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Your ref: Project Number 740
Our ref: DCP/NRC1986

September 5, 2007

Subject: AP1000 COL Response to Requests for Additional Information (TR 9)

In support of Combined License application pre-application activities, Westinghouse is submitting responses to the NRC requests for additional information (RAIs) on AP1000 Standard Combined License Technical Report 9, APP-GW-GLR-005, Containment Vessel Design Adjacent to Large Penetrations. These RAI responses are submitted as part of the NuStart Bellefonte COL Project (NRC Project Number 740). The information included in the responses is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification.

Responses are provided for RAI-TR09-001 through RAI-TR09-008, transmitted in NRC letter dated May 18, 2007 from Mike Miernicki to Andrea Sterdis, Subject: Westinghouse AP1000 Combined License Pre-Application Technical Report 9 – Request for Additional Information (TAC NO. MD1847). These responses complete all requests received to date for Technical Report 9

Pursuant to 10 CFR 50.30(b), the responses to the requests for additional information on Technical Report 9, is submitted as Enclosure 1 under the attached Oath of Affirmation.

Questions or requests for additional information related to the content and preparation of these responses 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,

Monte D Bartley FOR

A. Sterdis, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

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D079
D063
NRO

/Attachment

1. "Oath of Affirmation," dated September 5, 2007

/Enclosure

1. Responses to Requests for Additional Information on Technical Report No. 9

cc:	D. Jaffe	-	U.S. NRC	1E	1A
	E. McKenna	-	U.S. NRC	1E	1A
	S. Adams	-	Westinghouse	1E	1A
	G. Curtis	-	TVA	1E	1A
	P. Grendys	-	Westinghouse	1E	1A
	P. Hastings	-	Duke Power	1E	1A
	C. Ionescu	-	Progress Energy	1E	1A
	D. Lindgren	-	Westinghouse	1E	1A
	A. Monroe	-	SCANA	1E	1A
	M. Moran	-	Florida Power & Light	1E	1A
	C. Pierce	-	Southern Company	1E	1A
	E. Schmiech	-	Westinghouse	1E	1A
	G. Zinke	-	NuStart/Entergy	1E	1A
	N. Prasad	-	Westinghouse	1E	1A

ATTACHMENT 1

"Oath of Affirmation"

ATTACHMENT 1

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of:)

NuStart Bellefonte COL Project)

NRC Project Number 740)

APPLICATION FOR REVIEW OF
"AP1000 GENERAL COMBINED LICENSE INFORMATION"
FOR COL APPLICATION PRE-APPLICATION REVIEW

W. E. Cummins, being duly sworn, states that he is Vice President, Regulatory Affairs & Standardization, for Westinghouse Electric Company; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission this document; that all statements made and matters set forth therein are true and correct to the best of his knowledge, information and belief.

W. E. Cummins
Vice President
Regulatory Affairs & Standardization

Subscribed and sworn to
before me this 5th day
of September 2007.

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Patricia S. Aston, Notary Public
Murrysville Boro, Westmoreland County
My Commission Expires July 11, 2011
Member, Pennsylvania Association of Notaries

Notary Public

ENCLOSURE 1

Responses to Requests for Additional Information on Technical Report No. 9

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR09-001
Revision: 0

Question:

The Main Steam and Feedwater penetrations are not addressed in TR-9. These are important major penetrations, which potentially induce cyclic thermal and mechanical loading in the steel containment vessel, around the periphery of the penetrations. The staff requests the applicant to include the design and analysis details for the Main Steam and Feedwater penetrations in TR-9.

Westinghouse Response:

Section 2.6 has been added to the report describing the design of the Main Steam and Feedwater penetration reinforcement. The penetration assemblies are connected to the vessel by expansion bellows thus preventing significant cyclic thermal and mechanical loading in the steel containment vessel.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

See Revision 1 of the Technical Report.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR09-002
Revision: 0

Question:

The staff requires clarification why Westinghouse is trying to justify use of the seismic loading derived from the initial hard-rock site condition, previously reviewed and approved by the staff, for design/analysis of the containment penetrations. In TR-9, Westinghouse compares the initial hard-rock site seismic accelerations to the seismic accelerations obtained for the other soil conditions, and attempts to explain why exceedances are not important. If the design of the penetrations is intended to cover the entire range of site conditions, then the seismic loading for each soil condition should be analyzed, and the design should be performed based on the worst response at the critical locations around each penetration. The staff requests the applicant to provide quantitative information in TR-9 to specifically demonstrate the design adequacy for all soil conditions.

