RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

03/29/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 340-2004 REVISION 0**
SRP SECTION:	**03.08.05 - Foundations**
APPLICATION SECTION:	**3.8.5**
DATE OF RAI ISSUE:	**04/21/2009**

QUESTION NO. 03.08.05-18:

In DCD Subsection 3.8.5.5, three factors of safety are defined. They are the factor of safety against overturning, FS_o, the factor of safety against sliding, FS_{sw} & FS_{se}, and the factor of safety against flotation, FS_f.

The applicant is requested to provide the following information:

> Provide a table tabulating values of these factors for the four subgrade conditions defined in DCD Subsection 3.8.5.4.1 and DCD Table 3.8.5-3.

During the calculation of these factors of safety, was the passive soil pressure against the vertical face of the basemat and exterior walls that were embedded in soils utilized? If yes, describe how the passive soil pressure and its distribution along the vertical side of the embedded basemat and walls were calculated.

ANSWER:

This answer revises and replaces the previous MHI answer that was transmitted by letter UAP-HF-09363 (ML091900557).

Minimum factors of safety against overturning are listed in Table 1 for six soil profiles, using the results of soil-structure interaction (SSI) analysis under design basis seismic loads.

Table 1, Minimum Factors of Safety (FoS) against Overturning

Soil	Min Overturing FoS
270-200	1.65
270-500	1.68
560-500	1.65
900-100	1.25
900-200	1.25
2032-100	1.30

The self-weight from the dead load of the reactor building (R/B) complex is 1.23×10^6 Kips and buoyancy is 3.216×10^5 kips for ground water level at one ft below grade. The minimum factor of safety against flotation is calculated as follows:

$$FS_f = \frac{D}{F_{buoy}}$$

Where D is total Dead Load, and F_{buoy} is the buoyancy force.

Therefore, the factor of safety against flotation for the US-APWR standard plant is 3.82 for all six soil profiles. These factors of safety satisfy the requirements of Standard Review Plan (SRP) 3.8.5.

As discussed in Technical Report MUAP-12002, Rev 1, the equivalent-static factor of safety for sliding calculated for the R/B Complex subjected to certified seismic design response spectra (CSDRS)-compatible seismic accelerations was less than the minimum acceptable for very short time intervals during the earthquake. Technical Report MUAP-12002, Rev. 1 provides the maximum expected values of sliding for the R/B complex and the T/B. As specified in the Design Control Document (DCD), the design of all aspects related to interaction between adjacent structures and components (namely: structural gaps, structural connections, such as buried tunnels and other umbilicals, buried commodities) are designed to accommodate the displacements corresponding to the maximum expected sliding, and therefore the structure safety and functionality are not affected by these displacements. To demonstrate an adequate factor of safety, all inputs to sliding analyses were amplified by a factor of 1.1, which is equal to the factor of safety applicable for sliding specified in SRP 3.8.5, Acceptance Criteria II 5 for load combination C.

The passive soil pressure against the vertical face of the basemat and exterior walls embedded in soils is not considered for the calculation of the overturning and flotation factors of safety. The nonlinear sliding analyses were performed conservatively without considering the passive soil pressures against sliding.

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 the Technical/Topical Report.

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