


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

December 3, 2008

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-08272

Subject: MHI's Responses to US-APWR DCD RAIs No. 94, 95 and 96

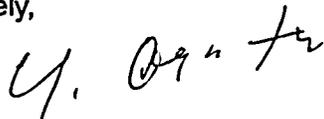
- References:**
- 1) "Request for Additional Information No. 94-1491 Revision 1, SRP Section: 02.05.04 – Stability of Subsurface Materials and Foundations, Application Section: 2.5.4," dated 11/6/2008.
 - 2) "Request for Additional Information No. 95-1493 Revision 1, SRP Section: 02.05.05 – Stability of Slopes, Application Section: 2.5.5," dated 11/6/2008.
 - 3) "Request for Additional Information No. 96-1498 Revision 1, SRP Section: 02.05.02 – Vibratory Ground Motion, Application Section: 2.5.2," dated 11/6/2008.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") documents as listed in Enclosures.

Enclosed are the responses to 3 RAIs contained within References 1 through 3.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittals. His contact information is provided below.

Sincerely,



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

Enclosures:

1. "Responses to Request for Additional Information No. 94-1491 Revision 1"
2. "Responses to Request for Additional Information No. 95-1493 Revision 1"
3. "Response to Request for Additional Information No. 96-1498 Revision 1"

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

DOB |
NRC

Contact Information

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Enclosure 1

UAP-HF-08272
Docket No. 52-021

Responses to Request for Additional Information No. 94-1491,
Revision 1

December 2008

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

12/3/2008

**US-APWR Design Certification
Mitsubishi Heavy Industries
Docket No. 52-021**

RAI NO.: NO. 94-1491 REVISION 1
SRP SECTION: 02.05.04 – STABILITY OF SUBSURFACE MATERIALS AND FOUNDATIONS
APPLICATION SECTION: 02.05.04
DATE OF RAI ISSUE: 11/06/08

QUESTION NO. : 02.05.04-01

Related to tables 2.1-1 (Tier 1) and 2.0-1 (Tier 2) "Key Site Parameters":

- a) Clarify your use of "average" static and dynamic bearing capacity rather than a minimum value. Please explain how the dynamic bearing pressure was determined.
 - b) Clarify why there is not a parameter value for settlement in Tier 1 and a description in Tier 2, Section 2.5.4.
 - c) Clarify the restrictions with regard to soil liquefaction, which states only "none."
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ANSWER:

a) Calculations relative to static and dynamic bearing loads and seismic affects utilize a finite grid evaluation process with grid sizes typically smaller than any single static element (such as the basemat). Geotechnical field parameters are also typically acquired in the COLA site investigation on a spacing typically smaller than a single static or dynamic element (for example, there are several geophysical data acquisition points within the basemat area). Static or dynamic bearing capacity within the area of a basemat footprint are likely to vary in absolute value based on minor differences in localized geology and in sampling tool response. The best statistical evaluation of an average value will vary by site. Therefore, a statistical average is a valid approach to estimating the area static and dynamic bearing capacity.

b) The maximum foundation subsidence or differential settlement is 2 inches as stated in Subsection 3.8.5.4.4. This is a conservative allowance that may not be applicable to all plant sites. Subsidence and differential displacement may therefore be reduced to less than 2 inches if justified by the COL Applicant based on site-specific soil properties. Therefore, no parameter value for settlement is specifically stated in Tier 1 or Tier 2, Subsection 2.5.4.

c) The US-APWR standard plant design is based on the premise that there is no potential of liquefaction. The COL Applicant is required by Subsection 2.5.4.8 to analyze for the potential of liquefaction occurring at the site. Compliance with site parameters as stated in Table 2.0-1 requires that the potential of soil liquefaction for seismic category I structures on site is "none".

Impact on DCD

The DCD will be changed to incorporate the following:

- Insert the following in front of the first sentence of Subsection 2.5.4.8: "The US-APWR standard plant design is based on the premise that there is no potential of liquefaction occurring at the site."

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

QUESTION NO. : 02.05.04-02

Please provide site uniformity requirements for the foundation support media and how an applicant should address potential variability within the site subsurface media.

ANSWER:

As discussed in Subsection 3.7.1.3, the seismic design of the US-APWR standard plant uses lumped parameter representation to model the interaction of seismic category I structures with the supporting media, where a set of generic material properties is assigned to the uniform elastic half-space modeling the subgrade. Since the effect of variation of properties, depth, and the layering of the soil over the bedrock is not included in the models used for seismic analysis of US-APWR standard plant, it is the responsibility of COL Applicant to perform site-specific SSI analyses of the R/B-PCCV-containment internal structure on their common basemat, as described in DCD Section 3.7.2.4.1 and specified as COL 3.7(25), to verify that these effects are enveloped by the standard design.

The site-specific analyses are performed using the SSI analysis program SASSI and considering minimum of three sets of layered soil profiles representing lower bound, best estimate and upper bound site-specific properties of the subgrade. The SASSI analyses use site-dependent input control motion that is derived from site-specific GMRS and FIRS. Soil properties that are compatible to the strains induced by site-specific SSE are used as input to the SASSI analyses in order to account for the primary non-linear material behavior of the soil. The standard plant seismic design is verified based on comparison of standard design ISRS to those derived from site-specific SASSI analysis.