Westinghouse Response:

With the exception of the large penetrations the containment vessel design was completed for the hard rock site condition and was reviewed by NRC during the hard rock Design Certification. This design has not changed. Section 2.5 of the report has been supplemented with member force results for all soil cases to demonstrate that the certified hard rock design also satisfies the demand for the soil sites.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

See Revision 1 of the Technical Report.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR09-003
Revision: 0

Question:

There are no design details for the penetrations in TR-9. The staff requests the applicant to include design information (geometry, material and material properties, dimensions and wall thicknesses) for each penetration in TR-9. Also specify the ASME Code, Class MC jurisdictional boundaries for each penetration.

Westinghouse Response:

Typical design information for the penetrations is provided in the DCD. This material has now been included in Appendix A of the report. Penetration assemblies, such as those shown in the upper figure on DCD Figure 3.8.2-4 (sheet 4 of 6) are ASME Class 2. Expansion bellows and guard pipes are ASME Class 2 or Class MC. The penetration assemblies are welded to sleeves that are ASME Class MC. Process piping welded directly to the vessel, such as shown in the lower figure in DCD Figure 3.8.2-4 (sheet 4 of 6) is ASME Class 2.

The material of construction is SA738 Grade B for the vessel shell, insert plates and nozzle necks of penetrations with inside diameters greater than 24". For penetrations less than 24" inside diameter and greater than 2" nominal diameter, forgings of SA350 LF2 material are used for the nozzle neck.

Design requirements for the mechanical penetrations are as follows:

- Design and construction of the process piping follow ASME, Section III, Subsection NC. Design and construction of the remaining portions follow ASME Code, Section III, Subsection NE. The boundary of jurisdiction is according to ASME Code, Section III, Subsection NE.

- Penetrations are designed to maintain containment integrity under design basis accident conditions, including pressure, temperature, and radiation.

- Guard pipe assemblies for high-energy piping in the containment annulus region between the containment shell and shield building that are part of the containment boundary are designed according to the rules of Class MC, subsection NE, of the ASME Code.

- Bellows are stainless steel or nickel alloy and are designed to accommodate axial and lateral displacements between the piping and the containment vessel. These displacements include thermal growth of the main steam and feedwater piping during plant operation, relative seismic movements, and containment accident and testing

conditions. Cover plates are provided to protect the bellows from foreign objects during construction and operation. These cover plates are removable to permit in-service inspection.

Design Control Document (DCD) Revision:

The following revisions are to DCD Rev 16.

Revise classification in Table 3.2.3 as shown below from MC to Class 2 for penetrations where the process pipe penetrates directly the containment vessel without the use of a fluid head (see typical detail on lower half of Figure 3.8.2-4, sheet 4 of 6). In this case the sleeve is a boundary of the process fluid and is required by the ASME Code to be Class 2.

Revise sheets 2, 3, 4 and 6 of Figure 3.8.2-4 as shown on the following pages to reflect detail design of the penetration reinforcement.

