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Your ref: Project Number 740
Our ref: DCP/NRC1779

September 22, 2006

Subject: AP1000 COL Response to Requests for Additional Information (TR #36)

In support of Combined License application pre-application activities, Westinghouse is submitting responses to NRC requests for additional information (RAIs) on AP1000 Standard Combined License Technical Report 36, APP-GW-GLR-016, Rev. 0, AP1000 Pressurizer Design. 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 requests TR36-5, RAI36-6, RAI36-7, TR36-8, TR36-9, TR36-10, TR36-11 transmitted in an NRC letter (NRC/DCP1357) from Steven D. Bloom to Andrea Sterdis, Subject: Westinghouse AP1000 Combined License (COL) Pre-application Technical Report 36 – Request for Additional Information (TAC No. MD2109).

Pursuant to 10 CFR 50.30(b), the responses to requests for additional information on Technical Report 36 numbered RAI-TR36-005, RAI-TR36-006, RAI-TR36-007, RAI-TR36-008, RAI-TR36-009, RAI-TR36-010, and RAI-TR36-011 are submitted as Enclosure 1 under the attached Oath of Affirmation.

It is expected that when the RAIs on Technical Report 36 are complete, the technical report will be revised as indicated in the responses and submitted to the NRC. The RAI responses will be included in the document.

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

D079

0035-ldk.doc

/Attachment

1. "Oath of Affirmation," dated September 22, 2006

/Enclosure

1. Responses to Requests for Additional Information on Technical Report No. 36
RAI-TR36-005, RAI-TR36-006, RAI-TR36-007, RAI-TR36-008, RAI-TR36-009, RAI-TR36-010, and RAI-TR36-011

cc:	S. Bloom	-	U.S. NRC	1E	1A
	S. Coffin	-	U.S. NRC	1E	1A
	G. Curtis	-	TVA	1E	1A
	P. Grendys	-	Westinghouse	1E	1A
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	D. Lindgren	-	Westinghouse	1E	1A
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	C. Pierce	-	Southern Company	1E	1A
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	G. Zinke	-	NuStart/Entergy	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 22nd day
of September 2006.

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Debra McCarthy, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Aug. 31, 2009
Member, Pennsylvania Association of Notaries

Notary Public

ENCLOSURE 1

Responses to Requests for Additional Information on Technical Report No. 36

RAI-TR36-005, RAI-TR36-006, RAI-TR36-007, RAI-TR36-008, RAI-TR36-009, RAI-TR36-010, and RAI-TR36-011

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR36-005
Revision: 0

Question:

Westinghouse proposed in the topical report (TR), APP-GW-GLR-016, its design changes for the AP1000 pressurizer. Specifically, Section 2.1 of the TR proposed that the inside of the diameter of the pressurizer was increased, and the pressurizer vessel height was decreased while the internal volume of the pressurizer maintained unchanged. These proposed changes would increase the cross-section of the pressurizer, and decrease the vessel height and the value (in percent of span) of the initial water level in the pressurizer assumed in DCD Chapter 15 transients and accident analysis. Section 2.2 proposed that the vertical angular position of the 14-inch ADS was changed. It is not clear whether the change will affect the ADS effective flow rate used in the DCD Chapter 15 analysis.

Section 2.4 and 2.10 proposed that the setpoints (in a percent of span) were changed for the following functions: (1) the reactor trip on high-3 pressurizer water level; (2) the PRHR actuation of high-3 pressurizer water level; (3) the CVCS isolation on high-2 pressurizer water level; and (4) the CVCS isolation on high-1 pressurizer water level coincident with the 'S' signal. These setpoint changes were to reflect the changes in dimension of the pressurizer and placement of the upper level tap on the upper head, while the water volumes of the respective setpoints were kept unchanged. Section 2.6 proposed that the elevations of ADS Stage 1,2, and 3 were reduced, and Section 2.9 proposed that the pressurizer heater length was reduced to reflect the pressurizer dimension changes.

As discussed above, the proposed changes involve the following design parameters:

(I) The cross-section area of the pressurizer, the pressurizer vessel height, and the analytical value of the initial water level (in a percent of span);
(II) The effective ADS flow rate;
(III) The setpoints (in a percent of span) of the pressurizer for 4 functions;
(IV) The elevations of ADS Stage 1,2, and 3 valves; and
(V) The pressurizer heater length.

Please provide information to address the impact of the proposed pressurizer design changes identified above on the results of the transient and accident analysis in DCD Chapter 15. The information should include:

i) A table that lists the values used in the DCD Chapter 15 analysis and the values for the proposed design changes for the parameters listed in items (I) through (V); and
ii) A discussion that addresses the impact of the changes for each parameter of items (I) through (V) on the Chapter 15 analysis, and demonstrates that the effects are insignificantly small and the Chapter 15 analysis is bounding and remains valid. If it is determined that Chapter 15 analysis is invalid, provide an acceptable reanalysis to the NRC for review and approval.

