RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

08/01/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 1045-7141 REVISION 3**
SRP SECTION:	**03.08.05 – Foundations**
APPLICATION SECTION:	**3.8.5**
DATE OF RAI ISSUE:	**07/08/2013**

QUESTION NO. 03.08.05-63:

On April 3, 2013, the applicant submitted a markup of DCD Tier 2 Section 3.8 to provide updated information related to a seismic design change.

In Subsection 3.8.5.5.1, "Overturning Acceptance Criteria," the last paragraph (Page 3.8-105) states, "The effects of basemat uplift are included at every time step by determining the reduction in contact area due to the time varying vertical force (up or down) and moments." The applicant is requested to explain how the information on the reduction of contact area is used in its overturning stability calculation.

ANSWER:

The sentence will be deleted in the current DCD revision. The reduction of contact area was not used in the overturning stability calculation. The reduction in contact area was only used to determine the maximum dynamic toe pressure under combination of gravity, buoyancy, lateral earth pressures, and seismic (quasi-static) loads for each soil profile. Refer to the response to RAI No. 94-1491 Rev. 1, Question No 02.05.04-01 for the iterative process to compute the reduced contact area and maximum toe pressure.

Impact on DCD

DCD Subsection 3.8.5.5.1 will be revised as indicated in Attachment 1.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Technical/Topical Report

There is no impact on the Technical/Topical Report.

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

obtained from the site independent SSI analyses. The SSI analyses are conducted separately for each earthquake direction. The earthquake responses from the separate SSI analyses are then applied simultaneously to evaluate overturning stability. The SSE overturning stability analyses, which are based on loads/masses extracted from the SSI analyses, include 25% of the live load in calculating both the resisting moment and the overturning moment. The presence of live loads has insignificant effect on the calculated overturning factor of safety because live loads make up an insignificant portion of the mass considered. Further, even though live loads have a stabilizing effect by increasing the overturning resisting moment, they increase the overturning moment. Therefore, the effects of live loads on overturning stability are insignificant. MIC-03-03-00057

Unbalanced lateral earth pressures are included in the analyses. This means that the overturning stability analysis considers the contribution of static soil pressure (at-rest lateral earth pressure), lateral earth pressure due to surcharge of 450 psf, and dynamic (Wood's) pressure acting in the same direction ~~of~~as the horizontal inertia forces on the below-grade walls and basemat, but conservatively considers only static at-rest pressure in resisting overturning loads. This is conservative because any passive reaction forces acting on the side walls and basemat below grade will reduce the global overturning effects during the stability analysis. Soil pressures acting on the below grade side walls and basemat are considered for the strength design as discussed in Subsection 3.8.4.4. MIC-03-03-00060 ~~The effects of basemat uplift are included at every time step by determining the reduction in contact area due to the time varying vertical force (up or down) and moments.~~ DCD_03.08.05-63 The overturning safety factors are calculated at each time step of the design earthquake excitation as the ratio between the resisting moments and the driving/overturning moments. The minimum value of the safety factor during the total duration of the earthquake for any of the design soil conditions is reported in Table 3.8.5-6. MIC-03-03-00060

3.8.5.5.2 Sliding Acceptance Criteria

The factor of safety against sliding caused by wind ~~or~~, tornado or hurricane is identified by the ratio: MIC-03-03-00057

$$FS_{sw} = [\, F_s \cancel{+ F_p} \,] / F_h \text{ , not less than } FS_{sl} \text{ as determined from Table 3.8.5-1,}$$ MIC-03-03-00057

where

FS_{sw} = Structure factor of safety against sliding caused by severe wind ~~or~~, tornado or hurricane DCD_02-03S02 DCD_02-03S01

F_s = Shear (or sliding) resistance along bottom of structure basemat. No credit is taken for side wall friction or passive soil pressure in calculating the factor of safety against sliding in standard plant building structures. MIC-03-03-00057

~~F_p = Resistance due to maximum passive soil pressure, neglecting any contribution of surcharge. No credit is taken for passive soil pressure in calculating the factor of safety against sliding in standard plant building structures.~~ MIC-03-03-00057