Westinghouse

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/NRC2239

August 28, 2008

Subject: AP1000 Response to Request for Additional Information (SRP3.9.5)

Westinghouse is submitting a revised response to the NRC request for additional information (RAI) on SRP Section 3.9.5. 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 revised response is provided for RAI-SRP3.9.5-EMB1-03 and -04. This response completes all requests received to date for SRP Section 3.9.5. A response to RAI-SRP3.9.5-EMB1-01 through -04 was submitted under letter DCP/NRC2164 dated June 20, 2008.

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

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

/Enclosure

1. Response to Request for Additional Information on SRP Section 3.9.5

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cc:	D. Jaffe	-	U.S. NRC	1E
	E. McKenna	-	U.S. NRC	1E
	M. Miernicki	-	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. Wiseman	-	Westinghouse	1E

ENCLOSURE 1

Response to Request for Additional Information on SRP Section 3.9.5

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP3.9.5-EMB1-03
Revision: 1

Question:

DCD Fig. 3.9-8 illustrates the flow skirt as a solid beam-like structure which is not representative of either its function or its description. Further clarification of Fig. 3.9-8, or additional figure details, should be provided to facilitate understanding of the form and function of this newly added component.

Westinghouse Response:

The flow skirt is a perforated cylindrical structure with a horizontal stiffening flange that is supported by eight lugs inside the reactor vessel lower head. Please see the attached Figures 1 and 2, which illustrate the flow skirt.

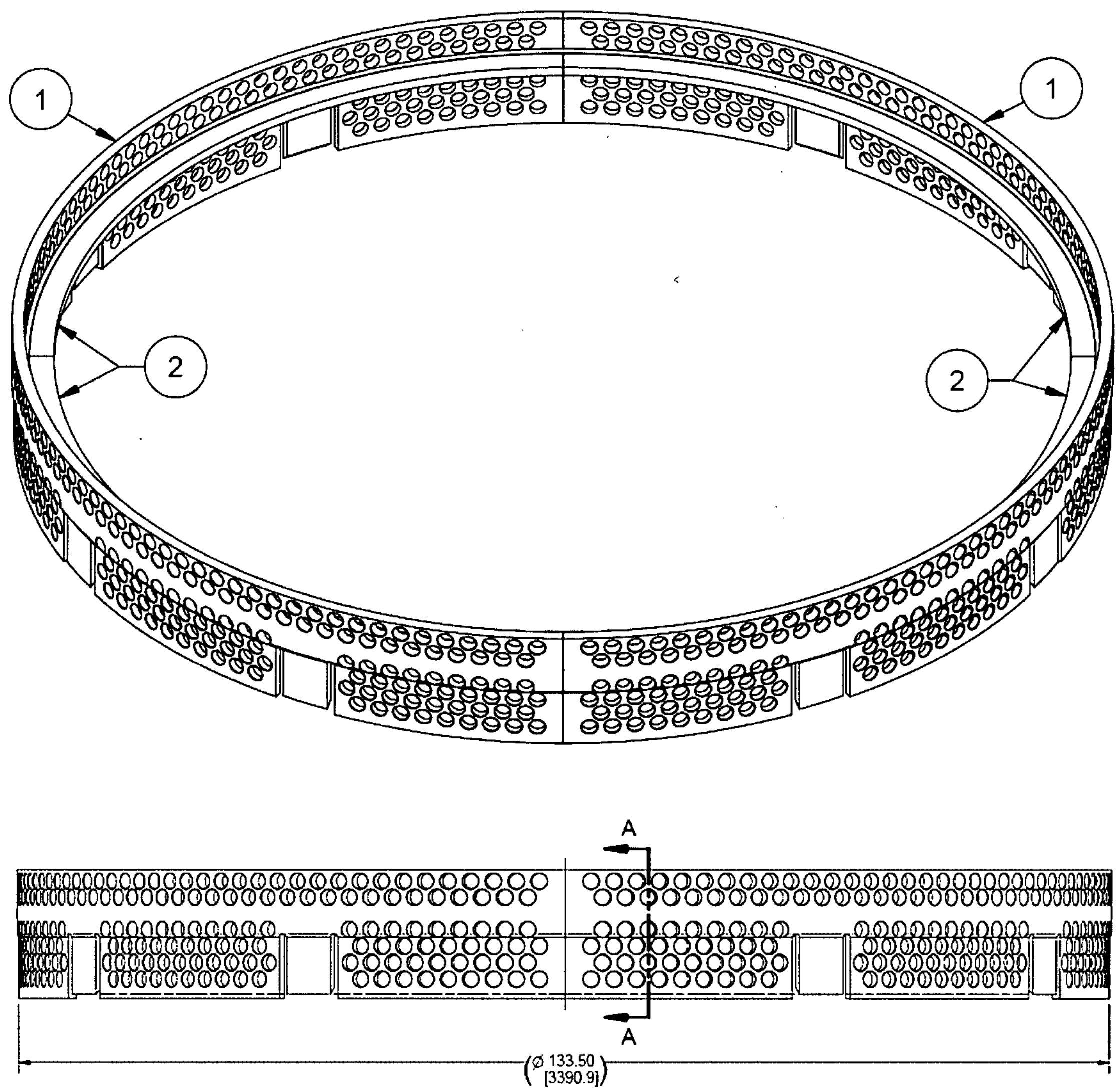

Figure 1 – Flow Skirt Isometric View

Notes:
Item 1 is the "Flow Skirt"
Item 2 is the "Flange"

