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DCP/NRC1310
NSD-NRC-98-5631
Docket No.: 52-003

March 23, 1998

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: T. R. QUAY

SUBJECT: RESPONSES TO STAFF REQUESTS REGARDING THE AP600 INSPECTIONS,
TESTS, ANALYSES, AND ACCEPTANCE CRITERIA (ITAAC) - NUCLEAR
ISLAND STRUCTURES

Dear Mr. Quay:

Enclosed are three copies of Westinghouse's revised responses to RAIs 640.10, 640.12, and 640.140 related to comments from the Civil Engineering and Geosciences Branch (CEGB) on Revision 3 of the AP600 Certified Design Material. Revised responses to RAIs 640.10 and 640.12 were requested by the staff in the ITAAC Task Group Meeting held on December 5, 1997, and in further discussions held with the staff on December 12, 1997. A revised response to RAI 640.140 has been prepared to address open item 6629, which relates to item d) of this RAI.

This submittal closes, from Westinghouse's perspective, open items 5068, 5070, and 6629. As a result, the Westinghouse status column will be changed to "Confirm W" in the Open Item Tracking System (OITS). The NRC should review these responses and inform Westinghouse of the status of each open item to be designated in the "NRC Status" column of the OITS.

Please contact Mr. Eugene J. Piplica at (412) 374-5310 if you have any questions concerning this transmittal.

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

jml

Enclosure

cc: J. M. Sebrosky, NRC (w/Enclosure)
J. N. Wilson, NRC (w/Enclosure)
N. J. Liparulo, Westinghouse (w/o Enclosure)

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Question 640.10

Re: Section 3.3 - Nuclear Island Buildings

Figures should be provided to show the configuration of the fire water tank. In addition, the ITAAC should commit to perform tests to ensure that no leakage of water from either the PCS tank or the fire waste tank, and to identify any deflection of roof structures during and after the first fill of the tank water.

Response:

- | ~~A fire water tank has been designed to fit within the concrete bounds of the passive containment cooling system (PCS) water tank and to be physically separated from it. A fire water tank overflow connection is provided to the PCS tank, which allows a flow circulation path and limits the amount of fire water in the tank. The location of the tank has been included in Figures 3.3-1, 3.3-2, and 3.3-10. The fire water storage tank was deleted from the PCS tank and Figures 3.3-1 and 3.3-2 revised by the response to RA1 640.139, revision 1. An ITAAC commitment has been included as defined below to address the leakage from the fire water or PCS tanks.~~
- | ~~The deflection of the roof structures during and after the first fill of the tank water has not been included in the ITAAC because a practical means of measuring the roof deflection is not available.~~
- | *SSAR subsection 3.8.4.7 and 3.8.6 have been revised to require the COL applicant to measure the change in relative elevation of the roof structures during and after the first fill of the tank water.*
- | *An ITAAC is not required to measure the deflection of the roof structures during and after the first fill of the the tank water. The purpose of ITAAC is to verify the important input assumptions of the safety analysis. The important assumptions to the structural analysis for the roof structures is verified as item 1.a) of Table 3.3-6 (Table 3.3-5 in Revision 3 of the AP600 CDM) which references the critical sections of the roof structure in Table 3.3-1. Measurement of the roof deflection, a calculated parameter, is validation of the structural analysis and therefore, is not appropriate as an ITAAC.*





ITAAC Revision:

<p>Table 3.3-6 Inspections, Tests, Analyses, and Acceptance Criteria</p>		
Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
9. The shield building roof <i>and</i> PCS storage tank, and the fire water storage tank support and retain the PCS and fire water sources.	Visual inspection of the PCS storage tank exterior tank boundary and shield building tension ring will be performed before and after filling of the PCS storage tank and fire water storage tank for significant water leakage (>100 gal/hr as measured by water level change).	The as-built inspection report exists and concludes that the water leakage does not exceed 100 gal/hr.

