
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/31/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 776-5851 REVISION 3
SRP SECTION: 03.07.02 – Seismic Systems Analysis
APPLICATION SECTION: 3.7.2
DATE OF RAI ISSUE: 06/15/11

QUESTION NO. RAI 03.07.02-78:

In Subsection 5.1.5 of MUAP-11001 (R0), "SSE Loads (Ess)," the third paragraph (page 59) states, "Therefore, in addition to the earthquake forces derived from RSA analyses, the effects of accidental torsion is also considered. A torsion moment equal to the larger of the torsions resulting from the product of the base shears times 5% of the building dimension that is perpendicular to the direction of the base shear force is applied to the analytical model."

The Applicant is requested to confirm that the effect of accidental torsion is included in the calculation of the displacement relative to the free-field ground motion. If this torsional effect was not included, the Applicant is requested to provide the technical basis and justification for its exclusion in determining the maximum relative displacements.

ANSWER:

This answer revises and replaces the previous MHI answer that was transmitted by letter UAP-HF-11281 (ML11243A163).

Technical Report MUAP-11001 has been superseded and the relevant information incorporated into Technical Report MUAP-10006, Rev. 3. The reactor building (R/B), prestressed concrete containment vessel (PCCV), containment internal structure, east and west power source buildings (PS/Bs), auxiliary building (A/B), and essential service water pipe chase (ESWPC) are now structurally integrated and supported on a common basemat to form the R/B complex. Technical Report MUAP-10006, Rev. 3 presents the information relevant to the added A/B and PS/Bs as well as the other buildings that make up the R/B complex.

DCD Tier 2 Subsection 3.7.2.11 describes the methodology used to account for torsional effects in the US-APWR standard plant design and analysis, which is in accordance with the recommendations outlined in Acceptance Criterion II.11 of SRP 3.7.2.

The torsional effects in a building structure can come from two parts. First, torsional effects are due to the general layout of the building, which cause eccentricities between the center of mass and center of rigidities, and these eccentricities vary from floor elevation to floor elevation. These eccentricities cause inertial torsional effects, which are considered by performing a dynamic analysis that incorporates the torsional degrees of freedom. Secondly, torsional effects are due to consideration of accidental torsion, where an additional eccentricity of +/- 5 percent of the

maximum building dimension is used for both horizontal directions. The use of the additional eccentricity in the structural design accounts for torsional effects that are not captured in the seismic response analyses, such as torsion due to incoherency (spatial variation) of the input ground motion, non-vertically propagating incident waves, and/or accidental eccentricities. The effects of responses from inertial torsion and accidental torsion are required to be combined in the building structural designs.

Accidental torsion effects are not included in the calculation of maximum relative displacements, which are computed for the R/B complex as described in Section 03.3.8 of Technical Report MUAP-10006, Rev. 3, using SSI results, which does account for the contribution of inertial torsional effects to displacement. Accidental torsion effects are required to be considered along with other displacement effects in addition to the SSI seismic displacements, including inertial torsional effects in the R/B complex structural designs. As stated above, the consideration of accidental torsion effects is in compliance with DCD Tier 2 Subsection 3.7.2.11 and in accordance with the recommendations outlined in Acceptance Criterion II.11 of SRP 3.7.2.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Technical/Topical Report

There is no impact on a Technical/Topical Report.

This completes MHI's response to the NRC's question.