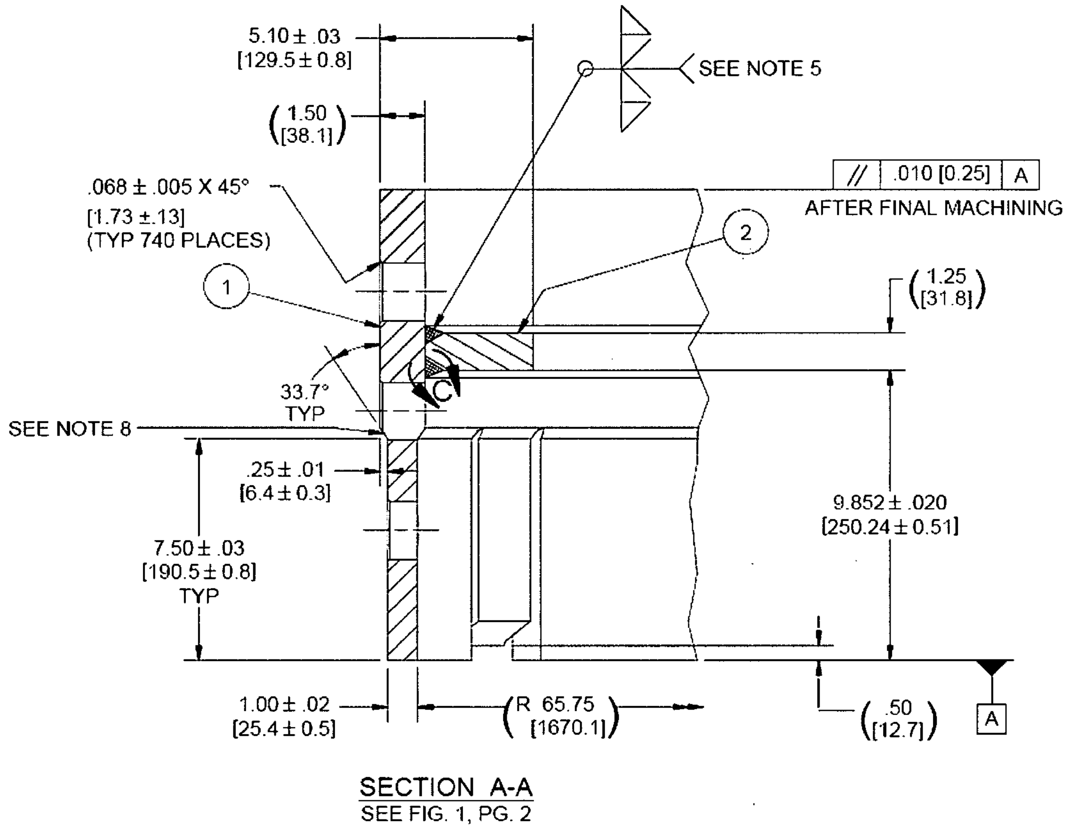

Figure 2 – Flow Skirt Vertical Cross-Section

Notes:
Item 1 is the "Flow Skirt"
Item 2 is the "Flange"

Design Control Document (DCD) Revision: ~~None.~~

The follow text change will be made in DCD Revision 16 Subsection 3.9.5.1.4:

3.9.5.1.4 Flow Skirt

The flow skirt is a perforated cylindrical ring, shown schematically in Figure 3.9-9, that is an attachment to the rector vessel bottom head. However, since this structure is located entirely within the pressure boundary, it will be described in this reactor internals section. The flow skirt is welded to support lugs on the inside surface of the reactor vessel bottom head. A vertical clearance is provided between the top of the flow skirt and the bottom surface of the lower core support plate to prevent contact during operation and postulated core drop accident conditions. The flow skirt provides a more uniform core inlet flow distribution.