Westinghouse Response:

The transient and accident analysis in Chapter 15 of the Design Control Document (DCD) is based on the water volumes associated with the pressurizer level. These water volumes were converted to the corresponding level as a percent of span. The water volumes were held constant while the levels in a percent of span were recalculated. By maintaining the water volumes, the transient and accident analysis of Chapter 15 remains valid. Below is a table which lists the pressurizer design parameters:

Parameter	DCD Revision 15	TR 36 Change
Cross-Sectional Area	44.18 ft^2	54.13 ft^2
Pressurizer Height	607.1 inches	502.9 inches
Analytical Water value of initial water level (1000 ft^3)	286.6 inches	237.6 inches
Effective ADS flow	0-300 lbm/sec (total)	Same (see discussion)
High-3 Reactor Trip	80% of span (1598 ft^3)	76% of span (1598 ft^3)
High-3 PRHR Actuation	80% of span (1598 ft^3)	76% of span (1598 ft^3)
High-2 CVCS isolation	67% of span (1358 ft^3)	63% of span (1358 ft^3)
High-1 CVCS isolation coincident with 'S' signal	30% of span (675 ft^3)	28% of span (675 ft^3)
ADS Stage 1, 2, and 3 Lower Tier	174'-3 13/16"	167'-3 ½"
ADS Stage 1, 2, and 3 Upper Tier	185'-0 13/16"	178'-0 ½"
Pressurizer Heater Length (From top of highest heater to lower weld)	59.11 inches	17.57 inches

The values presented in the table above are representative of the DVI break for the sequence of the break from ADS actuation to the actuation of the 4th stage ADS valve. The following analysis was conducted on the effects of the pressurizer changes on the effective ADS flow.

(I) Cross-Sectional Area: The cross-sectional area was increased due to the increase in the pressurizer diameter. By increasing the cross-sectional area, the interfacial area between the liquid and vapor space is also increased resulting in a larger release of vapor during depressurization.

(II) Pressurizer Vessel Height: The pressurizer vessel height has no significant impact on the ADS effective flow rate nor the Chapter 15 analysis because ADS flow is choked.

(III) Analytical value of initial water level: The analytical water level height was lowered due to the increase in cross-sectional area. Lowering the water level height increases the distance between the ADS valves at the top of the pressurizer and the water level. This increases the time steam is vented, resulting in a smaller pressure drop across the ADS valves longer, leading to a more rapid depressurization. In addition, a lower

hydrostatic head resulting from a lower water level in the pressurizer is beneficial for venting through the ADS Stage 4 valves.

(IV) Pressurizer Setpoints: The Chapter 15 analysis in the DCD is conducted using the pressurizer volumes. These volumes are converted into pressurizer levels as percent of span for instrumentation and controls. The water volumes were held constant; therefore, there is no impact on the Chapter 15 analysis.

(V) ADS Stage 1, 2, and 3 Elevations: The elevation of the ADS Stage 1, 2, and 3 valves has no significant impact on the ADS effective flow rate nor the Chapter 15 analysis because ADS flow is choked.

(VI) Pressurizer Heater Length: The pressurizer heater length has no impact on the ADS effective flow rate nor the Chapter 15 analysis.

As noted above, the overall effect of the pressurizer design change is a minor increase in ADS effective flow rate which decreases the time to depressurize the reactor coolant system sufficiently to allow gravity injection of the In-containment Refueling Water Storage Tank (IRWST). Therefore, based on this evaluation, the Chapter 15 analysis remains valid and bounding.

Reference:

1. APP-GW-GLR-016, Rev 0, "AP1000 Pressurizer Design"
2. APP-GW-GL-700, Rev 15, "AP1000 Design Control Document"

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-TR36-006
Revision: 0

Question:

On page 31 of the COLA Technical Report 36, the location of the Pressurizer centerline from the steam generator wall is shown to be 113.5" on the East side and 83.0" on the West side. On page 32 (which is the revised dwg.) the same dimensions are shown as 9'-7.39" and 7'-5.33" respectively. The applicant is requested to explain this difference in the text as is done for all of the other changes.

Westinghouse Response:

The original location of the pressurizer centerline was incorrectly shown as being 113.5" on the East side and 83.0" on the West side of the steam generator wall on Figure 3.8.3-6 of the design control document (DCD). Therefore, the centerline dimensions were revised to 9'-7.39" on the East side and 7'-5.33" on the West side of the steam generator wall in Figure 3.8.3-6 to correct the dimensions described in the figure.

Reference:

1. APP-GW-GLR-016, Rev 0, "AP1000 Pressurizer Design"
2. APP-GW-GL-700, Rev 15, "AP1000 Design Control Document"

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

The above discussion will be added to APP-GW-GLR-016 to explain the difference between the dimensions.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR36-007
Revision: 0

Question:

The applicant is requested to identify any modeling changes that were made to incorporate the configuration changes to the pressurizer. A comparison of the resulting spectra to the original spectra at the different locations where the desired response was expected to be lowered by this modification should also be presented.

Westinghouse Response:

The documented response spectra for the AP1000 pressurizer already include the design changes outlined in APP-GW-GLR-016. The original response spectra were not formally documented and changes were made prior to verification; therefore, the original response spectra are not available.

