

## US-APWRRAlSPeM Resource

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**From:** Ciocco, Jeff  
**Sent:** Tuesday, June 12, 2012 2:11 PM  
**To:** us-apwr-rai@mhi.co.jp; US-APWRRAlSPeM Resource  
**Cc:** Jain, Bhagwat; Shams, Mohamed; Galvin, Dennis; Hamzehee, Hossein  
**Subject:** US-APWR Design Certification Application RAI 940-6532 (3.7.1)  
**Attachments:** US-APWR DC RAI 940 SEB1 6532.pdf; image001.jpg

MHI,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs.

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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MESSAGE	496	6/12/2012 2:11:17 PM
US-APWR DC RAI 940 SEB1 6532.pdf		64336
image001.jpg	3989	

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# REQUEST FOR ADDITIONAL INFORMATION 940-6532 REVISION 3

6/12/2012

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)

03.07.01-40

In its response to RAI No.886-6202 Revision 3, Question No. RAI 03.07.01-33, MHI provided digitized acceleration versus time traces for the current design-basis Northridge Earthquake seed records and for the synthetic acceleration time histories developed from the seed records to match the CSDRS. The staff has conducted independent numerical analysis using this information, to evaluate whether the developed synthetic time histories provide an acceptable match to the CSDRS, in accordance with the assessment procedures detailed in SRP 3.7.1.

The applicant has specified that SRP 3.7.1, Option 1, Approach 2, criteria are satisfied. However, the staff has determined that Option 1, Approach 2, is not specifically applicable to site-independent CSDRS based on the RG 1.60 spectra. The acceptance criteria in Option 1, Approach 2, are not appropriate for site-independent CSDRS; rather it is applicable for developing synthetic time histories to match a site-specific uniform hazard response spectrum (UHRS).

When a single time history method is used, the SRP 3.7.1 specifies two approaches to generate synthetic time history. In Revision 2 (1989) of the SRP 3.7.1, for single time history, Option 1 had only one approach i.e., Approach 1. Approach 1 applies to RG 1.60 types of site-independent broad band spectra. In Revision 3 (2007), the guidance was enhanced to address site-specific uniform hazard type of spectra that are continuous curves and different in shape from RG 1.60 spectra. The technical basis for Revision 3 to SRP 3.7.1 is provided in NUREG/CR-6728. NUREG/CR-6728 was developed to provide guidance on generating time histories for site-specific hazard- and risk-consistent ground motion spectra. NUREG/CR-6728 is cited as reference 9 in SRP 3.7.1.

The staff performed an independent evaluation of the US APWR synthetic acceleration time histories to check whether the synthetic time histories satisfy the SRP 3.7.1 Option 1, Approach 1 criteria. The staff finds that for all three directions (2-horizontal, and 1 vertical) of the CSDRS, SRP 3.7.1 Option 1, Approach 1 criteria are not satisfied. The staff's evaluation also showed that for the case of 5% damping, which satisfied the Option 1, Approach 2 criteria, the criteria in Option 1, Approach 1 is not satisfied. Therefore, the staff requests the applicant to develop the design basis synthetic time histories for all three directions of the CSDRS in the DCD (R3), that satisfy the spectral matching criteria and PSD matching criteria of the SRP 3.7.1, Option 1, Approach 1.

- (1) In performing the spectral matching, demonstrate that for all three directions of the CSDRS, the Option 1, Approach 1, criteria are met for 2%, 3%, 5%, 7%, and 10% damping, or justify an alternate damping range based on the values used in the design basis seismic response analysis of SSCs.

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- (2) In performing the PSD match,
  - (a) develop target PSDs representative of each of the three directions the CSDRS, which are the stretched RG 1.60 spectra;
  - (b) provide the details of the method employed to develop the target PSDs; and
  - (c) describe the method and assumptions used to generate the PSDs for the synthetic time histories.

### 03.07.01-41

In its response to RAI No.886-6202 Revision 3, Question No. RAI 03.07.01-33, MHI provided digitized acceleration versus time traces for the current design-basis Northridge Earthquake seed records and for the synthetic acceleration time histories developed from the seed records to match the CSDRS. The staff has conducted independent numerical analysis using this information, to evaluate whether the developed synthetic time histories provide an acceptable match to the CSDRS, in accordance with the assessment procedures detailed in SRP 3.7.1.

The staff's independent calculations showed an unexpected significant difference in the value of the parameter,  $AD/V^2$  between the two horizontal components for both the seed records and the synthetic time histories. The applicant is requested to explain the difference in the values of  $AD/V^2$  between the two horizontal directions for both the seed records (15.4 vs. 3.8) and the generated synthetic times histories (7.22 vs. 2.80). The applicant is also requested to provide a detailed technical basis for the acceptability of such a large difference in the value of  $AD/V^2$  within a single set of synthetic time histories developed to match the same target spectra.

### 03.07.01-42

In its response to RAI No.886-6202 Revision 3, Question No. RAI 03.07.01-33, MHI provided digitized acceleration versus time traces for the current design-basis Northridge Earthquake seed records and for the synthetic acceleration time histories developed from the seed records to match the CSDRS. The staff noted that the selected seed records have 2210 points and a time increment of 0.01 seconds, while the synthetic acceleration time histories have 4417 points and a time increment of 0.005 seconds. The staff requests the applicant to:

- (1) explain in detail how the intermediate points were interpolated from the seed records; and
- (2) identify what database was used to select the starting Northridge seed records.

### 03.07.01-43

The applicant stated that results presented in its response to RAI No.886-6202 Revision 3, Question No. RAI 03.07.01-33, reflect the old general arrangement of structures on separate basemat. Staff understands that a redesign to increase the size of the common basemat and to include additional buildings on the common basemat is currently underway. The Applicant committed to revise the current RAI response after completing the evaluation of new structural configuration that combines the Reactor Building, Containment Internal Structure, Pre-stressed Concrete Containment Vessel, Auxiliary

## **REQUEST FOR ADDITIONAL INFORMATION 940-6532 REVISION 3**

Building and the two Power Source Buildings on a common basemat. The applicant is requested to submit a revised RAI response according to its commitment.

