

Status of RAI Responses

Based on the review of the latest responses submitted by Westinghouse, the table below summarizes RAI issues that need additional information and/or further review and discussion:

220.001, Part B

Information provided in Revision 1 of RAI responses dated 03/13/03 is acceptable, pending review of design calculations at the next week audit.

220.003

Revision 1 of the initial response to RAI 220.003 was submitted by Westinghouse on 01/21/03. The revision addresses the technical bases for the increased allowable stresses permitted in the 2001 (plus 2002 addenda) Code, compared to earlier code editions. This is acceptable.

The revision also discusses the material issue: SA537, Class 2 vs. SA738, Grade B. The information provided raises more questions than it answers about the suitability of SA738, Grade B as the AP1000 Containment shell material. In the discussion of SA537 Class 2, Westinghouse notes the excellent fracture toughness at low temperature in both the base metal and heat affected zone (HAZ). However, data in the as-welded condition (i.e., no post weld heat treatment [PWHT]) only covers thicknesses below 1.5". For thicker sections, most of the data is for the PWHT condition. This would seem to imply that for thicknesses of 1.5" and greater, PWHT is the common practice. The parenthetical statement "(Note that for these materials, PWHT generally deteriorates properties if it has any effect on properties, so that data for the PWHT condition should be conservative)" is counter to my engineering experience. PWHT is typically used to restore fracture toughness in the HAZ of thick-section welds. Yield and Ultimate Strength is typically higher in the as-welded HAZ when compared to base metal properties, but ductility and fracture toughness is typically lower in the as-welded HAZ when compared to base metal properties. If Westinghouse has the technical basis for the parenthetical statement, it needs to submit this. If not, then the response needs to be corrected to be technically accurate.

Since SA537 Class 2 is the AP600 containment shell material, which has been previously accepted, there is no need for Westinghouse to submit a technical basis for the adequacy of the fracture toughness of as-welded sections with thickness of 1.5" and greater, at the minimum temperature required by NE-2000 for AP600.

In the discussion of SA738 Grade B, Westinghouse presents a very weak, qualitative argument for the adequacy of the fracture toughness of as-welded sections with thickness of 1.15" and greater, at the minimum temperature required by NE-2000 for AP1000. Westinghouse needs to provide quantitative evidence that supports its position that adequate fracture toughness, as defined by NE-2000, is achievable for a thickness of 1.75" without PWHT.

This topic will be discussed and resolved at the upcoming staff audit.

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220.005

In Revision 1 of its response dated 03/13/03, Westinghouse discusses the results of the two (2) heat transfer analyses conducted to verify that -15°F is a conservative lower-bound design temperature for the containment shell. This is acceptable, pending review of heat transfer calculations the next week audit.

220.007

Revision 0 of the response was submitted by Westinghouse on 11/26/02. A advanced draft of the response was provided at the 11/12-15/02 meeting at Westinghouse. Revision 0 is identical to the draft provided at the meeting. At the meeting, the staff requested that the response be expanded to include additional technical information (see NRC Summary of 11/12-11/13 Meeting Discussion). However, the requested technical information has never been submitted. This topic will be discussed and resolved at the upcoming staff audit.

220.008

Information provided in Revision 1 of RAI responses dated 01/21/03 is acceptable, pending review of design calculations at the next week audit.

220.009

Information provided in Revision 1 of RAI responses dated 01/21/03 is acceptable, pending review of design calculations at the next week audit.

220.010

Information provided in Revision 1 of RAI responses dated 03/03/03 is acceptable, pending review of design calculations at the next week audit.

220.013

Revision 1 of the response submitted on 03/03/03 is acceptable. However, in this RAI response revision, Westinghouse introduces a new exception to ACI-349 that are not previously reviewed by the staff. Westinghouse's justification is to be discussed at the next week audit.

