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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. 856-6094 REVISION 3  
**SRP SECTION:** 03.07.02 – Seismic System Analysis  
**APPLICATION SECTION:** 3.7.2  
**DATE OF RAI ISSUE:** 10/24/11

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#### QUESTION NO. RAI 03.07.02-177:

In reviewing this technical report, MUAP-11011(R0), the staff found several areas which need further clarification, additional information, or editorial revision. The applicant is requested to address the following requests and questions:

1. In MUAP-11011(R0), the "Abstract" (Page II) states "The purpose of this report is to investigate the seismic response of the structure-soil-structure interaction (SSSI) effects among the US-APWR standard plant structures."

The applicant is requested to further clarify the purpose of these SSSI analyses by enumerating the expected specific physical and/or analytical effects and potential impact of any significant structure-soil-structure interaction on the seismic response of any of the standard plant structures. This information should describe both the types of physical impact that SSSI can have on the plant structures, and on the possible modifications of the seismic demands placed on each of these structures which may occur because of the SSSI.

2. In MUAP-11011(R0), "List of Acronyms" (Page VI), ARS is defined as "Amplified Response Spectra." In other technical reports (and the DCD) ARS is defined specifically as the "Acceleration Response Spectra."

The applicant is requested to choose a single consistent definition to avoid confusion.

3. In MUAP-11011 (R0), Section 1, "INTRODUCTION" (page 1) the first paragraph states "The focus of the initial phase of the investigation is on the seismic SSSI effects among the smallest and lightest US-APWR West Power Source Building (PS/B), the heaviest Reactor Building (R/B) Complex, and their adjacent Auxiliary Building (A/B). From the analyses results and assessment conclusions obtained from this initial investigation, the need for further investigations of the SSSI effects among the West and East PS/B, R/B Complex, A/B, and Turbine Building (T/B) will be determined and further SSSI analyses and result assessments will be made in subsequent phases, as required. The proposed analysis steps, in phases for assessment of SSSI effects on the US-APWR standard plant structures are outlined in Table 1.0-1."

The staff noticed that the initial investigation mentioned in the sentences above quoted is actually the "Analysis Step No. 2" in Table 1.0-1. The very first analysis listed in Table 1.0-1 involves only R/B and A/B. The applicant is requested to clarify this inconsistency.

4. In Section 2.0 of MUAP-11011 (R0), "Description of the US-APWR Standard Plant Layout," the second paragraph (Page 3) states, "From the SSSI effects perspective, it is anticipated that the seismic response of the larger and heavier structure will have a more significant effect on the seismic response than that of the smaller and lighter adjacent structures."

The staff finds the above quoted sentence confusing and its meaning unclear. The applicant is requested to revise this sentence to make the meaning clear.

5. In MUAP-11011(R0), Figure 2.0-1 (Page 3) shows the overall US-APWR standard plant layout (with North not defined). Later in the report, in Figure 3.3.1-1, the plant layout is the reverse of what is shown here, and the North direction is indicated. The applicant is requested to correct one or the other of these figures to make them consistent to avoid any possible confusion.
6. In Subsection 3.1 of MUAP-11011 (R0), "SSSI Analyses Methodology," the second paragraph (Page 5) states, "Due to the large coupled ACS SASSI (Reference 6) models involved, neglecting the embedment effect is currently the only viable approach that can be used to study such SSSI effects."

The applicant is requested to address whether or not the feasibility of including the embedment effect was considered in the SSSI study for a combined model of R/B and PS/B with both structures modeled by lumped mass stick models.

7. In Subsection 3.3.2 of MUAP-11011 (R0), "Coupled Dynamic SSSI Effect," the sixth paragraph (Page 30) states, "The results of the assessment of kinematic and dynamic SSSI effects described in this report are used as the basis to identify the critical generic site profile cases for which the SSSI effects is significant. The responses of PS/B obtained from the SSSI analyses of the identified critical site profile cases are enveloped with those of the SSI analyses of the standalone PS/B model."

Further, in Subsection 3.3.2 of MUAP-11011 (R0), the last paragraph (Page 30) states, "The findings of this initial study serve as a basis to determine whether additional assessments of SSSI effects are necessary between the R/B Complex and A/B, between T/B and PS/B, and between R/B Complex and T/B, in accordance with the phased approach as indicated in Table 1.0-1."

The staff is not able to identify the results of the dynamic SSSI effects described in this report, nor has the staff been able to locate the "...findings of this initial study..." (as in the second paragraph quoted above) in this report. The applicant is requested to provide section numbers in the current report where these results are presented. If the results are to be presented in Revision 1 of the Report, the applicant is requested to clarify this.

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#### **ANSWER:**

Technical Report MUAP-11011, Rev. 0 has been superseded and the relevant information on the structure-soil-structure interaction (SSSI) analysis methodology incorporated into Technical Report MUAP-10006, Rev. 3.

1. The SSSI analyses methodology is presented in Section 03.3.5 and the results are presented in Section 03.4.0 of Technical Report MUAP-10006, Rev. 3. The physical and analytical effects of the buildings on the seismic response are discussed in these sections. The possible effects from SSSI include modified dynamic response (frequency and amplitude) for the SSI analysis results for the Seismic Category I structures, but this is not a concern since

the conservative approach has been taken to fully envelope the seismic results of both the SSI and the SSSI analyses as stated in Section 03.3.6 of Technical Report MUAP-10006. Section 03.4.1.3 of this report states that both the access building and tank house are too small and light to have any significant SSSI effects on the response of the much heavier, larger reactor building (R/B) complex. Therefore, not considering the SSSI effects of these structures on the R/B complex does not affect the standard plant design.

2. The question is no longer applicable. Technical Report MUAP-10006, Rev. 3 has “ARS” defined as “Acceleration Response Spectra” that is consistent with the DCD acronym.
3. The question is no longer applicable. The standard plant layout has changed so the power source buildings (PS/Bs) together with R/B, prestressed concrete containment vessel (PCCV), containment internal structures, auxiliary building and essential service water pipe chase (ESWPC) are now placed on a common basemat. The SSSI analysis evaluates the effect of the turbine building (T/B) on the entire R/B complex.
4. The question is no longer applicable due to changes in the standard plant layout described in Part 3 above.
5. The question is no longer applicable due to changes in the standard plant layout described in Part 3 above.
6. The SSSI analysis in MUAP-10006, Rev. 3 considers the embedment of the R/B complex and the T/B.
7. The question is no longer applicable. The results of the SSSI analysis are presented in Section 03.4.0 of Technical Report MUAP-10006, Rev. 3.

#### **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 the Technical/Topical Report.

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This completes MHI's response to the NRC's question.