DCD TABLE 3.2-3: AP1000 CLASSIFICATION OF MECHANICAL AND FLUID SYSTEMS, COMPONENTS, AND EQUIPMENT

Tag Number	Description	AP1000 Class	Seismic Category	Principal Construction Code	Comments
CAS-PY-C02	Containment Instrument Air Inlet Penetration	B	I	ASME III, ~~MC~~2	
CAS-PY-C03	Containment Service Air Inlet Penetration	B	I	ASME III, ~~MC~~2	
CCS-PY-C01	Containment Supply Header Penetration	B	I	ASME III, ~~MC~~2	
CCS-PY-C02	Containment Return Header Penetration	B	I	ASME III, ~~MC~~2	
CVS-PY-C02	Letdown Line Containment Penetration	B	I	ASME III, ~~MC~~2	
CVS-PY-C04	Hydrogen Add Line Containment Penetration	B	I	ASME III, ~~MC~~2	
DWS-PY-C01	Containment Demineralized Water Supply Penetration	B	I	ASME III, ~~MC~~2	
FPS-PY-C01	Fire Protection Containment Penetration	B	I	ASME III, ~~MC~~2	
PSS-PY-C03	Containment Atmosphere Sample Line Penetration	B	I	ASME III, ~~MC~~2	
PXS-PY-C01	Nitrogen Makeup Containment Penetration	B	I	ASME III, ~~MC~~2	
VFS-PY-C01	Containment Supply Duct Penetration	B	I	ASME III, ~~MC~~2	
VFS-PY-C02	Containment Exhaust Duct Penetration	B	I	ASME III, ~~MC~~2	
VWS-PY-C01	Containment Chilled Water Supply Penetration	B	I	ASME III, ~~MC~~2	
VWS-PY-C02	Containment Chilled Water Return Penetration	B	I	ASME III, ~~MC~~2	
WLS-PY-C02	Reactor Coolant Drain Tank WLS Connection Penetration	B	I	ASME III, ~~MC~~2	
WLS-PY-C03	Containment Sump Pumps Combined Discharge Penetration	B	I	ASME III, ~~MC~~2	

