



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/NRC2314

December 5, 2008

Subject: AP1000 Responses to Requests for Additional Information (SRP3)

Westinghouse is submitting responses to the NRC request for additional information (RAI) on SRP Section 3. These RAI responses are submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in the responses 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 RAIs:

RAI-SRP3.6.2-EMB2-01, R2  
RAI-SRP3.6.4-EMB2-01, 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,

*John DeBlasio* /for

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

/Enclosure

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

cc: D. Jaffe - U.S. NRC 1E  
E. McKenna - U.S. NRC 1E  
B. Gleaves - U.S. NRC 1E  
P. Ray - TVA 1E  
P. Hastings - Duke Power 1E  
R. Kitchen - Progress Energy 1E  
A. Monroe - SCANA 1E  
J. Wilkinson - 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

Responses to Requests 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: 2

### **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 the DCD 3.6.2.5 accordingly.

### **Westinghouse Response:**

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

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

---

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 2 of this response is from DCD Revision 17 which includes changes identified in Revision 0 and Revision 1 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. 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

~~To support design certification, a~~ 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 completed 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

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

---

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 plant 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

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

---

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 provide an as-designed pipe rupture hazard evaluation. This evaluation will be based on a completed piping layout and will be completed to support the combined license. A pipe rupture hazard analysis is part of the piping design. It is used to identify postulated break locations and layout changes, support design, whip restraint design, and jet shield design. A report addressing environmental, spray, and flooding effects of cracks in moderate energy piping is also completed for the as-designed condition. The as-designed pipe rupture hazard evaluation reports are prepared on a generic basis to address all COL applications referencing the AP1000 Design Certification

The final piping design includes the properties and characteristics of procured components connected to the piping and target characteristics and locations. The final design for these activities will be completed prior to fabrication and installation of the piping and connected components. The 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 will be completed prior to fuel load.

**PRA Revision:**

None

**Technical Report (TR) Revision:**

None

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

---

RAI Response Number: RAI-SRP3.6.4-EMB2-01

Revision: 2

### **Question:**

AP1000 DCD Revision 15, Section 3.6.4.1 identified a COL Information Item 3.6-1 which required the COL applicants referencing the AP1000 certified design to complete the final pipe whip restraint design and to address as-built reconciliation of the pipe break hazards analysis in accordance with the criteria outlined in subsection 3.6.1.3.2 and 3.6.2.5. In APP-GW-GLR-021, TR 6 and APP-GW-GLR-074, TR 7, Westinghouse proposed to modify the COL Information Item and provided a pipe break hazards analysis report for staff's review. Westinghouse stated that the report addresses and documents, on a generic basis, design activities required to complete COL Information Item in Section 3.6.4.1 in the AP 1000 DCD. Westinghouse further stated that it is expected that when the NRC review of TR 7 is complete, the included activities to address the COL Information Item in Section 3.6.4.1 will be considered complete for COL applicants referencing the AP 1000 Design Certification. On the basis of its review of TR 7, the staff found that there are numerous areas in the report are incomplete (e.g., ASME Class 1 piping fatigue evaluation, the complete design of the jet shields and pipe whip restraints, use of seismic response spectrum, etc.). The staff therefore, determined that the pipe break analysis of TR 7 can not be considered complete and the proposed revision to the COL Information Item 3.6-1 concerning the COL applicant's responsibility is not acceptable.

In a letter dated January 14, 2008, Westinghouse proposed to revise AP1000 DCD Revision 16, Section 3.6.4.1 to address NRC staff's comments on the completeness of TR 7. Westinghouse stated that a combined License (COL) holder referencing the AP1000 design will complete the pipe whip restraint design and complete an as-designed pipe break hazards analysis in accordance with the criteria outlined in subsection 3.6.1.3.2 and 3.6.2.5. The as-designed pipe rupture hazards analysis including break locations based on as-designed pipe analysis will be documented in an as-designed Pipe Rupture Hazards Analysis Report. The applicant also stated that the final design for these activities will be completed prior to fabrication and installation of the piping and connected components. Furthermore, the applicant stated that the as-built reconciliation of the pipe break hazards analysis in accordance with the criteria outlined in subsection 3.6.1.3.2 and 3.6.2.5 will be completed prior to fuel load. The same statement was also included in APP-GW-GLR-134, Revision 3, "AP1000 DCD Impacts to Support COLA Standardization," dated January 14, 2008. Based on its review of the information currently available in DCD Revision 16 and in APP-GW-GLR-134 Revision 4, the staff determined that the following additional information concerning the acceptability of the proposed COL Holder Item is needed:

a. The staff maintains that the pipe break hazards analysis report of TR 7 is incomplete. RG 1.206 C.III.4.3 allows the applicant to propose an alternative the COL Information Item that can not be resolved completely before the issuance of a license. It requires the applicant to provide sufficient information to justify why that item can not be completed before the issuance of a license. Furthermore, it states that the applicant should provide sufficient information on this