SSAR Revision: None.

RESPONSES TO NRC REQUEST FOR ADDITIONAL INFORMATION

REVISION 1



Question 640.12

Re: Section 3.3 - Nuclear Island Buildings

ITAAC should also be provided for the construction sequence of the seismic Category I structures including the nuclear island foundation mat, embedded exterior walls, shield building roof structures, etc.

Response:

Design and construction of the safety related structures follow the requirements of ACI 349 as stated in SSAR subsection 3.8.4. The construction sequence is evaluated in accordance with paragraph 6.2 of ACI 349 which requires sufficient strength be demonstrated at all stages of construction. Requirements for the construction sequence are defined in the Construction Specifications. An ITAAC is not required for the normal construction procedures.

The construction sequence or construction approach becomes relevant *to the nuclear island basemat* only for soft soil sites having unconsolidated deposits with shear wave velocities in the range from 1,000 to 2,000 feet per second. Existing analysis shows that for any other site exceeding these limits, the construction sequence is independent of the soil conditions and will have no adverse impact on the seismic Category I structures. An ITAAC has been included to address only soft soil sites per the following:

Table 3.3-6 Inspections, Tests, Analyses, and Acceptance Criteria		
Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
10. The construction approach for soft soil sites includes two limits: i.) Shield building construction ahead of auxiliary building or	A visual inspection of the as-built auxiliary building, shield building, and containment structures will be performed during construction to confirm that one of the two limits were met: i.) The north walls of the auxiliary building are completed to elevation level 2 prior to placement of concrete in the shield building above elevation level 2 or in-containment structures above elevation level 2.	The as-built inspection concludes that the construction limits have not been exceeded.



REVISION 1

<p>Table 3.3-6 (cont.) Inspections, Tests, Analyses, and Acceptance Criteria</p>		
Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>ii.) Auxiliary building construction ahead of shield building.</p> <p>This commitment applies for only soft solid sites having unconsolidated deposits with shear wave velocities in the range from 1,000 to 2,000 feet per second.</p>	<p>ii.) The concrete was not placed in the auxiliary building above elevation level 4 before the shield building was completed to elevation level 2.</p>	

SSAR Revision:

None.

RESPONSES TO NRC REQUEST FOR ADDITIONAL INFORMATION

REVISION 2



Question 640.140

- a. AP600 ITAAC should commit to the basic configuration of the nuclear island structures as shown in Figure 3.3-1 and to inspect the as-built structures against this basic configuration.
- b. Westinghouse should provide key dimensions (such as overall dimensions, the distance between column lines, the distance between the center of the reactor vessel and column lines, elevations, total embedment depth, etc.) as the acceptance criteria for verifying the as-built conditions.
- c. What is the basis for acceptance criteria #9 (leak rate of 100 gal/hr or smaller for the PCCWS tank).
- d. For verifying that the NI structures will withstand the structural design basis loads, Westinghouse should require the existence of a structural analysis report in the ITAAC, which concludes that the as-built NI structures will withstand the structural design basis loads. Also, a description of the contents of a structural analysis report must be provided in the SSAR (Tier 2). *Based on further discussions with NRC at the ITAAC Task Group Meeting during week of 12/11/97, the NRC requested an ITAAC that verifies that a seismic analysis exists for the site conditions that exist for the as-built plant.*

Response:

Text shown in italics was added in Revision 1 of the response. Text shown in bold, italics and redline was added in revision 2 of the response.