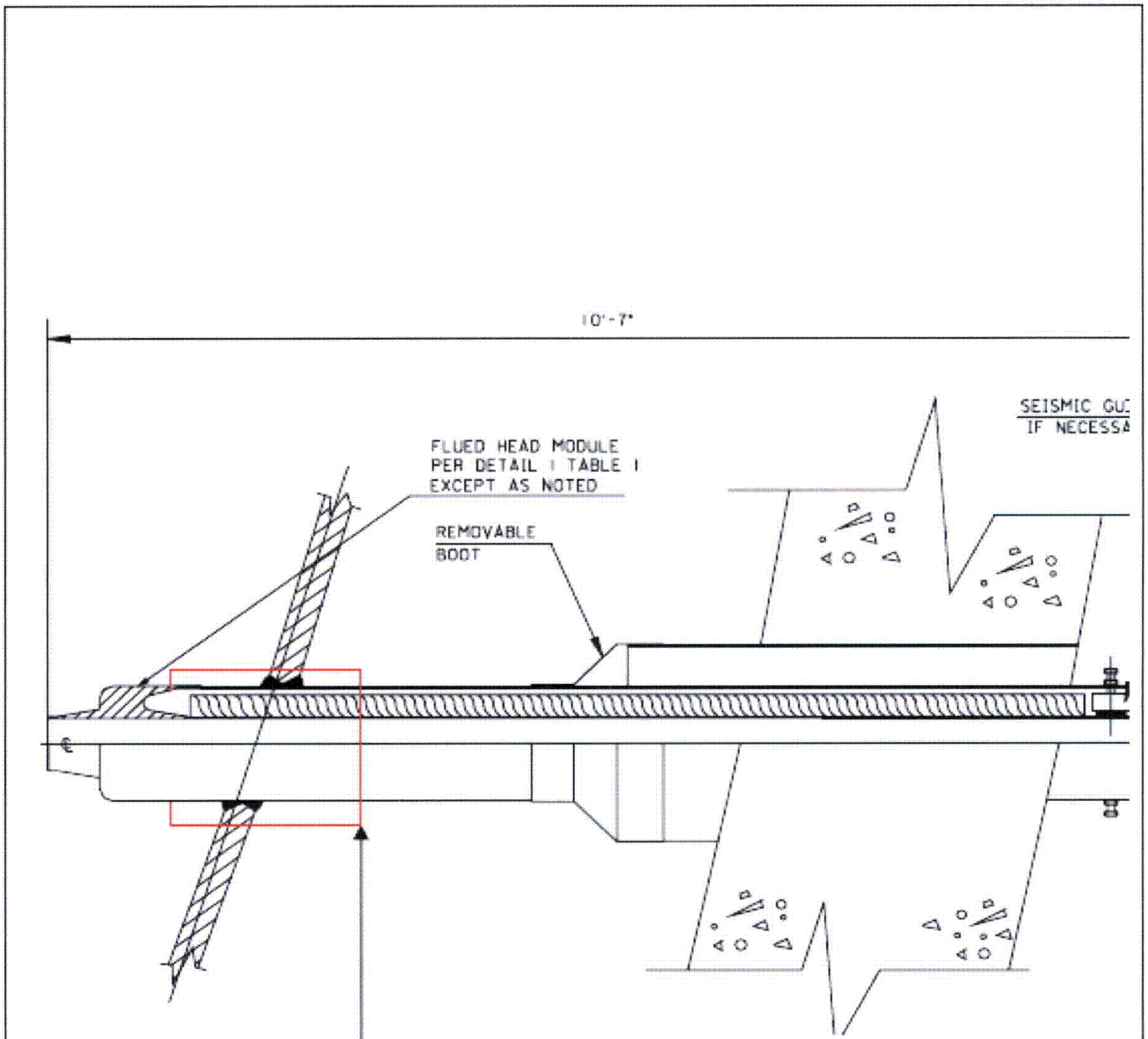

Figure 3.8.2-4 (Sheet 2 of 6)
Containment Penetrations Startup Feedwater

Thicken nozzle and add weld to guard pipe outside containment.

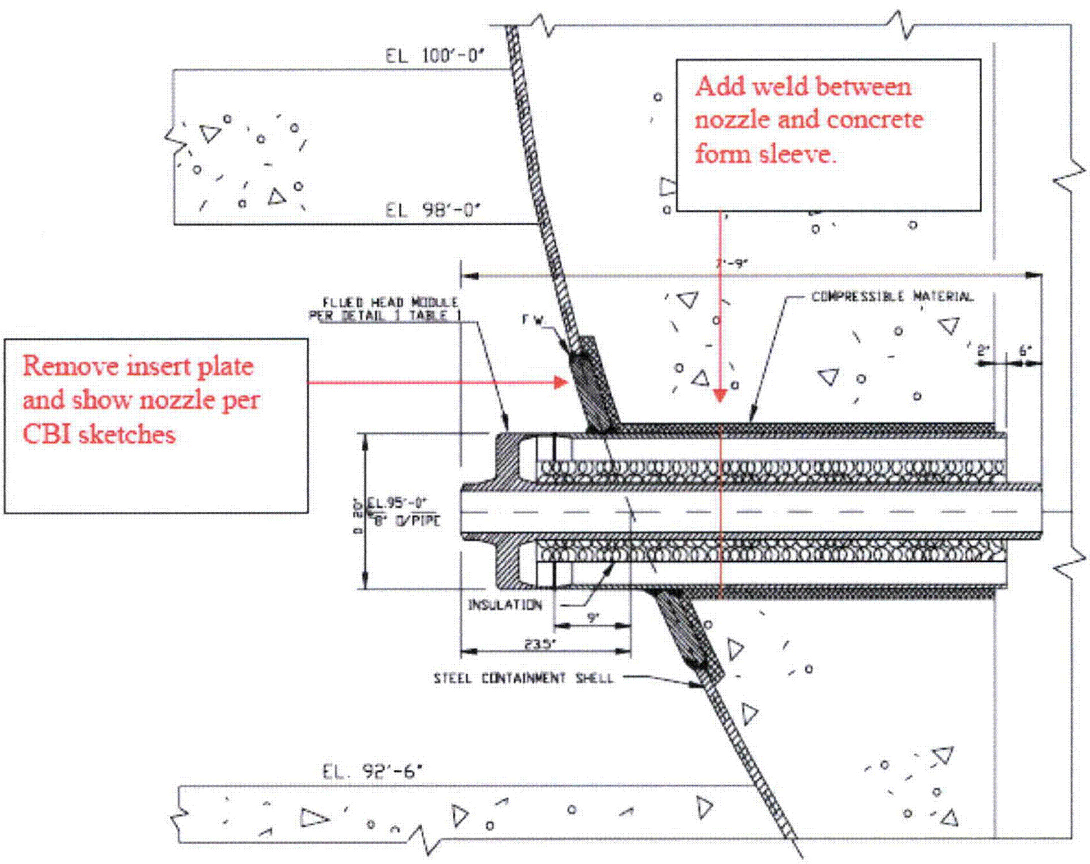

Figure 3.8.2-4 (Sheet 3 of 6)

Containment Penetrations Normal RHR Piping

Nozzle/sleeve thickness is greater than flued head thickness. Change on drawing (detail 14). No need to change in DCD, but update if opportunity arises.

