AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 3.7.2.3-2 (Revision 1)

Original RAI Number(s): 230.018

Summary of Issue:

In its response to RAI 230.18 Response Revision 3 transmitted by Westinghouse letter DCP/NRC1588, dated May 13, 2003, the studied the studied the effect of the steel containment vessel vertical response by the use of a multi-mass model of the polar crane instead of the single mass model used in the AP600 analyses and the initial AP1000 analyses. The staff would like Westinghouse to cite any other reasons that can explain the change in the steel containment vessel vertical response.

Westinghouse Response (Revision 1):

The maximum vertical absolute acceleration of the steel containment vessel is 1.49g for the AP600. In the original DCD the AP600 stick model was "stretched" to match the AP1000 height dimensions, and maximum vertical absolute acceleration of the steel containment vessel became 1.40g for the AP1000. In the most recent AP1000 analyses shown in DCD Revision 7, the maximum acceleration is 1.25g.

The reduction in vertical response is associated with two types of changes that were done to the stick model. The first type of changes applies to the Auxiliary/Shield Building (ASB). The ASB stick model properties are no longer based on "stretched" AP600 dimensions, but are now based finite element analyses which used the actual AP1000 dimensions to calculate stiffness and the develop more realistic AP1000 ASB stick model dimensions. The second type of change is that the model now includes better definition of the AP1000 polar crane and the use of a multi-mass model of the polar crane instead of the single mass used in the AP600 analyses and the initial AP1000 analyses. The maximum vertical absolute acceleration of the steel containment vessel after the two changes described above were implemented became 1.13g for the AP1000.

Based on a number of studies performed and submitted earlier, it is evident that the changes to the Auxiliary Building stick model properties is the major reason why the spectra values are reduced. Changing the polar crane to a multi-mass model also is a lesser effect that contributes to the reduction in maximum vertical absolute acceleration of the steel containment vessel.

In the spectra presented in DCD Rev. 7, two additional changes were applied to the model. First was the concrete stiffness was reduced by applying a 80%E factor to all the concrete elements. Second, the steel containment vessel (SCV) was directly connected to the CIS stick rather than to ASB stick. These effects increased the maximum acceleration 1.25g for the AP1000.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 3.7.2.9-1 (Revision 1)

Original RAI Number(s): 230.020

Summary of Issue:

As described in DCD Tier 2 Section 3.7.2.9, as part of accounting for parameter uncertainty, Westinghouse in its response to DSER Open Item 3.7.2.3-1 shows floor response spectra which include the effects of stiffness reduction due to shear wall concrete cracking. In comparing the floor response spectra published in DCD Revision 3 which was based on uncracked concrete properties (100% E), and DCD Revision 6 which is based on partially cracked concrete properties (80% E), it is found that in most instances the 80% E analysis, shows increases in floor response spectra peaks. There are a few instances however where the floor spectra peaks have been reduced. Examples of this are the floor response spectra in the EW (Y) direction of the containment internal structures nodes 532 and 535. The staff would like Westinghouse to cite the reasons that can explain the change in the reduction at these two locations.

Westinghouse Response (Revision 1):

Figures 3.7.2.9-1-1 and 3.7.2.9-1-2 show the floor response spectra in the EW (Y) direction of the containment internal structures nodes 532 and 535. The differences between the Rev 2 100% E spectra and the Rev 3 100 %E spectra are due to a more accurate representation of the nuclear island model (including the SCV being attached to the CIS). This more accurate representation included smaller masses at these locations as well as new beam properties based on the CIS finite element model stiffness analyses. The differences between the Rev 3 100% E spectra and the Rev 3 80 %E spectra are due to change from uncracked to partially cracked concrete properties. The reduced stiffness changes cause slight changes in the nuclear island mode shapes that reduce the response in this location.