- a. A new ITAAC item 1.f) will be added to define the configuration of the nuclear island structure based on key structural dimensions included in a new ITAAC table. This table will include dimensions between selected key column lines and distances between column lines and inside wall surfaces at the 66'-6" level. Dimensions are based on SSAR Figures 3.7.2-12 (Sheet 1 of 12).
- b. The embedment depth has already been included in Table 3.3-1. Key dimensions that define the overall NI building are defined in new ITAAC commitment 1.f) defined in response to item a) above. *A new entry will be added to Table 3.3-1 to include the dimension to the highest point on the shield building roof that covers the PCS tank.*
- c. The 100 gal/hr leak rate is based on the two following criteria:
 - 1) A tolerable leak rate *for which tank inventory could be easily maintained* under normal operating modes.
 - 2) This value *is a measurable leak rate that could be detected using the narrow range level transmitter over a 12 to 24 hour period.* This same narrow range transmitter is used to determine the tank water level.
- d. Westinghouse has already generated design summary reports that conclude that the NI structures will withstand the structural design basis loads. *These reports have been audited by the NRC on various occasions and will be summarized in the SSAR (subsections 3.8.3.5.7 and 3.8.3.5.8 for the containment internal structures, 3.8.4.5.3, 3.8.4.5.4 and Appendix 3H for the auxiliary and shield buildings, and 3.8.5.4.4 and 3.8.5.4.5 for the basemat.* The concrete thicknesses and reinforcement quantities as defined on Table 3.3-1 when included in the as-built structure confirm the as-built structure will



withstand the design basis loads. The COL applicant will be responsible to *reconcile applicable deviations from the structural design summary report as stated in SSAR subsection 3.8.6.3.*

The seismic analyses summarized in the SSAR are based on the range of ground acceleration and soil conditions defined in the site parameters list. Siting of the AP600 will be consistent with the above listed site parameters. Siting at a location that exceeds the range of the site parameters would require a new seismic analysis. In either case a seismic analysis must exist prior to construction and therefore is not necessary to be an ITAAC item. The COL applicant will be responsible to reconcile any deviations as stated in SSAR subsection 3.7.5.4.

SSAR Revision:

- a) None
- b) None
- c) None
- d) None

ITAAC Revision:

- a) 1.f) The key features of the nuclear island structures is as defined on Table 3.3-5.

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1.f) The key features of Nuclear Island Structures <i>are</i> defined on Table 3.3-5.	An inspection will be performed of the as-built configuration of the Nuclear Island Structures for key features defined on Table 3.3-5 .	The as-built inspection report exists and concludes that the key features of the Nuclear Island Structures are consistent with the dimensions defined on Table 3.3-5.

(Note: References to the existing Table 3.3-5 must be updated to reflect the insertion of this new table.)

- b) See the revision on Table 3.3-1 in response to RAI 640.139 (R1)-5 to reflect addition of a new element.
- c) None
- d) None

RESPONSES TO NRC REQUEST FOR ADDITIONAL INFORMATION

REVISION 2



Table 3.3-5 Key Dimensions of NI Building Features Reference Column Lines are Defined Relative to Containment Centerline			
Reference Column Line	Reference Distance From Containment Centerline (ft-in North/South/East/West)	Nominal Wall Inside Surface Distances and Relationship to Reference Column Lines at Elevation Level 1 (ft-in)	Tolerance on Measured Distance (\pm in)
I	87 ft-6 in /East of Cont. CL.	X1 (Distance between Inside Surface <i>of walls</i> at Col Ln. I & N when Measured between Col 1 and 2) = 85 ft-0 in.	\pm 12 in
N	On <i>Containment</i> Centerline Along N-S direction		
J	69 ft-6 in /East of Cont. CL.	X2 (Distance between Inside Surface <i>of walls</i> at Col Ln. I & J when Measured between Col 7.3 and 11)=15 ft-0 in	\pm 12in
K	51 ft-6 in /East of Cont. CL.	X3 (Distance between Inside Surface <i>of walls</i> at Col Ln. J & K when Measured between Col 7.3 and 11)=16 ft-0 in	\pm 12in
L	26 ft-0 in /East of Cont. CL.	X4 (Distance between Inside Surface <i>of walls</i> at Col Ln. K & L when Measured between Col 7.3 and 11)=23 ft-6 in	\pm 12in
M	8 ft-0 in /East of Cont. CL.	X5 (Distance between Inside Surface <i>of walls</i> at Col Ln. L & M when Measured between Col 7.3 and 11)=16 ft-0 in	\pm 12in
P	10 ft-0in /West of Cont. CL.	X6 (Distance between Inside Surface <i>of walls</i> at Col Ln. M & P when Measured between Col 7.3 and 11)=16 ft-0 in	\pm 12in
Q	28 ft-0 in /West of Cont.CL.	X7 (Distance between Inside Surface <i>of walls</i> at Col Ln. P & Q when Measured between Col 7.3 and 11)=15 ft-0 in	\pm 12in
1	137 ft-0 in /South of Cont. CL	X8 (Distance between Inside Surface <i>of walls</i> at Col Ln. 1 & 2 when Measured at interface with Col. I)= 19 ft-0 in	\pm 12in
2	115 ft-0 in /South of Cont. CL		