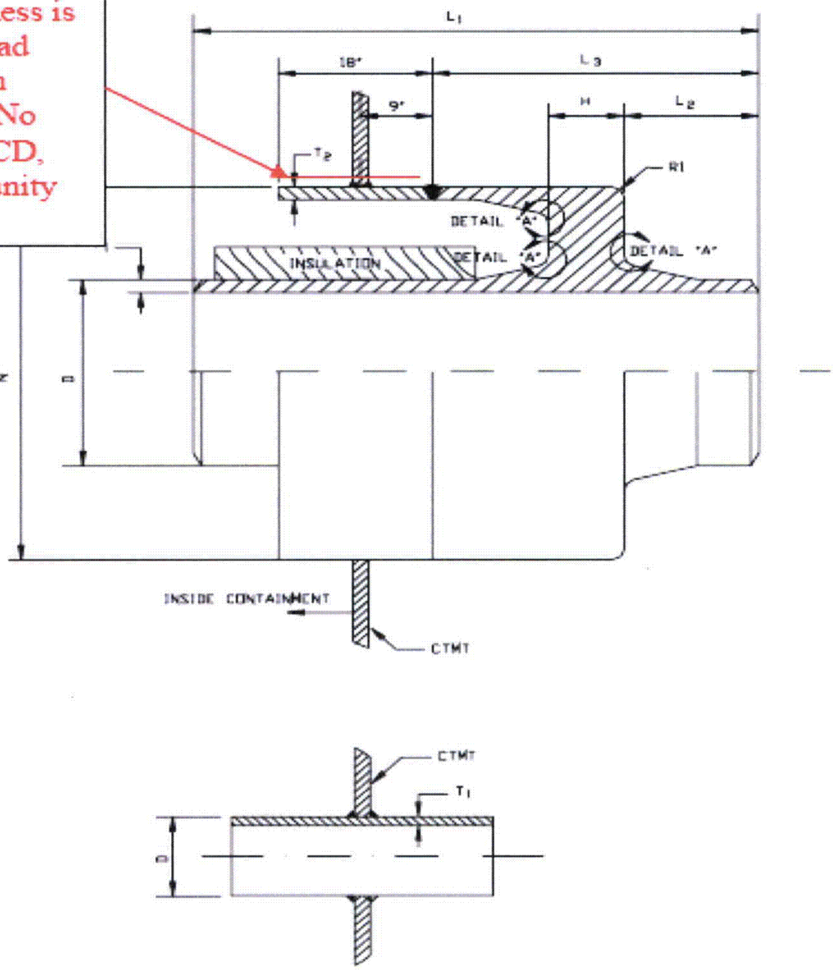

Figure 3.8.2-4 (Sheet 4 of 6)