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

---

item to support the NRC licensing decision and also to propose a method for ensuring the final closure of the item including implementation schedules to allow the coordination of activities with the NRC construction inspection program following issuance of the COL. The current DCD and APP-GW-GLR-134 do not cover the level of detail described in RG 1.206 C.III.4.3. Westinghouse is requested to propose an alternative along with the described justification including implementation schedules to allow the coordination of activities with the NRC construction inspection program.

b. In some of the DCD Tier I tables of System Based Design Description and ITAAC, the applicant includes an acceptance criteria which states that for the as-built piping, a pipe break evaluation report exists and concludes that protection from the dynamic effects of a line break is provided. It should be noted that the pipe break hazards analysis report is required for all the piping systems (with the exception of LBB piping) that are within the scope of SRP 3.6.2. The staff's concern is that the current AP1000 system based ITAAC tables do not reflect that. Westinghouse is requested to address how the system based ITAAC approach addresses all the piping systems which are within the scope of SRP 3.6.2 and are required to be included in a pipe break analysis performed in accordance with the criteria outlined in subsection 3.6.1.3.2 and 3.6.2.5.

### Westinghouse Response:

Revision 1 and 2 of this response are prepared in response to NRC comments.

a.) Westinghouse is performing piping analysis as part of the piping DAC review. This analysis will provide results that will be used to determine the intermediate pipe break locations (if any) in the risk significant lines. The information to support the determination of intermediate pipe break locations is available at the time of the piping DAC review for the risk significant lines. The piping analysis includes the all-soils response spectra. Representative pipe whip restraint and impingement shield designs will also be available as part of the pipe break hazard evaluation. Westinghouse will provide an as-designed pipe rupture hazards analysis including break locations. The as-designed pipe rupture hazards analysis will be documented in an as-designed Pipe Rupture Hazards Analysis Report.

b.) The Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) included in Tier 1 of the AP1000 DCD are intended to provide the NRC staff a means to support their 10 CFR 52.103g determination that it is acceptable to load fuel upon completion of the construction of an AP1000. These ITAAC are not intended to supplement, replace, or supersede design requirements or commitments in the design control document. The scope and definition of AP1000 ITAAC were evaluated, reviewed, and accepted during the Design Certification review. There have been no changes to the AP1000 design or NRC regulations that would permit or require reconsideration of the AP1000 ITAAC related to pipe break hazard.

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

---

Final Safety Analysis Reports included in COL applications referencing the AP1000 incorporate Subsections 3.6.1 and 3.6.2 of the AP1000 DCD by reference. Criteria and requirements included in Subsections 3.6.1 and 3.6.2 provide sufficient assurance that a pipe break analysis in accordance with the criteria outlined in Subsection 3.6.1.3.2 and 3.6.2.5 is prepared. The ITAAC tables in the AP1000 DCD are system-based and Westinghouse has specifically included a pipe break evaluation report for four systems (RCS, PXS, SGS, and RNS). Westinghouse, however, generates a single pipe break evaluation report that addresses all high energy lines for all systems. The single report addresses all of the piping systems which are within the scope of SRP 3.6.2 and are required to be included in a pipe break analysis performed in accordance with the criteria outlined in subsection 3.6.1.3.2 and 3.6.2.5. Reports addressing environmental, spray, and flooding effects of cracks in moderate energy piping are also prepared. These pipe break evaluation reports are generic and apply to all COL applications referencing the AP1000 Design Certification

Subsection 3.6.4.1 contains a COL holder requirement for an as-built pipe break hazard analysis. Revision 1 of the response to RAI-SRP3.6.2-EMB2-01 provides a proposed revision to Subsections 3.6.2.5 and 3.6.4.1 to include the requirement for an as-designed pipe break hazard analysis. This analysis will be based on pipe analyses supporting the piping DAC review. Revision 2 of the response to RAI-SRP3.6.2-EMB2-01 modifies the DCD revision to address NRC comments

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

None

**PRA Revision:**

None

**Technical Report (TR) Revision:**

None