The following new figure is added as Figure 3.9-9

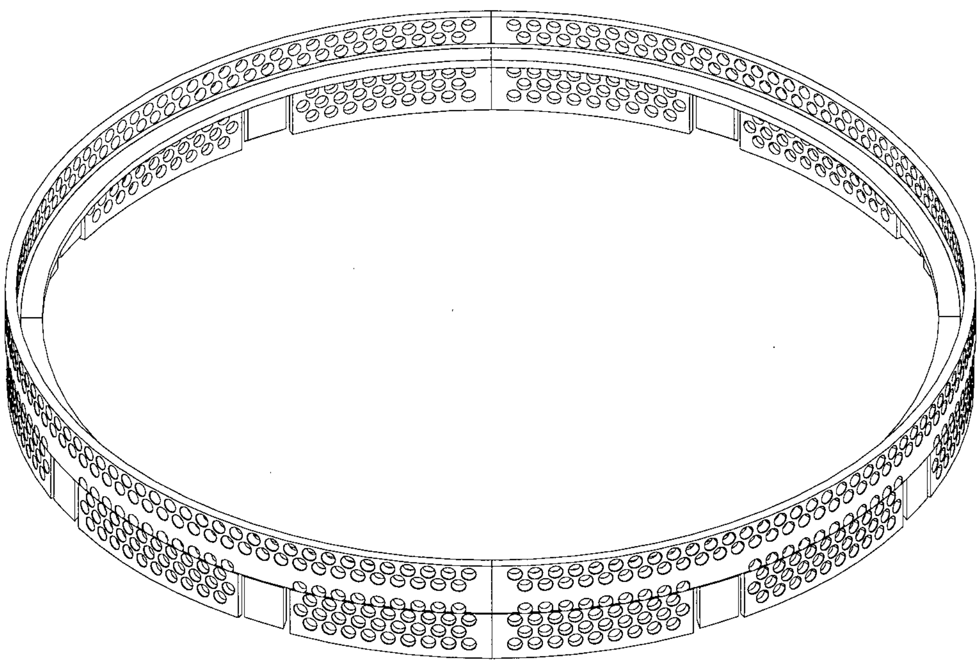

Figure 3.9-9
Flow Skirt Schematic

PRA Revision: None.

Technical Report (TR) Revision: None.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP3.9.5-EMB1-04
Revision: 1

Question:

DCD Section 3.9.5.1.1 re: addition of neutron panels:

a. In accordance with ASME III, Subsection NG-1120, are the neutron panels classified as core support structures or as internal structures?
b. The design basis for the components described in DCD Section 3.9.5.1.1 is unclear. The description of the lower core support assembly, which includes the neutron panels, suggests that this assembly may provide a core support function which defines the ASME Code classification and design basis for the components. Identify the design basis for this assembly, and the design basis of individual components, if different from the assembly.
c. If the neutron panels are classified as internal structures, what specific design criteria are used as the basis for their design and construction?
d. Describe how the neutron panels are fastened to the core barrel, and how this connection is designed to resist vibratory loading.
e. Describe how the addition of the neutron panels affects the fluid flow in the reactor downcomer annulus, especially with respect to the potential for adverse flow-induced vibration loading.

Westinghouse Response:

a. The only function of the neutron panels is to protect the reactor vessel from detrimental radiation effects by limiting total exposure. Thus, the neutron panels are classified as internal structures.

b. The neutron panels are attached to the core barrel with threaded fasteners. The core barrel is a core support structure; however, the attached components (neutron panels, specimen baskets, and direct vessel injection flow diverter) are classified as internal structures because they do not provide either direct or indirect support of the load from the core support structures.

The neutron panels provide shielding over the active core elevations on the outside of the core barrel. The shielding consists of four strategically located panels. The shielding protects the reactor vessel from detrimental radiation effects by limiting total exposure. For conservatism, the Neutron Panels are analyzed in accordance with the requirements of ASME Subsection NG.

The specimen baskets are located on the periphery of the core barrel. Specimens are located to achieve acceptable lead factors to predict vessel exposure. Specimens are removed from the baskets with long-handled tools from the refueling bridge. The specimen baskets are attached to the core barrel with threaded fasteners. For conservatism, the specimen baskets are analyzed in accordance with the requirements of ASME Subsection NG.

The direct vessel injection flow diverter is attached to the outside of the core barrel; its function is to protect the core barrel from direct impingement from the flow entering the direct vessel injection nozzle and to direct the flow downward in the annulus of the core barrel. For conservatism, the direct vessel injection flow diverters are analyzed in accordance with the requirements of ASME Subsection NG.

c. The ASME B&PV Code Subsection NG rules for core support structures have been conservatively applied to the neutron panels. The neutron panels are fabricated from material complying with NG-2000 and are designed and analyzed per NG-3000.

d. The neutron panels are attached to the core barrel with threaded fasteners. The neutron panels have been sized to prevent excessive thermal loading on the bolts and to withstand flow, thermal and vibratory loading.

In addition the bolts and preload of the bolts have been sized to accommodate radiation relaxation and radiation induced gamma heating such that preload is maintained. These bolts are secured by locking devices.

Oscillatory forces on the neutron panel have been calculated based on the turbulence in the annulus between the neutron panel and reactor vessel based on correlation with past scale model tests and CFD analysis. The analysis of the forces, as discussed above were evaluated to assure that preload is maintained and that design limits are achieved.

e. The circumferential extent of the neutron panels was limited to correspond to the high vessel fluence levels and thus minimize the flow blockage in the downcomer. The neutron panels are tapered circumferentially (following the reduction in fluence level) to minimize the flow area reduction. In addition, the reactor vessel inside diameter was increased by two inches over the core elevations when the panels were added. This results in a net flow area increase of 4% relative to the flow area before the panels were added. Thus, the lower average downcomer velocity is expected to tend to offset the effects of the turbulence added by the neutron panels.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None