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

December 23, 2009

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

Attention: Mr. Jeffery A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-09575

Subject: MHI's Response to US-APWR DCD RAI No. 489-3516

Reference: 1) "Request for Additional Information No. 489-3516 Revision 0, SRP Section: 03.4.2 – Analysis Procedures," dated 11/23/2009.

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. 489-3516, Revision 0."

Enclosed is the response to 1 RAI contained within Reference 1. This transmittal completes the response to this RAI.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, 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,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Response to Request for Additional Information No. 489-3516, Revision 0

CC: J. A. Ciocco
C. K. Paulson

Contact Information
C. Keith Paulson, Senior Technical Manager
Mitsubishi Nuclear Energy Systems, Inc.
300 Oxford Drive, Suite 301
Monroeville, PA 15146
E-mail: ck_paulson@mnes-us.com
Telephone: (412) 373-6466

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Docket No. 52-021
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Enclosure 1

UAP-HF-09575
Docket No. 52-021

Response to Request for Additional Information No. 489-3516,
Revision 0

December, 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

12/23/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 489-3516 REVISION 0**
SRP SECTION:	**03.04.02 - Analysis Procedures**
APPLICATION SECTION:	**3.4.2**
DATE OF RAI ISSUE:	**11/23/2009**

QUESTION NO. RAI 03.04.02-5:

Supplemental RAI Text:

The staff requests the applicant to provide more information on the base/soil interface shear resistance evaluation and further response on the subject regarding passive earth pressure in the dynamic lateral resistance force evaluation.

Staff Assessment of Response to RAI 3.4.2-03 (No. 219-1908 Revision 0):

According to the Applicant's response to RAI 3.4.2-03 dated 4/29/2009 (see Reference below) , the Foundation Sliding for the deeply-embedded mat foundations for the RB/FB and CB mat foundations (or others) was analyzed assuming that the resistance to sliding is provided by shear resistance along the base of the mat, and if necessary, from passive soil resistance in front of the mat in the direction of sliding.

However, no detail guidance was provided in evaluating the shear resistance (along the base) in the DCD. The staff would like the applicant to provide more detailed methodology on shear resistance evaluation at interface, such as what are the criteria used to determine the allowable friction coefficient at the soil and base interface? And provide statement on whether such friction coefficient at base/soil interface is strongly dependent on the interfacial property, such as the moisture or water content at the soil structure interface.

In general, the type of earth pressures to the walls depends solely on the inclination of the wall tilt angle. For example, during the seismic event, the passive (and active) earth pressure is needed to be considered due to the lateral vibration response of the wall structure. Therefore, the staff concurs with the applicant's response of using the passive earth pressure for the initial safety factor evaluation to against slide.

However, in reality, due to seismic cyclic loading (dynamic shear deformation oscillation) induced compaction of the backfill or soil around the walls (in the laterally back and forth excitation displacement of the foundation walls), the subsequence passive earth pressure induced by seismic loading is expected to be significantly reduced within a few cycles. Therefore, from the conservative/safety point, it will be sensible not to include the resistance contributed by the passive earth pressure to the analysis of safety factor against sliding caused by the earthquake.

Furthermore, in a saturated soil condition (or high water table), the pore pressure will likely carry most of the stress induced by the high strain rate of the seismic dynamic loading.

Reference:

Mitsubishi Heavy Industries, Ltd. "MHI's Response to US-APWR DCD RAI No. 219-1908" MHI Ref: UAP-HF-09151, April 9, 2009, ML091040320.

ANSWER:

The response to DCD RAI 340-2004, Question 3.8.5-18, clarified that passive soil pressure is not used in the design of the standard plant to resist sliding loads. Subsection 3.8.5.5.2 was modified during DCD Revision 2 as a result of RAI 340-2004, Question 3.8.5-18, to state no credit is taken for passive soil pressure in calculating the factor of safety against sliding in standard plant structures.

The coefficient of friction at the base/soil interface used in the standard plant analyses is described in the response to RAI 340-2004 Question 3.8.5-17, in which case the friction coefficient is taken as 0.7. This relatively high coefficient of friction can be obtained by special treatment of the interface. The coefficient of friction at the concrete-to-concrete interface (i.e., between the fill concrete and foundation concrete), can also be taken as 0.7, which can be achieved by minor roughening of the top of the fill concrete where necessary at certain sites.

The ground water level is an important parameter for estimating the buoyant forces on the structure, which are a part of the stability analysis. However, the effect of ground water level on the coefficient of friction at the soil-foundation interface is negligible.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's responses to the NRC's questions.