220.015

Revision 0 of the response was submitted by Westinghouse on 12/02/02. The response is acceptable concerning the determination of maximum compartment pressures; however, compartment temperatures have not been adequately addressed. This topic will be discussed at the upcoming staff audit. **(Note to Project: Does this issue need to be reviewed by the Plant System Branch people?)**

220.017

In AP600 DCD, Figure 3.8.5.3 (Sheet 1 through 5) was designated as Tier 2* for which any proposed change to these figures will require NRC approval prior to implementation of the change. In AP1000 DCD, Westinghouse changed the designation of these figures as Tier 2. It is the staff's position that all the design information related to the critical sections should be designated as Tier 2*. More discussion is needed during the upcoming meeting.

The status of RAls 220.016, 220.018, 230 series, 240 series and 241 series has been provided to the Project Branch.

The following issues that are to be discussed at the upcoming meeting are resulted from the review of the DCD, Revision 3 and from the 11/12-15/02 meeting:

1. Connection between the stick model of the containment internal structure (CIS) and 3-D finite element model of auxiliary/shield building in Calculation No. APP-1200-S2C-001.
2. Excessive reduction of vertical response at top of SCV acceleration per Calculation No. APP-1000-S2C-037 when polar crane is modeled by 5-masses.
3. Consideration of missing mass effect in the modal time history analysis of the NI stick model.
4. Why finite element mode (FEM) of coupled auxiliary/shield building is fixed at mid height of basemat (Elev. 63'-6") while FEM of CIS is fixed at bottom of basemat (Elev. 60'-6").
5. Peer review of seismic model development.
6. Consideration of shear wall stiffness reduction due to concrete cracking.
7. Soil nailed wall construction sequence leads to use of in-situ side soils acting on exterior NI walls. The details are a COL item. If soil nailing cannot be used at a particular site, what are minimum conditions required for specification of backfill soils?
8. Criteria for definition of acceptable rock bearing capacity is unclear and is stated differently in different reviewed documents. Minimum criteria needs to be defined which corresponds to "8,000 fps" bedrock.
9. Criteria on definition of acceptable definition of variability of bedrock across the site needs to be presented.
10. No calculation package has been made available for review for design of the basemat. This includes the definition of loads used for basemat design as well as coefficients of subgrade reaction used to represent the bedrock.
11. The effect of potential liftoff of the foundation mat on the seismic responses such as (a) in-structure response spectra, (b) peak contact pressures associated with seismic overturning and (c) bending developed in the basemat has not as yet been addressed and (d) tension in the shield building wall.

12. Static and dynamic bearing pressure at the toe and average across the foot-print of the NI structures.
13. Geological site conditions as they relate to the foundation mat design.

**AP1000 Design Control Document
Tier 2 Material, Sections 3.8.2 thru 3.8.5**

**Follow-up Items Needing Clarification
(Revision 2, prepared by R. Morante, BNL, 03/24/03)**

FOLLOW-UP ITEMS NEEDING CLARIFICATION

This original BNL RAI#1, submitted on 08/02/02, was not forwarded to Westinghouse. My recollection is that it was going to be treated as a "follow-up item needing clarification". However, it did not get transferred to the list of follow-up items. Consequently, Westinghouse has never been asked about this omission.

RAI#1) In Table 1-1, pages Intro-7 thru Intro-9, of the AP1000 DCD Introduction, Westinghouse identifies the AP1000 Tier 2 information requiring NRC approval for change. The deletion of 3 items in the AP1000 table from the comparable table in the AP600 DCD (CD version) appears to be an error. The items are "Design Summary of Critical Sections," "Definition of critical locations and thicknesses for shield and auxiliary buildings," and "Definition of critical locations and thicknesses for nuclear island basemat." In the AP1000 DCD Tier 2 Material, Section 3.8, this information is bracketed and asterisked, indicating it cannot be revised without NRC approval. Westinghouse is requested to revise the subject Table 1-1, to include all applicable items. If Westinghouse disagrees with the staff's assessment that the subject items belong in the table, then Westinghouse is requested to provide a detailed technical explanation for their exclusion.