Containment Penetrations

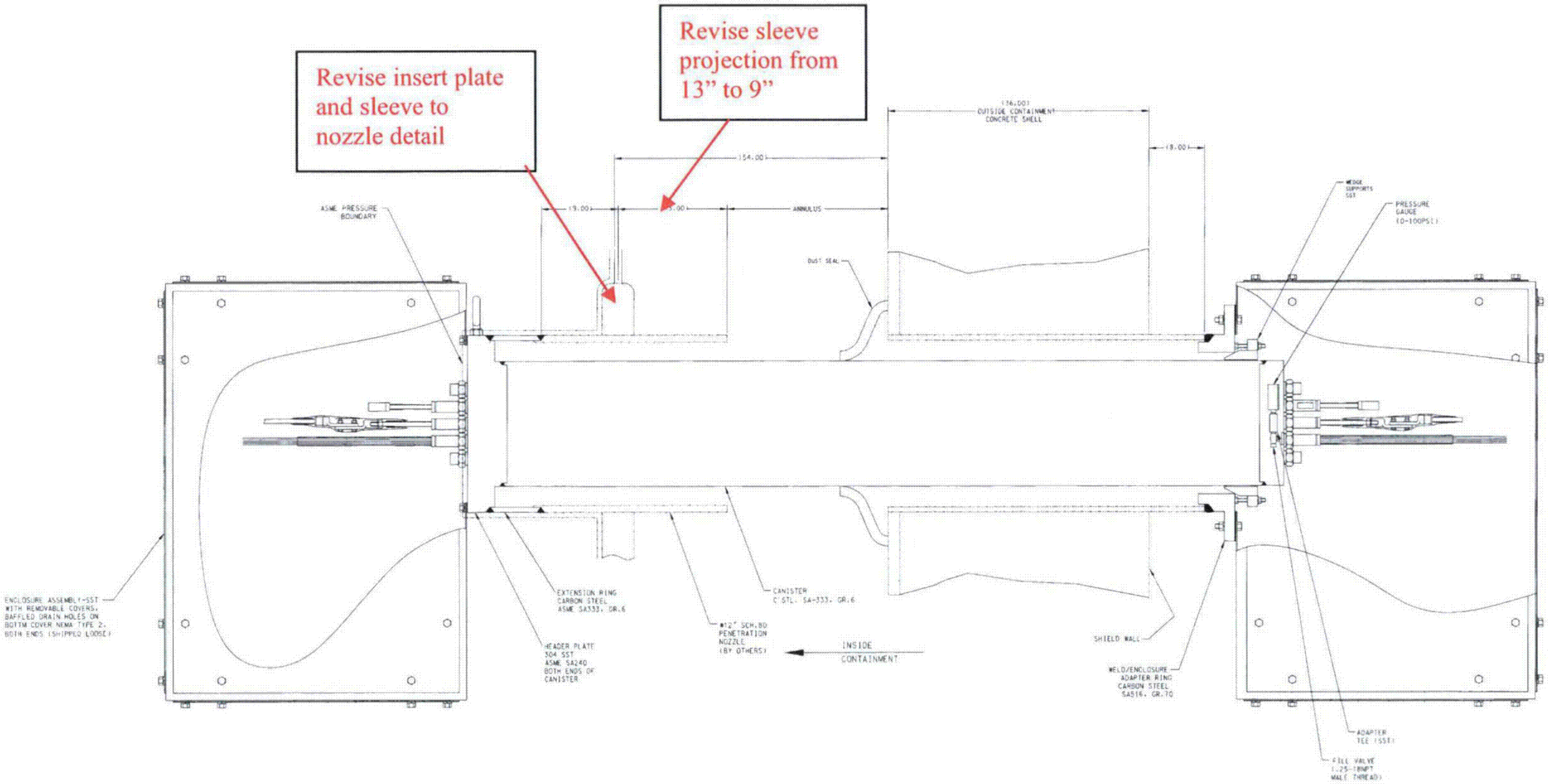

Figure 3.8.2-4 (Sheet 6 of 6)
Containment Penetration Typical Electrical Penetration

PRA Revision:
None

Technical Report (TR) Revision:

See Revision 1 of the Technical Report.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR09-004
Revision: 0

Question:

There is insufficient description in TR-9 of the local ANSYS models developed for the penetrations. For each penetration, the staff requests the applicant to address the following in TR-9:

- How is local thickening of the containment vessel modeled?
- How is the ANSYS output used to conduct the ASME Code stress checks?
- What ASME categories of stresses are directly obtainable from the ANSYS results: primary, primary + secondary, primary + secondary + peak?

Westinghouse Response:

The local ANSYS model for the upper equipment hatch is shown in Figure 2-6(b) of the report. This model is included as a refined part of the overall model. Elements are defined so that the local thickening is represented by the element thickness. The thicker portion around the upper equipment hatch is visible in Figure 2-6(b).

Hand calculations are used to check Primary General Membrane stresses (Pm). ANSYS output is used directly to make ASME Code stress checks for the following:

- Primary stresses - Local Membrane (PL)
- Primary and Secondary Stresses (Pb + PL + Q)

There are no loads causing primary bending stresses, Pb, or peak stresses, F, in the vicinity of the large penetrations.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

See Revision 1 of the Technical Report.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR09-005
Revision: 0

Question:

There is insufficient description in TR-9 of the load cases analyzed. For each penetration, the staff requests the applicant to address the following in TR-9:

- How many actual load cases were analyzed?
- How are these combined to check all the required load combinations?
- Is the containment post-accident flooding load combination applicable? It is not identified in the load combination table included in the report.

