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Your ref: Docket No. 52-006
Our ref: DCP_NRC_002622

September 17, 2009

Subject: AP1000 Response to Request for Additional Information (SRP 6)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 6. 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-SRP6.2.2-SRSB-17
RAI-SRP6.2.2-SRSB-18
RAI-SRP6.2.2-SRSB-19
RAI-SRP6.2.2-SRSB-20

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 6

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 6

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP6.2.2-SRSB-17
Revision: 0

Question:

The AP1000 reactor internals has been modified with the addition of a flow skirt in the lower plenum. Is the flow skirt included in the WCOBRA/TRAC reactor vessel model for the long-term cooling sensitivity study cases described in APP-PXS-GLR-001, Revision 1? If not, provide a quantitative evaluation of the effects of the flow skirt on the long-term cooling to justify the validity of the sensitivity analysis results.

Westinghouse Response:

The AP1000 WCOBRA/TRAC input model was updated for the long-term cooling sensitivity study cases described in APP-PXS-GLR-001, Revisions 0 and 1, to reflect identified changes in the reactor vessel and reactor vessel internals. Thus, the flow skirt is included in the WCOBRA/TRAC reactor vessel model for the long-term cooling sensitivity analyses described in APP-PXS-GLR-001, Revision 1.

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-SRP6.2.2-SRSB-18
Revision: 0

Question:

The AP1000 post-LOCA long-term cooling (LTC) performance is analyzed using WCOBRA/TRAC "window mode" calculations for various windows at limiting times during LTC as judged by the prevailing core decay power, sump level, water temperature, and other conditions. DCD Section 15.6.5.4C.3 includes a "window mode" analysis of the DEDVI break at 14 days with wall-to-wall floodup for containment recirculation. The LTC sensitivity analysis described in APP-PXS-GLR-001, Revision 1, includes three cases with the time windows up to 12,000 seconds into the DVI break initiation.

Explain and justify why no other time windows, such as the time window of wall-to-wall floodup that has the lowest water level in the PXS room and the driving head, are included in the sensitivity analysis.

Westinghouse Response:

The wall-to-wall floodup case is non-limiting for long-term cooling ECCS performance, and therefore it does not require investigation for sump debris sensitivity scenarios. The AP1000 DCD Chapter 15.6.5.4C cases illustrate that the core boiloff rate (and therefore the water flow rate delivery requirement into, as well as through, the core) is much less for the wall-to-wall floodup window than it is at the start of containment recirculation. Comparing Figures 15.6.5.4C-20, 27 and 28 with Figures 15.6.5.4C-6, 13 and 14, one observes that the wall-to-wall floodup case ratio of the core boiloff rate to the total DVI flow rate delivered into the vessel is only approximately 3%, whereas it is on the order of 25 % in the long-term cooling analysis performed at the start of containment recirculation. So, the potential core cooling impact of a specific core inlet flow resistance increase and the percent flow reduction associated with it on core cooling performance is less for the wall-to-wall floodup window because at that time during long-term cooling the plant is able to accept a larger percent reduction in flow delivered to the core, relative to the start of containment recirculation, and still maintain effective cooling.

The fact that core decay power is at its maximum value at the start of containment recirculation during the DEDVI break for any AP1000 long-term cooling recirculation scenario identifies that as the limiting case in terms of required water delivery into the core. It is therefore the limiting case for core inlet flow resistance increase considerations.

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-SRP6.2.2-SRSB-19
Revision: 0

Question:

There appears to be an inconsistency regarding the DVI Line elevation. In Westinghouse's response to RAI-SRP 6.2.2-SRSB-11, Rev. 2, on page 4, it shows the DVI Line elevation to be 97 ft., which is inconsistent with the DVI elevation of 99 feet-7 inches shown in the AP1000 plant layout diagrams. Is 97.0 ft DVI elevation used in the long-term cooling sensitivity analysis? If so, explain the effect of 2 ft-7in difference in the analysis.

Westinghouse Response:

The AP1000 Direct Vessel Injection line piping is represented in detail in the input of WCOBRA/TRAC. In particular, the TRAC component that represents the final length of piping that connects into the reactor vessel enters the vessel at the 99 ft.-7 in. DVI line nozzle elevation noted above. The 97 ft elevation in the subject response is the point at which the IRWST injection pipe from the IRWST/containment sump enters this final TRAC component; the elevation rise up to the 99 ft.-7 in. DVI line nozzle elevation is then modeled within that final component.

The 97.0 ft elevation is the reference elevation used to specify liquid level in the AP1000 WCOBRA/TRAC input as a pressure boundary condition for flow through the intact DVI line. It is the elevation at which the IRWST/sump entry into the DVI piping is modeled; its use is consistent with the topology used to model the AP1000 Direct Vessel Injection line piping.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

This detail will be documented in the next revision of APP-GW-GLR-079, "AP1000 Verification of Water Sources for Long-Term Recirculation Cooling Following a LOCA."

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP6.2.2-SRSB-20
Revision: 0

Question:

On page 30 of APP-GW-GLR-079 (TR26), Revision 4, third paragraph states that "The bump-up factor is implemented in the LOCADM calculation on a mass basis. The basis for the bump-up factor is the assumption that all of the latent fibrous debris mass will pass through the bottom nozzles and protective grids of the fuel and enter the core. To implement the bump-up, all materials that contribute to the formation of chemical precipitates are increased by a uniform percentage so that the resulting precipitates available for deposition have increased by approximately the amount of latent fibrous debris assumed for the AP1000. This conservative method is independent of the type, diameter, or length of the fiber."

The staff also notes that the fibers, which will pass through the IRWST and recirculation screens, are typically different than the unfiltered fibers that pass to the core through the break. This difference was noted in WCAP-17028, Revision 1 where Fiber A is said to represent fiber that passed through a screen.

Due to the significant increase of unfiltered fiber type that is transported to the reactor core, has the bump-up factor used in the LOCADM calculation been adjusted accordingly? Please identify how much fiber was assumed in the bump-up factor calculation and describe the adjustments performed in the calculation to incorporate the longer fibers expected in the unfiltered debris.

Westinghouse Response:

The LOCADM analysis (APP-PXS-M3C-057 Revision 1) was performed with a "bump-up" factor based on an equivalent of 22.5 pounds of fiber having transported to the core. This more than bounds the 6.6 lbm of fiber in AP1000.

As noted in RAI-SRP6.2.2-SRSB-20, the bump-up factor in LOCADM is 'independent of the type, diameter, or length of the fiber' and independent of the source of the fiber whether it be screen pass-through or break bypass. The bump-up factor is set such that total mass of deposits on the core after 30 days is increased by the best estimate of the 'mass' of the fiber that may reach the core.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

None