Westinghouse Electric Company
Nuclear Power Plants
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
USA

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, D.C. 20555

Direct tel: 412-374-6206
Direct fax: 412-374-5005
e-mail: sisk1rb@westinghouse.com

Your ref: Docket No. 52-006
Our ref: DCP_NRC_002541

June 30, 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-SRP3.6.2-EMB2-01 R3

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,

John DeBlasio

Robert Sisk, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization /for

/Enclosure

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

D063
NRO

cc:	D. Jaffe	-	U.S. NRC	1E
	E. McKenna	-	U.S. NRC	1E
	B. Gleaves	-	U.S. NRC	1E
	T. Spink	-	TVA	1E
	P. Hastings	-	Duke Power	1E
	R. Kitchen	-	Progress Energy	1E
	A. Monroe	-	SCANA	1E
	P. Jacobs	-	Florida Power & Light	1E
	C. Pierce	-	Southern Company	1E
	E. Schmiech	-	Westinghouse	1E
	G. Zinke	-	NuStart/Entergy	1E
	R. Grumbir	-	NuStart	1E
	D. Lindgren	-	Westinghouse	1E

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-SRP3.6.2-EMB2-01
Revision: 3

Question:

In DCD Revision 16, Section 3.6.2.5 under high energy break locations, Westinghouse stated that for ASME Class 1 piping terminal end locations are determined from the piping isometric drawings. Intermediate break locations depend on the ASME Code stress report fatigue analysis results. These results are not available at design certification. For the design of the AP 1000, breaks are postulated at locations typically associated with a high cumulative fatigue usage factor. Westinghouse further stated that these locations are part of the as-built reconciliation as discussed in subsection 3.6.4.1. As discussed in RAI-SRP3.6.4-EMB2-01 Question 1.a, the determination of break locations is a part of the as-designed pipe break analysis and is not part of the as-built reconciliation. Westinghouse is requested to address this concern and to revise DCD 3.6.2.5 accordingly.

Revision 3

In a meeting on May 20, 2009 on the status and plans for the pipe rupture hazard analysis the NRC technical review staff requested that Westinghouse provide more specific information on the elements of the pipe rupture hazard analysis to be completed during the design certification review and the elements to be completed by the COL applicants. The staff also requested that that the AP1000 specifically address an as-designed pipe rupture hazard analysis.

Westinghouse Response:

Revision 3 of the response provides more specific information about the schedule for pipe rupture hazard analysis information to be provided as part of design information and revises the DCD COL information item to be more specific as to the as-designed pipe rupture hazard analysis elements that will not be completed as part of the design certification amendment review and will be provided by the COL applicants.

Revision 2 of this response was prepared to address NRC comments. NRC comments particularly related to inclusion of fatigue analysis and specifically addressing moderate energy effects.

Revision 1 of this response was prepared in response to NRC comments.

Westinghouse performs the ASME safety class piping analysis, including the fatigue analysis for class 1 lines and the calculation of the pipe break equation for the class 2/3 lines, for the risk significant lines in preparation for the piping DAC review and in support of the initial COL applications. These analyses allow Westinghouse to determine the terminal-end and

intermediate break locations for these risk significant lines during the as-designed analysis for these high energy lines.

A pipe break hazard evaluation will be completed using the as-designed piping analysis. This as-designed piping analysis is based on completed piping routings, layouts, and isometrics. The pipe support design and locations are established. The results of this hazard evaluation using the as-designed piping analysis will update the break hazard information provided to support the certified design. The as-designed pipe analysis results identify any intermediate break locations. The locations of breaks and postulated targets are updated based on the as-designed analyses. The locations and designs of pipe whip restraints and jet shields are also established.

Consideration of moderate energy breaks is also included in the pipe break hazard analysis. Large leakage cracks in moderate energy pipes are evaluated for adverse effects. The effects considered for the evaluation of cracks in moderate energy pipes are flooding, spray onto nearby equipment and environmental effects.

The flooding evaluation focuses on the design features included in the systems and structures to minimize the buildup of water through the use of drain line sizing and slopes of floors and similar design features. The flooding assessment for the as-designed condition is updated to consider the changes in equipment locations and any changes in wall, doors and stairwells.

Spray and environmental effects are addressed through equipment design requirements and equipment qualification. The as-designed evaluation of spray and environmental effects is updated to consider changes to equipment locations and equipment design.

Additional information will be included in the DCD about the as-designed pipe break hazard analysis as shown below. The base DCD text marked up below for Revision 3 of this response is from DCD Revision 17 which includes changes identified in Revision 0, Revision 1 and Revision 2 of this response

The as-built evaluation of pipe break hazards is done on a generic basis for all COL applications referencing the AP1000 Design Certification. Some of the results of the pipe break hazard evaluation are expected to be available during the review of the Design Certification amendment review. The results of this hazard evaluation using the as-designed piping analysis will update the break hazard information provided to support the certified design. The as-designed pipe analysis results identify any intermediate break locations. The locations of breaks and postulated targets are updated based on the as-designed analyses. The locations of pipe whip restraints and jet shields are also established based on the as-designed piping analysis. The designs of some pipe whip restraints and jet shields are also established. Some pipe whip restraint and jet shield designs are not expected to be completed in time to support preparation of the Advance SER with no open items. Completion of the remaining whip restraint and jet shield design will require a modified COL information item to be addressed in the COL

applications. The effects of leakage and through wall cracks in moderate energy pipes include flooding, spray onto nearby equipment, environmental effects, and sub-compartment pressurization are evaluated as part of the as-designed pipe rupture hazard analysis. Portions of the evaluation to complete the COL information item may be completed during the COL application review or after the license is issued.