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640.140(R2)-3



Table 3.3-5 Key Dimensions of NI Building Features Reference Column Lines are Defined Relative to Containment Centerline			
Reference Column Line	Reference Distance From Containment Centerline (ft-in North/South/East/West)	Nominal Wall Inside Surface Distances and Relationship to Reference Column Lines at Elevation Level 1 (ft-in)	Tolerance on Measured Distance (\pm in)
4	71 ft-0 in /South of Cont. CL	X9 (Distance between Inside Surface <i>of walls</i> at Col Ln. 1 & 4 when Measured at interface with Col. 1)=63 ft-0 in	\pm 12in
7.3	45 ft-9 in /North of Cont. CL	X10 (Distance between Inside Surface <i>of walls</i> at Col Ln. 7.3 & 11 when Measured at interface with Col. 1)= 67 ft-9 in	\pm 12in
11	117 ft-0 in /North of Cont. CL		
7	On <i>Containment</i> Centerline Along East-West Direction	X11 [Radial Distance from Center of Containment (Intersection of Col. Lines N and 7) to Outside Surface of Shield Building when Measured along Col. Lines 7 and N]= 72 ft-6 in	+ 15 in - 3 in
--	--	X12 (Distance between Outside Surface of walls at Col Ln. 1 & N when Measured at Col. Line 1) = 91 ft-0in.	+3 ft -1 ft
--	--	X13 (Distance From Outside Surface of wall at Col Ln. 1 to Col. Line 7 when Measured at Col. Line 1) = 138 ft-0in.	+3 ft -1 ft
--	--	X14 (Distance From Outside Surface of wall at Col Ln. 11 to Col. Line 7 when Measured at Col. Line 1) = 118 ft-0in.	+3 ft -1 ft
--	--	X15 (Distance between Outside Surface of walls at Col Ln. 1 & Q when Measured at Col. Line 11) = 117 ft-6in.	+3 ft -1 ft
--	--	X16 (Distance From Outside Surface of wall at Col Ln. Q to Col. Line N when Measured at Col. Line 11) = 29 ft-0in.	+3 ft -1 ft



RESPONSES TO NRC REQUEST FOR ADDITIONAL INFORMATION

REVISION 2



Table 3.3-5 Key Dimensions of NI Building Features Reference Column Lines are Defined Relative to Containment Centerline			
Reference Column Line	Reference Distance From Containment Centerline (ft-in North/South/East/West)	Nominal Wall Inside Surface Distances and Relationship to Reference Column Lines at Elevation Level 1 (ft-in)	Tolerance on Measured Distance (\pm in)
--	--	<i>X17 (Distance between Outside Surface of shield building wall to shield building centerline when Measured between Col. Lines N to Q) = 72 ft-6 in.</i>	+3 ft -1 ft
--	--	<i>X18 (Distance between shield building centerline to Reactor Vessel center line when Measured along Col. Line N in North-South Direction) = 7 ft-6 in.</i>	\pm 3 in



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640.140(R2)-5