MITSUBISHI HEAVY INDUSTRIES, LTD.
16-5, KONAN 2-CHOME, MINATO-KU
TOKYO, JAPAN

July 11, 2012

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-12198

Subject: **MHI's Response to US-APWR DCD RAI No. 933-6440 Revision 3 (SRP 02.05.02)**

Reference: 1) "Request for Additional Information No. 933-6440 Revision 3, SRP Section 02.05.02 – Vibratory Ground Motion - Application Section: 2.5.2", dated May 29, 2012.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Response to Request for Additional Information No. 933-6440 Revision 3."

Enclosed are responses to questions contained within Reference 1.

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,

Y. Ogata

Yoshiki Ogata,
Director- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Response to Request for Additional Information No. 933-6440 Revision 3

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NRO

CC: J. A. Ciocco
J. Tapia

Contact Information
Joseph Tapia, General Manager of Licensing Department
Mitsubishi Nuclear Energy Systems, Inc.
1001 19th Street North, Suite 710
Arlington, VA 22209
E-mail: joseph_tapia@mnes-us.com
Telephone: (703) 908 – 8055

Enclosure 1

UAP-HF-12198
Docket No. 52-021

Response to Request for Additional Information No. 933-6440
Revision 3

July 2012

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

07/11/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 933-6440 REVISION 3**
SRP SECTION:	**02.05.02 - VIBRATORY GROUND MOTION**
APPLICATION SECTION:	**2.5.2**
DATE OF RAI ISSUE:	**5/29/2012**

QUESTION NO.: 02.05.02-2

During a public meeting conducted on March 29, 2012, the MHI presented a resolution plan for the US-APWR design certification application review issues (ML12090A635). As part of this plan, the MHI proposes to revise the six soil profiles used in the SSI analyses. The MHI's proposed plan states that the generic curves provided in EPRI TR-102293 will be used for soil degradation properties. In order for the staff to fully evaluate the adequacy of the assumptions and input parameters to be used in the SSI analyses as well as to ensure the seismic stability of safety related structures, in accordance with 10 CFR Part 50, Appendix S, please provide the following:
1) Discussion on the basis of creating the 270-200, 270-500 and 560-500 soil profiles.
2) Clarification on the type of subsurface materials involved in the proposed soil profiles and justification for the applicability of EPRI TR-102293 soil degradation curves to those profiles.

ANSWER:

The methodology used to develop the revised set of generic soil profiles for the new set of site-independent soil-structure interaction (SSI) analyses of US-APWR standard plant buildings (to be documented in Technical Report MUAP-10006, Rev. 3) is identical to that previously used and documented in Technical Report MUAP-10001, Rev. 4 with the only difference being that the revised strain compatible properties are consistent with the revised approach for site-independent seismic response analyses that considers SSI responses of embedded foundations. The differences between the revised generic profiles of strain compatible subgrade properties that will be presented in Technical Report MUAP-10006, Rev. 3 and those used for the previous sets of site-independent analyses as previously documented in Technical Report MUAP-10001, Rev. 4 are very small. (Technical Report MUAP-10001, Rev. 4 is being superseded and its contents are being incorporated into Technical Report MUAP-10006, Rev. 3.)

1) The seismic strain compatible properties used as input for the revised set of site-independent SSI analyses are developed from the results of a new set of site response analyses that use as input initial small strain shear wave velocity profiles that are identical to those presented in Technical Report MUAP-10001, Rev. 4, Figure 4.2-2. The methodology used for the revised site response analyses is identical to that previously used for development of strain compatible generic profiles

and documented in Sections 4.2 and 5.2 of Technical Report MUAP-10001, Rev. 4 with the only difference that the new set of dynamic soil properties are compatible to the strains generated by the seismic ground motions where spectra from full soil column outcrop motion at the reactor building (R/B) complex foundation bottom elevation are enveloped by US-APWR CSDRS for each soil profile. This change in methodology ensures that the revised strain compatible properties are consistent with the new standard seismic design approach that is based on responses obtained from site independent SSI analyses of embedded foundations with CSDRS compatible input ground motion defined at the bottom of the R/B complex foundation.

