



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: 412-374-6306  
Direct fax: 412-374-5005  
e-mail: [sterdia@westinghouse.com](mailto:sterdia@westinghouse.com)

Your ref: Project Number 740  
Our ref: DCP/NRC1980

August 23, 2007

Subject: AP1000 COL Response to Requests for Additional Information (TR 3)

In support of Combined License application pre-application activities, Westinghouse is submitting revised responses to the NRC requests for additional information (RAIs) on AP1000 Standard Combined License Technical Report 3, APP-GW-S2R-010, Extension of Nuclear Island Seismic Analysis to Soil Sites. 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.

Revised responses are provided for TR3-21 and TR3-23. Revision 1 of RAI-TR03-021 was transmitted to the NRC via DCP/NRC1942 on June 15, 2007. Revision 0 of RAI-TR03-023 was sent on April 5, 2007 via DCP/NRC1858. There are five remaining RAI responses for Technical Report 3 to be submitted separately.

Pursuant to 10 CFR 50.30(b), the responses to the requests for additional information on Technical Report 3, 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,

*Mont D Bartley FOR*

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

/Attachment

1. "Oath of Affirmation," dated August 23, 2007

/Enclosure

1. Responses to Requests for Additional Information on Technical Report No. 3

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
	B. LaPay	- Westinghouse	1E	1A

ATTACHMENT I

“Oath of Affirmation”

ATTACHMENT 1

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

In the Matter of: )  
NuStart Bellefonte COL Project )  
NRC Project Number 740 )

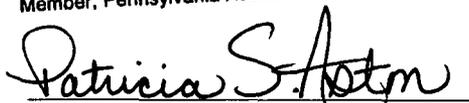
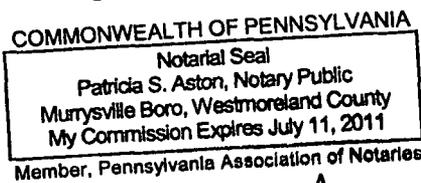
APPLICATION FOR REVIEW OF  
"AP1000 GENERAL COMBINED LICENSE INFORMATION"  
FOR COL APPLICATION PRE-APPLICATION REVIEW

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 23<sup>rd</sup> day  
of August 2007.



Notary Public

ENCLOSURE I

Responses to Requests for Additional Information on Technical Report No. 3

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

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RAI Response Number: RAI-TR03-021  
Revision: 2

### **Question:**

The staff's review of Section 6.2 identified a number of items in need of clarification or explanation. The staff requests Westinghouse to address the following:

- a. The fourth paragraph of page 91 of 154 states "In Section 6.3 a comparison of member forces obtained from seismic static and time history analyses is given." Please confirm that the reference should be to Section 6.4.
- b. The last paragraph of page 91 of 154 states "For those local flexible structures that are amplified, apply an additional acceleration to these structures equal to the difference between the average uniform amplified component accelerations and rigid body component equivalent static accelerations. These accelerations are to be considered in local design of the flexible portion of the structure but do not need to be considered in areas of the structure away from the local flexibility. They can be applied in a series of individual load vectors." It is not obvious to the staff how this methodology has been implemented, and whether the effects of increased accelerations on locally flexible structures can be ignored in areas of the structure away from the locally flexible structures. The sum total of all the flexible masses times the corresponding acceleration increments may impose non-negligible additional loads on the overall structure, in the two horizontal directions and in the vertical direction. Therefore, Westinghouse is requested to (1) describe in greater detail the implementation of this methodology, including a numerical example; and (2) provide a quantitative technical basis for the conclusion that the effects of increased accelerations on locally flexible structures can be ignored in areas of the structure away from the locally flexible structures.
- c. The top paragraph of Page 93 of 154 states "The vertical equivalent static seismic accelerations at (Shield Bldg) elevations 294.93 ft and 333.13 ft are obtained directly from the maximum time history results by taking the average of locations at opposite ends of a diameter. The vertical accelerations from the 3D finite element model at the shield building edges at these elevations are significantly influenced by the horizontal loading. If they are used for the vertical equivalent accelerations, the horizontal response would be double counted in the vertical direction." It is not obvious to the staff how this methodology has been implemented, and whether it is even appropriate. Therefore, Westinghouse is requested to submit a numerical example, based on elevation 333.13 ft of the Shield Building, to demonstrate the implementation of this methodology. In this example, please also include the vertical acceleration value that would be obtained if this methodology was NOT implemented.

