REQUEST FOR ADDITIONAL INFORMATION 821-5984 REVISION 3

9/1/2011

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 03.07.01 - Seismic Design Parameters
Application Section: 3.7.1

QUESTIONS for Structural Engineering Branch 1 (AP1000/EPR Projects) (SEB1)

03.07.01-18

In the supplemental response of June 2011 to RAI No. 659-5133 Revision 2, Question No. 3.7.1-17, the applicant provided a description and justification for the decrease in shear wave velocity with increase in depth. The applicant is requested to provide additional justification to the following observations from the supplement response to ensure that the soil profiles used in the standard design realistically represent typical site conditions in the US and the approaches used in the development of strain compatible soil profiles are conservative in order for the staff to fully evaluate the adequacy of the US-APWR design in accordance with the requirements of 10 CFR Part 50, Appendix A, General Design Criteria 2; 10 CFR Part 50 Appendix S; and 10 CFR Part 100.23.

1. The staff observed that the behavior of increase in shear wave velocity with depth in not limited to the 560-500 profile but is evident in all strain compatible profiles for postulated soil sites, namely 270 m/s and 560 m/s soil profile series. Please explain why the shear wave velocity in the initial profiles never decreases but increase with depth as defined in the standard design.

2. It is well known that when shear wave propagates from bedrock up to the surface horizontally through a softer media, the ground motion at the surface normally will be higher than the bedrock input motion, or the soil column acts as an amplifier. The strain compatible shear wave velocity at deeper depth normally will be higher than that at a shallow depth if the whole soil column consists of the same type of material. Even if the increased motion at the softer-stiffer material interface may increase shear strain and thus results in the decrease of shear wave velocity, why does the strain compatible shear wave velocity not only decrease at the depth close to the interface but also at depths way above the interface for all 270 m/s and 560 m/s soil profiles series?

3. There is no reliable data to verify the actual soil shear wave velocity at deep depth when under seismic loading. Please explain how the strain compatible soil profiles where the shear wave velocity decreases as depth increases, as presented in this design, can be considered realistic.

4. Although the soil profiles with decreased shear wave velocity can result in higher peak responses; will similar results be obtained over all frequency range in the soil-structure interaction (SSI) analysis?

5. The shear wave velocity in some profiles decreases, then increases, and then decreases again within certain depth ranges. This behavior appears to have non-physical attributes caused by the numerical instabilities in the computer code that was used to develop the soil profiles. Please provide justification for the behavior of the shear wave velocity and details of the computer code used including its validation and verification performed for this application.