2) The 270-200, 270-500 and 560-500 profiles provide layering and dynamic properties (shear wave velocity, compressive wave velocity and unit weight) that are representative of nuclear power plant soil sites with differing stiffness and depth to underlying rock strata as follows:

   i. Profile 270-200 represents shallow soil site with nominal shear velocity 270 m/sec and depth of soil strata from the plant grade to the rock base of 200 ft

   ii. Profile 270-500 represents deep soil site with nominal shear velocity of 270 m/sec and depth of soil strata from the plant grade to the rock of 500 ft

   iii. Profile 560-500 represents hard soil site with nominal shear velocity of 560 m/sec and depth of soil strata from plant grade to rock of 500 ft

   The initial small strain dynamic soil properties used for development of the three generic soil profiles are developed from the database of soil sites that provide suitable subgrade conditions for supporting heavy nuclear power plant foundations. The softer 270-200 and 270-500 profiles represent sites consisting of layers of dense cohessionless soil and/or over-consolidated stiff clay. The 560-500 profile is representative of glacial till sites consisting of highly consolidated mixtures of fine and coarse grained soils.

   The site response analyses that provide the strain compatible 270-200, 270-500 and 560-500 profiles used as input for the site-independent SSI analyses, utilize the equivalent linear approach based on soil degradation curves representing the shear modulus and damping of the soil material as a function of cyclic shear strain. The strain compatible properties of 270-200, 270-500 and 560-500 generic profiles were developed using the standard modulus reduction and damping curves documented in Appendix 7.A of EPRI TR-102293, Volume 2 that are appropriate for cohesionless soils and clays with low plasticity.

Impact on DCD

There is no current impact on the DCD. However, the DCD will be updated in accordance with the Seismic Closure Plan (MHI submitted details of the Seismic Closure Plan within MHI Letter UAP-HF-12082, dated March 31, 2012).

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

Technical Reports MUAP-10006 and MUAP-11007 are being revised in accordance with the Seismic Closure Plan.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

07/11/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 933-6440 REVISION 3**
SRP SECTION:	**02.05.02 - VIBRATORY GROUND MOTION**
APPLICATION SECTION:	**2.5.2**
DATE OF RAI ISSUE:	**5/29/2012**

QUESTION NO.: 02.05.02-3

In the proposed resolution plan of the US-APWR DCD review issues discussed during the public meeting on March 29, 2012 (ML12090A635), the MHI stated that DCD Chapter 2 Table 2.0-1 would be revised in the areas of soil profile descriptions and data, bearing capacity demands, and allowable settlements due to the changes in the foundation design and embedment conditions. The MHI also stated that new stability analyses would be performed. Since the static and dynamic lateral earth pressures will also be affected by the changes in the foundation design and embedment conditions, in accordance with 10 CFR 100.23 and 10 CFR Part 50, Appendix S, please clarify whether the lateral earth pressure parameters will also be revised based on the new foundation design and analyses results, as these are important parameters for structure stability evaluation.

ANSWER:

On March 31, 2012, MHI submitted the details of the Seismic Closure Plan (MHI Letter UAP-HF-12082). The Seismic Closure Plan includes an updated stability analysis to be documented in Technical Report MUAP-10006. Updated lateral earth pressures due to the revised reactor building (R/B) complex configuration on a common basemat will be included in the analysis. Technical Report MUAP-10006, Rev. 3 is being revised and submitted in accordance with the Seismic Closure Plan. This revision will provide the detailed bases for the stability evaluations and determination of the lateral earth pressures.

Impact on DCD

There is no current impact on the DCD. However, the DCD will be updated in accordance with the Seismic Closure Plan.

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 Reports

Technical Report MUAP-10006 is being revised in accordance with the Seismic Closure Plan.