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

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- d. Confirm that in Table 6.2-7, the referenced table numbers should be 6.2-3, 6.2-4, 6.2-5, and 6.2-6.
- e. In Page 99, under the heading "Seismic Accelerations for Evaluation of Building Overturning," states "The dynamic response of the structure affecting overturning and basemat lift off is primarily the first mode response at about 3 hertz on hard rock. This reduces to about 2.4 hertz on soil sites as shown in the 2D ANSYS and SASSI analyses. The higher auxiliary building accelerations of Table 6.2-2 are not considered in overturning since they are from higher frequency modes greater than 2.4 hertz. Amplified response of individual walls in the Auxiliary Building and the IRWST need not be considered since they are local responses that do not effect overturning." For the overturning analysis, the staff is concerned that the methodology employed may not predict an overall moment on the basemat that envelops the maximum overturning moment for all site conditions. Westinghouse is requested to provide its technical basis for the conservatism of the methodology employed.

### Westinghouse Response:

- a. It is confirmed that the reference should be Section 6.4 and not Section 6.3.
- b. Equivalent static analyses are no longer being used for the design of the auxiliary building, shield building, and containment internal structure. Seismic response spectrum analysis is being performed to develop the seismic design loads for these buildings (see RAI-TR03-036). Therefore, the loads generated include the amplified load due to flexibility and the distribution of this load to the surrounding structures.
- c. Since seismic response spectrum analysis is being used (see RAI-TR03-036), this part of the question is no longer applicable.
- d. It is confirmed that in Table 6.2-7, the referenced table numbers should be 6.2-3, 6.2-4, 6.2-5, and 6.2-6. However, it is noted that Section 6.2 will be revised to remove the auxiliary building, shield building, and containment internal structure since equivalent static analysis is no longer used for the design of these buildings.
- e. The conservatism of the overall moment on the basemat is addressed in Section 2.6.1.2 of the Nuclear Island Basemat and Foundation report (Reference 1). This part of the RAI should be considered during the review of this report.

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

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Reference:

1. APP-GW-GLR-044, Rev 0, "Nuclear Island Basemat and Foundation", October, 2006

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

None

**PRA Revision:**

None

**Technical Report (TR) Revision:**

Section 6.2 will be revised to remove the auxiliary building, shield building, and containment internal structure since equivalent static analysis is no longer used for the design of these buildings. The comparison of equivalent static results to time history results will be removed from Section 6.4 since seismic response spectrum analysis is being used. The fourth paragraph of page 91 of 154 that states "In Section 6.3 a comparison of member forces obtained from seismic static and time history analyses is given" has been removed. Therefore, there is no need to change the reference to be Section 6.4. Section 6.4 will be revised to add a description of the response spectrum analyses.

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

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RAI Response Number: RAI-TR03-023

Revision: 1

### **Question:**

The staff review of Section 6.4 identified a number of items in need of clarification or explanation. The staff requests Westinghouse to address the following:

- a. A comparison of equivalent static acceleration results to the worst-case time history results is presented for a small number of selected locations. It is not clear to the staff why these specific locations were selected for comparison, and whether they are representative of all other locations in the structural model. Therefore, Westinghouse is requested to (1) explain the basis for selecting these specific locations for presentation in the report, and (2) confirm that a comprehensive comparison was conducted in order to validate that the equivalent static acceleration results generally envelop the worst-case time history results, and that any under predictions are minor.
- b. The staff noted that the only significant under-prediction documented in Section 6.4 is for TY at ASB south elevation 107 ft. The equivalent static result is 76.7 ksf; the worst time history result is 89.5 ksf. This represents a 15% under-prediction. Please discuss whether this is the maximum under-prediction identified. If not, please explain the criteria applied to justify the acceptability of under-predictions, in reaching the conclusion that the equivalent static acceleration method of analysis provides an acceptable basis for structural design.

### **Westinghouse Response:**

The seismic loads for the design of the auxiliary building, shield building, and containment internal structure are now based on loads from seismic response spectrum analyses following Regulatory Guide 1.92, Rev 2. See RAI-TR03-036 for more discussion of the response spectrum analysis methodology used.

Since seismic response spectrum analyses are being used it is no longer necessary to address this question.

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

None

### **PRA Revision:**

None

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

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### Technical Report (TR) Revision:

Section 6.2 will be revised to remove the auxiliary building, shield building, and containment internal structure since equivalent static analysis is no longer used for the design of these buildings. The comparison of equivalent static results to time history results will be removed from Section 6.4 since seismic response spectrum analysis is being used. In this section (6.4) will be added a description of the response spectrum analyses.