including these conservative factors should be included

Westinghouse Response: (Revision 0)

An evaluation of AP1000 containment vessel, in the vicinity of large penetrations, was performed by Westinghouse to meet the requirements of COL Information Item 3.8-1. During this evaluation an additional scenario was postulated for the containment vessel shell analysis. The AP1000 plant is designed for sites that can have cold weather conditions with a minimum atmospheric temperature of -40 °F. Therefore, an SSE event was postulated to occur in conjunction with extreme cold weather condition (-40 °F outside temperature) and inadvertent actuation of active containment cooling. The analyses results were documented in an AP1000 calculation. The analyses determined that during this event, the containment vessel will be subjected to an external pressure of 0.9 psid and a 'Service Metal Temperature' of -18.5 °F.

Westinghouse Technical Report APP-GW-GLR-005 submitted to the NRC described these analyses in subsection 2.4.1 of the report. Also, in Table 3.8.2-1 'Load Combinations', at the end of the report, a reference was added for this event. This Table showed the external pressure of 0.9 psid, but inadvertently did not include the corresponding 'Service Metal Temperature' of -18.5 °F.

This change will be incorporated in the next revision of the DCD.

Additional Response (Revision 1):

The Revision 0 change indicated was made in DCD Rev 17.

The additional information required to verify the minimum service metal temperature is provided in Westinghouse document APP-MV50-Z0C-020. Rev 0. This document is made available for review in the Twinbrook office, and provides support for the Lowest Service Metal Temperature of -18.5 °F, corresponding to -40 degree F outside temperature.

Design Control Document (DCD) Revision: (Revision 0)

The following change will be incorporated in the next revision of the DCD:

- Note 6 will be added in DCD Table 3.8.2-1 as follows:

  The 'Lowest Service Metal Temperature' corresponding to -40 degree F outside temperature is -18.5 °F.

PRA Revision:
None

Technical Report (TR) Revision: (Revision 0)

Technical Report APP-GW-GLR-005 (TR 9) will be revised as follows:

Note 6 will be added in Table 3.8.2-1 and will read:

The 'Lowest Service Metal Temperature' corresponding to -40 degree F outside temperature is -18.5 degree F.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP3.10-EMB-08
Revision: 2

Question:

In Subsection 3.10.2.2, a rigid valve is defined as the valve with natural frequency equaling or exceeding 33 hertz (Hz). The use of Figure 1 (not Figure 6 as stated) of IEEE 382-1996 as the RIM (up to 32 Hz) for qualification of valve is adequate for Certified Seismic Design Response Spectra (CSDRS). However, the definition of rigid valve, the determination of the equivalent static load from the dynamic analysis of the valve, and the use of Figure 1 (not Figure 6 as stated) of IEEE 382-1996 might not be adequate for HRHF required response spectra (RRS) with exceedance. For HRHF spectra, the definition of rigid valve depends on the frequency at the beginning of zero period acceleration (ZPA) of the RRS for the valve. The applicant is requested to explain why the use of Figure 1 (frequency ends at 32 Hz) of IEEE 382-1996 is still adequate for qualification of valves, and provide methodologies that would be acceptable for the case of HRHF RRS with exceedance.

Westinghouse Response (Revision 1):

Please note that Figure 6 of IEEE Std 382-1996 is the "Seismic qualification required input motion (RIM)." Figure 1 of IEEE Std 382-1996 is the "Qualification type test parameters inside BWR..." AP1000 safety-related equipment will be seismically qualified to in-structure response spectra (ISRS) based on AP1000 Certified Seismic Design Response Spectra (CSDRS). The cutoff frequency (zero period acceleration (ZPA)) for the AP1000 CSDRS is 33Hz based on Regulatory Guide 1.60, Revision 1 entitled "Design Response Spectra for Seismic Design of Nuclear Power Plants."

Westinghouse is performing seismic qualification of safety-related structures, systems and components (SSCs) based on AP1000 CSDRS. The HRHF screening is a functional verification test in compliance with Interim Staff Guidance defined in COL/DC-ISG-1, "Interim Staff Guidance on Seismic Issues of High Frequency Ground Motion." to verify potential high frequency sensitive safety-related equipment will be perform as required under Hard Rock High Frequency (HRHF) seismic demand response spectra.