Design Control Document (DCD) Revision:

Revise the DCD Revision 17 write-up under the heading Verification of the Pipe Break Hazard Analysis in Subsection 3.6.2.5 as follows:

> **Verification of the Pipe Break Hazard Analysis**
>
> A pipe rupture hazard analysis is prepared based on the as-designed piping stress analyses and pipe whip restraint design information. The as-designed piping analysis is based on piping routings, layouts, and isometrics. Intermediate break locations are identified using the as-designed piping stress analysis, including the fatigue analysis required for ASME Code Class 1 piping. As-designed piping stress analysis information is used to confirm the location and configuration of pipe whip restraints and jet impingement shields. The information included in Tables 3.6-2 and 3.6-3 is updated and validated as part of the as-designed pipe rupture hazard analysis. Large leakage cracks in moderate energy pipes are evaluated for adverse effects as part of the pipe break hazard evaluation.
>
> The ASME Code, Section III, requires that each plant have a Design Report for the piping system that includes as-built information. Included in the Design Reports are the loads and loading combinations used in the analysis. Where mechanistic pipe break requirements are used to eliminate the evaluation of dynamic effects of pipe rupture in ASME Code, Section III, Class 1, 2, and 3 piping system, the basis for the exclusion is documented in the Design Report.
>
> The final piping stress analyses, pipe whip restraint design, and as-built reconciliation of the pipe break hazard analysis is discussed in subsection 3.6.4.1. The final piping stress analysis includes design properties and characteristics of procured components selected to be included in the piping system that are not available for the as-designed evaluation. The as-built reconciliation is required prior to fuel loading and includes evaluation of the ASME Code fatigue analysis, pipe break dynamic loads, reconciliation to the certified design floor response spectra, confirmation of the reactor coolant loop time history seismic analyses, changes in support locations, preoperational testing, and construction deviations.

Revise the write-up in DCD Revision 17, Subsection 3.6.4.1 as shown below. Note that the paragraph about preparation of as-designed pipe whip restraints and an as-designed pipe break hazard analysis was added in APP-GW-GLR-134 Rev. 2 to address Design Certification amendment acceptance issues.

3.6.4.1 Pipe Break Hazard Analysis

The Combined License information requested in this subsection has been partially addressed in APP-GW-GLR-021 (Reference 14) and APP-GW-GLR-074 (Reference 16), and the applicable changes are incorporated into the DCD. Additional work is required by the Combined License holder to address the aspects of the Combined License information requested in this subsection as delineated in the two following paragraphs:

> The pipe rupture hazard evaluation (for pipe whip and jet impingement) was performed for the AP1000 Design Certification. The purpose of this evaluation was to identify potential targets and determine the method of protection to be used for safety-related targets located in the vicinity of postulated high-energy pipe breaks at terminal ends. In addition, the room locations of pipe whip restraints were identified.
>
> As explained in APP-GW-GLR-021, which discusses AP1000 As-Built COL Information Items, the timing of the reconciliation of the as-built pipe break hazard analysis is such that the reconciliation cannot be provided by an applicant for a COL. This reconciliation will be done prior to operation of the plant. An as-designed pipe rupture hazard analysis based on the as-designed pipe analysis is prepared to update and validate the information provided in APP-GW-GLR-074 (Reference 16).

The following words represent the original Combined License Information item commitment, which has been addressed as discussed above:

> Combined License applicants referencing the AP1000 certified design will complete the final pipe whip restraint design and address as-built reconciliation of the pipe break hazards analysis in accordance with the criteria outlined in subsections 3.6.1.3.2 and 3.6.2.5. The as-built pipe rupture hazard analysis will be documented in an as-built Pipe Rupture Hazards Analysis Report.

After a Combined License is issued, the following activity will be completed by the COL holder:

> Combined License applicants referencing the AP1000 certified design will complete the design of pipe whip restraints and jet shields at the locations specified in the as-designed pipe rupture hazard evaluation.

These design efforts to be completed by the COL holder will be based on the information provided in the as-designed pipe rupture hazard evaluation, and will be completed to support the combined license. The as-designed pipe rupture hazard evaluation, including identification of locations where pipe whip restraints and jet shields are required, is prepared on a generic basis to address COL applications referencing the AP1000 Design Certification. The final pipe whip restraint and jet shield design includes the properties and characteristics of procured components connected to the piping, components, and walls at identified break

and target locations. The final design will be completed prior to fabrication and installation of the piping and connected components. The as-built reconciliation of the pipe rupture hazards evaluation whip restraint and jet shield design in accordance with the criteria outlined in subsections 3.6.1.3.2 and 3.6.2.5 will be completed prior to fuel load.

PRA Revision:
None

Technical Report (TR) Revision:
None