Reference:

1. APP-GW-GLR-016, Rev 0, "AP1000 Pressurizer Design"
2. APP-GW-GL-700, Rev 15, "AP1000 Design Control Document"

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-TR36-008
Revision: 0

Question:

It appears from the proposed changes made to Table 3.3-1 (Definition of Wall Thicknesses for Nuclear Island Buildings and Annex Building) of the AP1000 Tier One DCD that the thickness of the concrete walls surrounding the redesigned pressurizer have not changed as a result of this proposed change in the pressurizer dimensions. Verify that the thickness of these walls is sufficient to ensure that the radiation zones outside of the pressurizer compartment will not increase as a result of any possible increase in the radiation levels from the pressurizer as a result of the proposed pressurizer dimension changes.

Westinghouse Response:

The thickness of the shield walls surrounding the pressurizer is sized based on structural/constructability considerations and is much thicker than radiation shielding needs would dictate. As a result the radiation zones outside the pressurizer compartment will not change as a result of the proposed pressurizer dimension changes.

Reference:

1. APP-GW-GLR-016, Rev 0, "AP1000 Pressurizer Design"
2. APP-GW-GL-700, Rev 15, "Design Control Document"

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-TR36-009
Revision: 0

Question:

Describe what affects, if any, the increase in the diameter of the pressurizer will have on the radiation levels (during full power, 24 hours after shutdown, and post-accident) inside the pressurizer compartment. If radiation levels from the pressurizer will increase, describe any effects this may have on exposures to personnel working in the vicinity of the pressurizer and describe any changes (e.g., extra shielding, administrative controls) that will be made to counteract this increase in radiation levels resulting from this design change.

Westinghouse Response:

Radiation levels in the pressurizer compartment are dominated by the header pipes and valves located above the pressurizer and by the piping and heater penetrations at the bottom of the pressurizer. As a result, the increase in the diameter of the pressurizer will have an insignificant effect on the radiation levels in the pressurizer compartment.

Reference:

1. APP-GW-GLR-016, Rev 0, "AP1000 Pressurizer Design"
2. APP-GW-GL-700, Rev 15, "AP1000 Design Control Document"

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-TR36-010
Revision: 0

Question:

On the basis of this proposed pressurizer design change, Westinghouse has modified various plant layout drawings in Chapters 1, 3, 5, and 9 to reflect the dimension changes to the concrete walls surrounding the pressuizer. Similar changes should be made to the applicable layout drawings shown in Figures 12.3-1, 12.3-2, and 12.3-3 in Chapter 12. In addition, these revised radiation zone drawings should indicate the resulting projected radiation levels (during full power, 24 hours after shutdown, and post-accident) in the vicinity of the pressurizer as a result of the pressurizer dimension changes.

Westinghouse Response:

Regarding changes made to plant layout drawings in Chapters 1, 3, 5, and 9, similar changes will be made to the layout drawings in Figures 12.3-1, 12.3-2, and 12.3-3 in Chapter 12.

As indicated in responses RAI-TR36-008 and RAI-TR36-009, radiation levels in the vicinity of the pressurizer are not expected to change as a result of the pressurizer dimension changes.

Reference:

1. APP-GW-GLR-016, Rev 0, "AP1000 Pressurizer Design"
2. APP-GW-GL-700, Rev 15, "AP1000 Design Control Document"

Design Control Document (DCD) Revision:
Figures 12.3-1, 12.3-2, and 12.3-3 in Chapter 12 will be altered to show the applicable changes to the pressurizer.

PRA Revision:
None

Technical Report (TR) Revision:
Figures 12.3-1, 12.3-2, and 12.3-3 will be added to APP-GW-GLR-016 as changes.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR36-011
Revision: 0

Question:

Section 2.1 (Pressurizer Vessel) of the submittal states that the inside diameter of the pressurizer will be increased from 90 to 100 inches while the inside dimensions of the concrete walls enclosing the pressurizer will remain unchanged. Section 2.3 (Pressurizer Manway) states that the pressurizer manway will be relocated from the spherical head of the pressurizer to the cylindrical portion of the pressurizer. Table 12.4-6 of the AP1000 DCD, Tier 2, states that the annual dose estimate for in-service inspection work associated with the pressurizer shell is 1.20 man-rem. Discuss what affect the decrease in work area surrounding the pressurizer (due to the increase in pressurizer diameter), coupled with the relocation of the pressurizer manway, will have on personnel accessibility inside the pressurizer compartment and on the estimated annual dose for pressurizer shell in-service inspection.

Westinghouse Response:

The annual dose estimate of 1.20 man-rem for in-service inspection work associated with the pressurizer shell is based largely on operating plant experience and as such is not expected to be affected by the increase in the diameter of the pressurizer or the relocation of the manway. Access to the inside of the pressurizer via the manway is not a part of normal maintenance or inspection activities.

Reference:

1. APP-GW-GLR-016, Rev 0, "AP1000 Pressurizer Design"
2. APP-GW-GL-700, Rev 15, "AP1000 Design Control Document"

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None