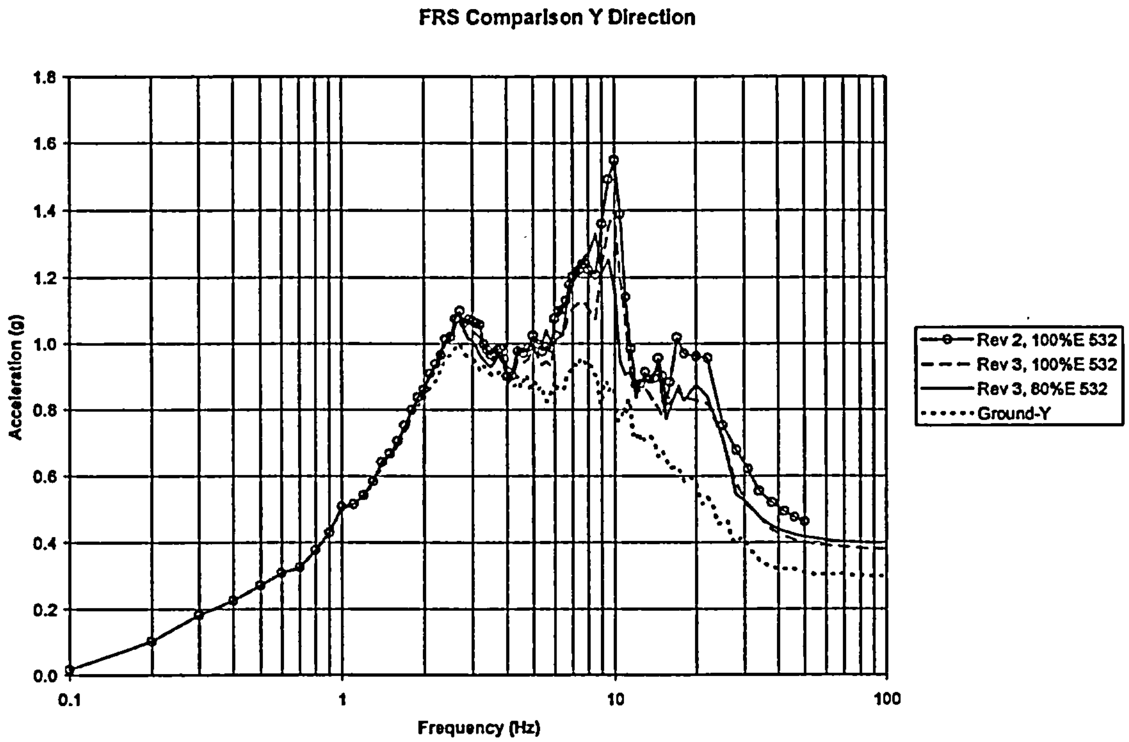

Figure 3.7.2.9-1-1: Node 532 – FRS comparison - Y Direction

Note: Rev. 2 was included as part of DCD Rev 3
Rev. 3 was included as part of DCD Rev 6

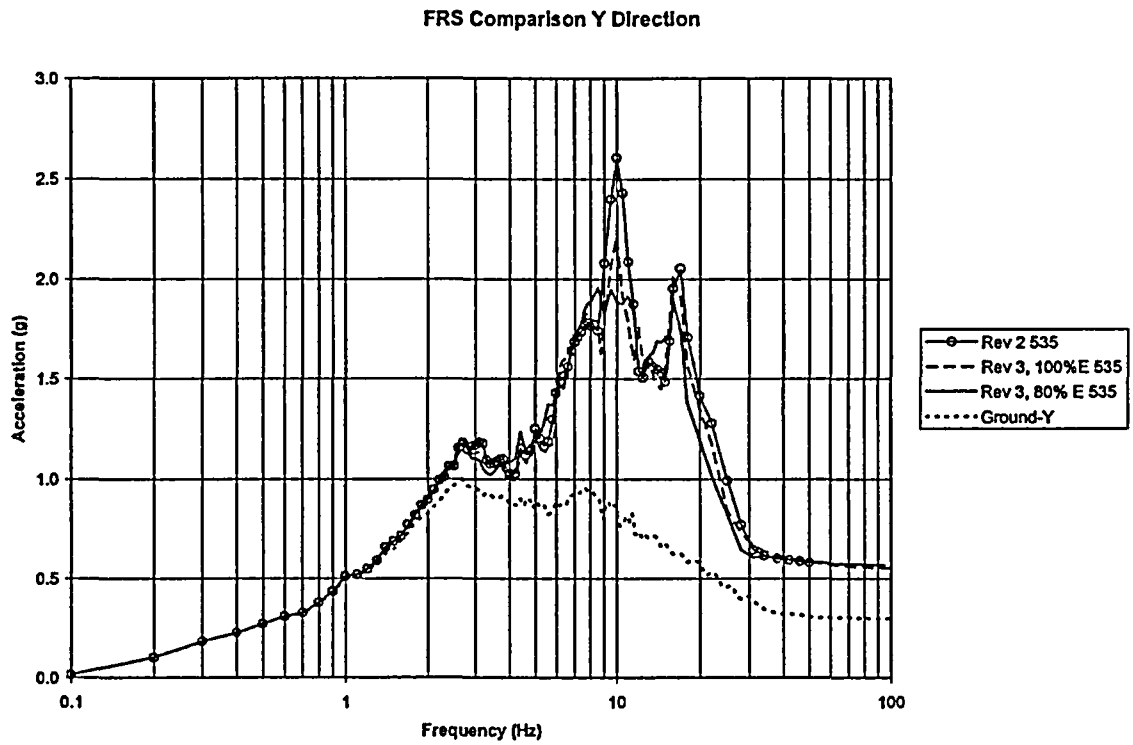

Figure 3.7.2.9-1-2: Node 532 – FRS comparison - Y Direction

Note: Rev. 2 was included as part of DCD Rev 3
Rev. 3 was included as part of DCD Rev 6

Design Control Document (DCD) Revision:

None

PRA Revision:

None