The HF screening is a supplemental evaluation to the required seismic qualification methods performed in accordance with IEEE Std. 344-1987 for those plants which have high frequency exceedance of their CSDRS and potentially high frequency sensitive equipment and components. The industry review of HRHF and further evaluations of SSCs performed by Westinghouse concluded that evaluations employing HRHF Ground Motion Response Spectra (GMRS) are less harmful than the CSDRS demand except for the functionality of potential HRHF-sensitive components. For potential HRHF-sensitive components an additional evaluation would be performed by Westinghouse using the HF screening process defined in AP1000 Technical Report APP-GW-GLR-115, Revision 0, "Effect of High Frequency Seismic

Content on SSCs." The purpose of the HF screening is to demonstrate that the potential HRHF-sensitive equipment is acceptable for the application. In those instances where the seismic qualification of line-mounted equipment (e.g. valve appurtenances) are potential HRHF-sensitive components, seismic testing performed in compliance with IEEE Std 382-1996 Figure 6 RIM curve will be extended out for one additional octave to 64 Hz.

AP1000 DCD Tier 2 document, Section 3.7.3.5.1 defines rigid components such as rigid valves as the following: "A rigid component (fundamental frequency ≥33 hertz), whose support can be represented by a flexible spring, can be modeled as a single degree of freedom model in the direction of excitation (horizontal or vertical directions)." When dealing with HRHF sites we should refrain from using the wording rigid equipment or rigid components because it can differ between the AP1000 CSRDS and HRHF sites. Seismic qualification of safety-related equipment by analysis will be addressed over the range of interest up to the cutoff frequency of the AP1000 certified design ISRS. In most instances a dynamic analysis or a static coefficient analysis using the peak of the applicable response spectra at the mounting location of the equipment will be used.

Additional question (Revision 2)

Per telephone discussion, please address the following question:

In the third paragraph of the response to RAI-SRP3.10-EMB-08 R1, Westinghouse indicates "In those instances where the seismic qualification of line-mounted equipment (e.g. valve appurtenances) are potential HRHF-sensitive components, seismic testing performed in compliance with IEEE Std 382-1996 Figure 6 RIM curve will be extended out for one additional octave to 64 Hz.".

The staff requests that Westinghouse incorporate this 64 Hz value into the DCD, justify that it is not required, or show where it has been already incorporated into the DCD.

Westinghouse Response (Revision 2)

AP1000 DCD Tier 2 document, Appendix 3I, Table 3I.6-3 defines a list of AP1000 safety-related equipment and mechanical equipment not high frequency sensitive. Notes 1 and 2 of the table identify the requirement for performing seismic RIM testing of line-mounted equipment out to 64 Hz. The notes state the following:

1. Rugged AP1000 safety-related equipment with no moving parts required in demonstrating functional operability during a seismic event is considered to be not sensitive to HRHF seismic loadings. Seismic qualification is based on the seismic loads associated with the mounting location of the safety-related

equipment as a minimum. AP1000 CSDRS seismic loads at the mounting location of the safety-related equipment produces comparable or higher equipment stresses and deflections than the HRHF seismic loadings based on the work reported in APP-GW-GLR-115, "Effect of High Frequency Seismic Content on SSCs." For rugged safety-related line-mounted equipment being qualified by test, seismic testing will be performed in compliance with IEEE Standard 382-1996 with a required input motion (RIM) curve extended to 64 Hz typically to a peak acceleration of 6g.

2. AP1000 safety-related valves are seismic qualified in accordance with ASME code for structural integrity to a maximum acceleration of 6g in all three principal orthogonal axes. AP1000 CSDRS seismic loads at the mounting location of the safety-related equipment produce comparable or higher equipment stresses and deflections than the HRHF seismic loadings based on the work reported in APP-GW-GLR-115, "Effect of High Frequency Seismic Content on SSCs." For rugged safety-related line-mounted equipment being qualified by test, seismic testing will be performed in compliance with IEEE Standard 382-1996 with a required input motion (RIM) curve extended to 64 Hz typically to a peak acceleration of 6g.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

None