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**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

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1/31/2013

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

**RAI NO.:** NO. 211-1946 REVISION 2  
**SRP SECTION:** 03.07.01 – Seismic Design Parameters  
**APPLICATION SECTION:** 3.7.1  
**DATE OF RAI ISSUE:** 02/25/09

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**QUESTION NO. RAI 03.07.01-01 (03.07.01-05):**

Section 3.7.1.2 of the DCD states that the damping values presented in Tables 3.7.3-1(a) and 3.7.3-1(b) are in accordance with RG 1.61 and ASCE 4-98. The SRP acceptance criteria 3.7.1.II.2 states that the damping values used in the analyses of Category I SSCs are considered acceptable if they are in accordance with RG 1.61. The staff has not reviewed and endorsed ASCE 4-98 for the damping application. Currently this ASCE standard is under revision. Provide justification for all the damping values in Tables 3.7.3-1(a) and 3.7.3-1(b) that are either different from or are not specified in RG 1.61. In particular, justify the damping values shown for welded aluminum structures, and state the percentage of critical damping values to be used for conduit systems with other than maximum cable fill.

Also, the primary shield wall and other walls inside containment are fabricated as steel-concrete (SC) module walls described in Section 3.8.3.1.5 of the DCD. Discuss the methodology for calculating the stiffness and damping values used in modeling the module walls for seismic analysis of the containment structures. Provide justification including test data to demonstrate the appropriateness of the stiffness and damping values used in the seismic analysis and design.

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**ANSWER:**

This answer revises and replaces the previous MHI answer that was transmitted by letter UAP-HF-09187 (ML091170058).

The US-APWR standard design does not use welded aluminum structures. DCD Tables 3.7.3-1(a) and 3.7.3-1(b) have been revised to delete damping values for these structures.

Table 4 of RG 1.61 specifies the use of 5% and 3% damping values for safe-shutdown earthquake (SSE) and operating-basis earthquake (OBE) (where required) analyses of empty conduits and related supports. Tables 3.7.3-1(a) and 3.7.3-1(b) have been revised to add these damping values. The damping values presented in Tables 3.7.3-1(a) and 3.7.3-1(b) are in accordance with RG 1.61. The reference to ASCE 4 for damping has been deleted from DCD Subsection 3.7.1.2.

The steel-concrete (SC) module members can experience varying levels of stress resulting in different patterns of concrete cracking under the different loading conditions that can exist in the

reactor containment. Depending on the reactor operating conditions, the containment internal structure members can be subjected to design seismic loads in combination with normal operating or accidental thermal loads resulting in different levels of stiffness reduction due to concrete cracking. For the different types of SC members, two stiffness levels are assigned, corresponding to:

1. Normal operating conditions characterized with insignificant reduction of stiffness and concrete cracking; and
2. Accidental conditions characterized with significant reduction of stiffness due to cracking of the concrete under high accidental thermal loads.

Different material damping values are assigned to the different members depending on the level of stresses and corresponding concrete cracking. For the SC walls, OBE damping of 4% is used for normal operating loading conditions, and SSE damping of 5% is used for accidental loading conditions.

Technical Report MUAP-10006, Rev. 3, Table 02.4.1.1.3-2 refers to Technical Report MUAP-11018, Rev. 1 that contains a discussion of the SC module test data and stress analyses that establishes the bases for the stiffness and damping values used in the seismic analysis. Technical Report MUAP-10006, Sections 02.3.3, 02.4.1.1.3, and 02.4.2.2 describe how these stiffness and damping values are used in the soil-structure interaction analysis of the reactor building complex.

#### **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 a Technical/Topical Report.

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