Impact on DCD

There is no impact on DCD.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

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Enclosure 2

UAP-HF-08272
Docket No. 52-021

Responses to Request for Additional Information No. 95-1493,
Revision 1

December 2008

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

12/3/2008

**US-APWR Design Certification
Mitsubishi Heavy Industries
Docket No. 52-021**

RAI NO.: NO. 95-1493 REVISION 1
SRP SECTION: 02.05.05 – STABILITY OF SLOPES
APPLICATION SECTION: 02.05.05
DATE OF RAI ISSUE: 11/06/08

QUESTION NO. : 02.05.05-01

Please clarify the dynamic/seismic loads to be considered in the slope stability analysis (e.g. site-specific GMRS).

ANSWER:

The US-APWR standard plant design is based on the premise that there is no site-specific potential for slope failure that could jeopardize safety-related SSCs. The evaluation of slope stability is addressed on a site-specific basis in consideration of the applicable site-specific conditions, slope characteristics and appropriate methodology for slope stability analysis. Seismic loads are developed based on the site-specific SSE using the site-specific GMRS and/or FIRS. The use of site-specific GMRS may be applicable only for stability evaluations of some slopes comprised of native soil materials. It is anticipated that it will be more appropriate to use FIRS as the basis for development of seismic loads for analysis of slopes comprised of borrowed and engineered backfill material.

Impact on DCD

The DCD will be changed to incorporate the following:

- Insert the following in front of the first sentence of Subsection 2.5.5: "The US-APWR standard plant design is based on the premise that there is no site-specific potential for slope failure that could jeopardize safety-related SSCs."

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

QUESTION NO. : 02.05.05-02

Please clarify why there are no restrictions with regard to slope failure or required factors of safety with regard to slope stability in DCD Tier 1 Table 2.1-1 and Tier 2 Table 2.0-1.

ANSWER:

The slope stability evaluations, as described in SRP 2.5.5, are conducted using site-specific design criteria established in consideration of the site-specific conditions, slope characteristics, assumptions inherent to the methods of analysis, and uncertainties associated with the input design parameters (variation of soil properties, water table, etc.). Relevant guidance issued by public agencies, such as the U.S. Department of the Navy, U.S. Army Corps of Engineers, and U.S. Bureau of Reclamation, are usually used for selecting appropriate methods of analysis and for establishing site-specific design criteria in terms of allowable minimum factors of safety and/or allowable maximum displacements.

Impact on DCD

There is no impact on DCD.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

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MHI Ref: UAP-HF- 08272

Enclosure 3

UAP-HF-08272
Docket No. 52-021

Response to Request for Additional Information No. 96-1498,
Revision 1

December 2008

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

12/3/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 96-1498 REVISION 1
SRP SECTION: 02.05.02 – VIBRATORY GROUND MOTION
APPLICATION SECTION: 02.05.02
DATE OF RAI ISSUE: 11/06/08

QUESTION NO. : 02.05.02-01

Please clarify: (1) the location of the control point for the GMRS; (2) how the site-specific foundation input response spectra (FIRS) are determined, whether the FIRS must be enveloped by the CSDRS, and how applicants will meet the minimum requirements for the FIRS as specified in Appendix S to 10 CFR Part 50; and (3) what the requirements are for a site where the FIRS are not enveloped by the CSDRS?

ANSWER:

In response to question (1) above:

As discussed in DCD Subsection 3.7.1.1, the location of the GMRS control point is determined on a site-specific basis for each plant site based on the in-situ conditions. The GMRS defines the site-specific SSE free-field outcrop motions at a control point located at plant grade (ground surface) when in-situ competent material is present. For sites with soil layers near the surface that will be completely excavated to expose competent material, the GMRS can be specified on an outcrop or a hypothetical outcrop that will exist after excavation, as permitted by SRP 2.5.2. For purposes of the US-APWR, competent material must have a shear-wave velocity of 1,000 ft/s or greater.

In response to question (2) above:

As discussed in DCD Subsection 3.7.1.1, foundation input response spectra (FIRS) define the horizontal and vertical components of the site-specific SSE outcrop motions for free-field conditions at the bottom elevations of seismic category I and II foundations. The site-specific FIRS for each seismic category I and II foundation are developed from the results of probabilistic seismic hazard analyses based on the site-specific geological conditions using local and regional seismological input data. The seismic hazard analyses will follow either the probabilistic approach outlined in RG 1.165 (DCD Reference 3.7-2) or the performance-based approach outlined in RG 1.208 (DCD Reference 3.7-3).

The seismic design of the US-APWR standard plant, which is documented in Section 3.7 of the DCD, is applicable for a particular site only if all of the site-specific FIRS are enveloped by the site-independent CSDRS.

As discussed in DCD Subsection 3.7.1.1, for all US-APWR plant sites, the horizontal FIRS must meet the minimum requirement stipulated in Appendix S (IV)(a)(1)(i) of 10 CFR 50. This minimum requirement is met by confirming that the horizontal component of the FIRS envelopes, at all frequencies, the minimum design earthquake response spectra which has the shape of the horizontal US-APWR CSDRS and a PGA value of 0.1g.

In response to question (3) above:

As discussed in DCD Subsection 3.7.1.1, if the site-specific FIRS exceed the CSDRS at any frequency, or the results of the verification analysis described in Section 3.7.2.4 indicate that the site-independent seismic design may be inadequate for a particular site, a scoping re-design analysis of the affected SSCs must be performed using a site-specific SSE defined by the site-specific FIRS. Re-design or modification of the affected portions of the plant would be required in cases where a scoping analysis determines that the standard seismic design is not suitable for the site-specific seismic conditions.

Impact on DCD

The DCD will be changed to incorporate the following:

- Add the following sentence at the end of Subsection 2.5.2.6: "Further discussion of the GMRS is provided in Subsection 3.7.1.1."

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.
