RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/31/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO. 850-6002 REVISION 3**
SRP SECTION:	**03.07.01 – Seismic Design Parameters**
APPLICATION SECTION:	**3.7.1**
DATE OF RAI ISSUE:	**10/21/11**

QUESTION NO. RAI 03.07.01-23:

In Subsection 4.2.2 of MUAP-10001(R3), "Development of US-APWR CSDRS Strain Compatible Properties Equivalent Dynamic Mass," the second paragraph (page 4-7) states, "Control motions reflect a representative magnitude of M7.5 for CEUS hazard and are consistent with the overall spectral shape of the CSDRS."

The staff noticed that the criteria used in generating CSDRS compatible ground motion time histories are for a M6.5 earthquake (See footnote to Tables 5.1-2 and 5.1-3). The applicant is requested to provide an explanation as to why CSDRS represents a M7.5 earthquake; whereas, the CSDRS compatible motions only match a M6.5 earthquake.

ANSWER:

This answer revises and replaces the previous MHI answer that was transmitted by letter UAP-HF-11417 (ML11339A013).

Technical Report MUAP-10001 Rev. 3 has been replaced by Technical Report MUAP-10006, Rev. 3. Sections 01.4.2 and 01.5.2.1 of MUAP-10006, Rev. 3 describe the approach used for modeling the control motion in the site response analyses to determine strain compatible soil properties consistent with the shape of the certified seismic design response spectra (CSDRS). The control motion for the site response analyses is derived from magnitude broad spectral shape by adjusting the distances to the **M**7.5 control earthquake, such that the 5% damped median spectrum computed for each profile approaches, but does not exceed, the horizontal and vertical CSDRS at foundation bottom level. Magnitude **M**7.5 is used to define the input for the response analyses because its broad spectral shape is consistent with that of the CSDRS. The CSDRS is adopted from the Regulatory Guide (RG) 1.60 spectral shape, which reflects a median plus one-sigma analysis of several earthquakes and a range of site conditions. Since the RG 1.60 and the CSDRS were based on a plus one-sigma analysis of earthquakes ranging in magnitude from approximately **M**5.4 to **M**7.7, the overall shape is consistent with a median spectra with magnitude of approximately **M**7.5 (for example, see Figure 6-75 of NUREG/CR-6728). In order to maintain consistency with the spectral shape of the CSDRS, control motions are used as input for the site response analyses that reflect a representative magnitude of **M**7.5 for Central and Eastern United States earthquake.

A point-source model is used to develop control motions as described in Section 01.4.2.2 of MUAP-10006, Rev. 3. The distances and median estimates of the horizontal and vertical peak accelerations used as input for the site response analyses of different profiles are listed in Table 01.5.2.1-1 of MUAP-10006, Rev. 3. The comparisons presented in Figures 01.5.2.1-1 and 01.5.2.1-2of MUAP-10006, Rev. 3, demonstrate that the median horizontal and vertical spectra computed for each profile approaches and does not exceed the horizontal and vertical CSDRS. The input control motions used for the site response analyses reflect contributions of multiple site conditions and earthquakes of varying sizes that define the CSDRS as broadband design spectra. The use of input control motions that represent a single earthquake ensures that the site response analyses provide appropriate strain compatible properties of the generic soil profiles reflecting realistic strains in the soil columns.

Section 01.4.1.3 of MUAP-10006, Rev. 3 describes the methodology used to develop the design basis time histories that is in accordance with SRP 3.7.1 Option 1, Approach 1. The BAL (Mount Baldy, CA) recordings of the January 17th, 1994, Northridge Earthquake with magnitude M6.7 are used as the seed ground motions for generating the seismic design basis time histories. Although the most representative earthquake for the CSDRS is of magnitude M7.5, the use of these seed time histories that are from a smaller magnitude seismic event for development of time histories is not an issue. This is because the magnitude M7.5 earthquake is used with distance adjustments from the control earthquake, so as not to exceed the CSDRS, to determine strain compatible soil properties. These properties are equivalent to soil properties based on smaller magnitude seismic events with smaller distance adjustments. The BAL recordings of the Northridge earthquake are selected because they meet the key requirements of SRP 3.7.1. The selected records have the required durations and correlations (statistical independence among the three components). Their spectral shapes, when scaled, are a reasonably good match to the CSDRS in the 2-20 Hz range for all three orthogonal components.

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.