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U.S. Nuclear Regulatory Commission
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Your ref: Docket No. 52-006
Our ref: DCP/NRC2252

September 5, 2008

Subject: AP1000 Response to Request for Additional Information (SRP3.9.1)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 3.9.1. 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-SRP3.9.1-EMB1-01 and -02, as sent in an email from Mike Miernicki to Sam Adams dated August 14, 2008. This response completes all requests received to date for SRP Section 3.9.1.

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 Request for Additional Information on SRP Section 3.9.1

DO03
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 3.9.1

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP3.9.1-EMB1-01
Revision: 0

Question:
DCD Tier 2 Subsection 3.9.1.1.1.4 addresses the unit loading and unloading operations associated with power changes of 5 percent per minute between 15 percent and 100 percent power levels. The number of loading and unloading operations is defined as 2000 each for the 60-year plant design. The applicant is requested to provide the technical basis for how the 2000 occurrences were split from the original 19800 occurrences for the plant loading and unloading at five percent of the full power per minute for the normal plant startup/shutdown, and loading resulting from all service levels B, C, and D transients that result in a reactor trip.

Westinghouse Response:
As is noted in Subsection 3.9.1.1 of the DCD, the specific transients to be considered for equipment fatigue analysis are based on engineering judgment and experience. When the design transients for the AP1000 were initially established, it was decided to use the unit loading and unloading transient to cover the load follow and increase the number of these transients to cover a daily load follow. This was a conservative approach since the load follow transient is less severe than the unit loading and unloading transient. When analysts for ASME Code components started to analyze fatigue usage factors as part of design finalization, they found that the large number of loading and unloading transients resulted in excessive fatigue usage factors at some locations of some components.

The EPRI Utility Requirements Document (URD) for Advanced Light Water Reactors includes a requirement for a daily load follow capability that is much less severe than a unit loading and unloading transient. That URD requirement was used to develop the daily load follow transient. The load follow transient has been verified to produce a lower value of fatigue usage than the unit loading and unloading transient.

To address the excessive fatigue usage factor a daily load follow transient was created to replace the unit loading and unloading transient for most of the load follow requirement. 2000 occurrences of unit loading and unloading were retained to account for shutdowns and to account for the recovery from service level B, C, and D transients. The 2000 occurrences cover the approximately 700 total service level B, C, and D transients and 1 (one) per month for loading and unloading each for a total of 1420 occurrences in 60 years. This frequency is far larger than has occurred at currently operating units and is considered bounding.

The change to a specific daily load follow transient for the AP1000 was approved as part of the AP1000 design change process. As part of that process the change was reviewed and impacted by experienced Westinghouse engineers and reviewed by experienced utility personnel. Both groups of reviewers found the change, including the number of transients, to be appropriate and acceptable.

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-SRP3.9.1-EMB1-02
Revision: 0

Question:

A new Subsection 3.9.1.1.1.19, "Daily Load Follow Operations" is added to the DCD to account for the one load follow operation per day that were included as portion of the plant loading and unloading events for the design transients. The applicant is requested to provide the basis how the 17800 cycles was determined for the daily load follow operations during the plant design of 60 years based on a 90 percent availability factor, which will result in 19800 occurrences. Explain why the load follow event could not coincide with the plant loading and unloading including the B, C, and D service transients while they might occur at the same time.

Westinghouse Response:

The total of unit loading and unloading and unloading transients combined with the daily load follow transient is 19,800 transients. The assumption is made that a plant would not have a unit unloading and a daily load follow event on the same day. With 2000 occurrences (each) for unit loading and unloading transients, the remaining 17,800 occurrences are now specified for the daily load follow transient. As noted in the comment, although, 17,800 occurrences are 2000 less than the calculated 19800 with 90% plant availability factor, 17.800 occurrences are still considered to be conservative considering the conservative assumptions used in developing the load follow transient analysis. As an example, the analysis of the daily load follow transient assumed that the load drop/increase is at rate at least twice the rate that would be expected during a load follow event.

The unit loading and unloading transient is much more severe as far as fatigue usage is concerned than is a daily load follow transient because the load swing from a unit loading and unloading transients is much higher than the load swing from a load follow transient. A planned unit unloading would be expected to occur instead of a daily load follow transient or from the reduced power condition of the load follow transient. The transient that results from a unit unloading initiated at less than 100% power during a daily load follow cycle would be less severe than a unit unloading from 100% power and bounded by the unit loading and unloading transient.

An exigent or emergency reduction of power using the unit loading and unloading rates will typically be the result of a condition that takes a least a day to resolve. This provides a basis to expect that a unit unloading reduces the load follow transients needed. The daily load follow transient is provided to satisfy a requirement of the EPRI Utility Requirements Document (URD). Combining the number of daily load follow transients and the unit loading and unloading transients satisfies the URD requirement for a daily load follow transient.

Finally the 17,800 occurrences of a daily load follow is a very conservative number. Nuclear power plants typically operate in a 100 percent power base load mode and rarely in a cyclic mode. When nuclear power plants run at reduced power or in a load following mode, typically on a weekly cycle not a daily cycle, it is for a limited period of time to move the start of an outage to a more convent time. Based on that experience, there is no need to provide for a number of load follow transients that would assume a unit loading and unloading on the same day.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None