Westinghouse Response:

Section 2.3 of the report has been revised to describe the individual load cases and their combination.

The post accident flooding load combination is not applicable in the design of the containment vessel. Containment flooding events are described in DCD subsection 3.4.1.2.2.1. Curbs are provided around openings through the maintenance floor at elevation 107'-2" to control flooding into the lower compartments. The maximum curb elevation of 110'-2" establishes the maximum flooding on the containment vessel boundary. There are seals at elevation 107'-2" between the containment vessel and maintenance floor as shown in sheet 2 of DCD Figure 3.8.2-8. In the event of seal leakage hydrostatic pressure could be imposed on the vessel behind the concrete. Pressure loads below elevation 100' are resisted by the mass concrete of the nuclear island basemat. Pressure loads above elevation 100' would be carried by the steel vessel. Hence there could be a maximum hydrostatic head of 10' corresponding to a hydrostatic pressure of about 5 psi.

The containment vessel is designed for a design pressure of 59 psi. This pressure exceeds the maximum calculated pressure in design basis accidents.

Maximum flooding occurs late during the accident transient. The combination of hydrostatic pressure at elevation 100' and containment pressure is less than the design pressure of 59 psi. Hence, the post-LOCA flooding event is enveloped by the other design cases.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

See Revision 1 of the Technical Report.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR09-006
Revision: 0

Question:

There is insufficient description in TR-9 of the stress results. For each penetration, the staff requests the applicant to include the following in TR-9:

- Tabulated summary of stress results for all of the analyzed load conditions.
- Tabulated summary of combined stresses for the identified load combinations.
- Tabulated summary of the comparisons to ASME Code allowable stress limits for all applicable Service Levels.

Westinghouse Response:

Section 2.4.2.1 has been added to the report to provide the requested information.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

See Revision 1 of the Technical Report.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR09-007
Revision: A

Question:

There are no results presented in TR-9 for the buckling analyses conducted. It is simply stated that Code Case N284-1 was used. As documented in RG 1.193, the staff does not officially accept Code Case N284-1. However, the staff has accepted its use for AP600 and AP1000, subject to the conditions delineated in the respective DCDs/SERs. The staff requests the applicant to include in TR-9 a detailed description of the buckling analysis results, and a clarification that the conditions placed on the use of Code Case N284-1 have been satisfied.

Westinghouse Response:

Section 2.4.2.2 has been added to the report to provide the requested information.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

See Revision 1 of the Technical Report.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR09-008
Revision: 0

Question:

In TR-9, starting on p. 4, Westinghouse presents a justification for reducing the design external pressure from 2.9 psid to 0.9 psid, and states that "the extreme conservatism in the above analyses was reduced and an estimate of the external pressure was provided in the response to DSER Open Item 3.8.2.1-1." The staff reviewed the AP1000 SER and could not establish that this reduction has been specifically reviewed and accepted by the staff. The staff also reviewed AP1000 DCD, Rev. 15, and found that the design external pressure is specified to be 2.9 psid on page 3.8-1. Since there is no evidence that the reduction in design external pressure has been reviewed and accepted by the appropriate staff reviewers, and a determination of acceptability cannot be made by staff structural reviewers, Westinghouse must use the design external pressure of record (i.e., 2.9 psid) in demonstrating the adequacy of the containment penetration designs. Therefore, the staff requests the applicant to

- Demonstrate the design adequacy of the containment penetrations for a design external pressure of 2.9 psid.
- Confirm the design adequacy of the steel containment vessel (other than penetrations) for a design external pressure of 2.9 psid.

Westinghouse Response:

The containment vessel, including the penetrations, is designed for a design external pressure of 2.9 psid. The design external pressure is the second "design" case in DCD Table 3.8.2-1 and also shown as "Des2" in Table 2-4 of this report. The design external pressure plus SSE is considered in the first Service Level D case in DCD Table 3.8.2-1 and also shown as "D1" in Table 2-4 of this report. The lower external pressure of 0.9 psid is only used as part of the "loss of all AC in cold weather" event (cases A1 and D2 in Table 2-4).

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

None