BNL's last previous submittal of follow-up items was Rev. 1, dated 09/25/02. Of the 15 items on that list, #s 1 thru 6 were general; #s 7 and 15 have been addressed by Westinghouse; and #s 8 thru 14 have NOT been addressed by Westinghouse.

8) In AP1000 DCD Tier 2 Material, subsection 3.8.2.4.2.6, 2nd paragraph, it appears that "SA537, Class 2" should be "SA738, Grade B". Otherwise, the information is irrelevant. Westinghouse needs to correct the text.

9) In the AP1000 DCD, Tier 2 Material, Section 3.8.2 "Steel Containment", subsection 3.8.2.4.2.3 "Equipment Hatches" (Page 3.8-12) and subsection 3.8.2.4.2.8 "Summary of Containment Pressure Capacity" (Page 3.8-14), Westinghouse reports conflicting pressure capacities for the 16' diameter equipment hatches at 100°F (74 vs. 84, using NE 3222 Service Level C limits; 111 vs. 126, using Code Case N-284). Westinghouse needs to correct the discrepancies in the reported pressure capacity for the 16' diameter equipment hatch.

10) AP1000 DCD, Tier 2 Material, Section 3.8.3.2, "Applicable Codes, Standards, and Specifications," references ACI 349-01 (and supplemental requirements in Section 3.8.4.5), but does NOT identify ACI 349-01 as Tier 2* information. This reference to ACI 349-01 (and supplemental requirements in Section 3.8.4.5) needs to be identified as Tier 2* information.

11) AP1000 DCD, Tier 2 Material, Section 3.8.3.2, "Applicable Codes, Standards, and Specifications," also references AISC N690-84 (and supplemental requirements in Section 3.8.4.5), but does NOT identify AISC N690-84 as Tier 2* information. This reference to AISC N690-84 (and supplemental requirements in Section 3.8.4.5) needs be identified as Tier 2* information.

12) In AP1000 DCD, Tier 2 Material, Figure 3.8.3-8 (sheet 1 of 3) and Figure 3.8.3-15 (sheets 1 and 2), some of the information in both the hard-copy printed version and the CD version are illegible. Figure 3.8.3-8 also has unrecognizable symbols for the weld information. Legible copies of these figures need to be submitted to permit review of the technical information contained on these figures.

13) AP1000 DCD, Tier 2 Material, subsection 3.8.4.1.1 "Shield Building" indicates that "The conical roof supports the passive containment cooling system tank as shown in Figure 3.8.4-2." This figure apparently replaces AP600 Figure 3.8.4-7, and has been revised to show the AP1000 roof and tank dimensions and elevations. However, AP600 Figure 3.8.4-7 was designated as Tier 2*, while there is no such designation for AP1000 Figure 3.8.4-2. Westinghouse needs to identify this figure as Tier 2*, or provide the justification for reclassifying this information.

14) AP1000 DCD, Tier 2 Material, subsection 3.8.4.4.1 "Seismic Category I Structures" discusses seismic design and analysis procedures. Figure 3.8.4-3 shows the GTSTRUDL model of the AP1000 shield building, with a refined discretization of the roof and the passive containment cooling water storage tank. This model appears to be a revision of the AP600 model shown in Figure 3.8.4-9 of the AP600 DCD. The staff notes that the AP1000 model appears to contain geometry errors in the vicinity of the openings, as evidenced by the irregularities in the mesh. Westinghouse needs to (1) provide a revised Figure 3.8.4-3, with the apparent errors corrected, or (2) explain why the model is correct as shown.

These follow-up items are all considered important enough to forward to Westinghouse prior to the audit and, if possible, to get at least a preliminary response from Westinghouse. The Tier 2* issue needs to be resolved very soon; staff input is also important here.