
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/31/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 660-5134 REVISION 2
SRP SECTION: 03.07.02 – Seismic System Analysis
APPLICATION SECTION: 3.7.2
DATE OF RAI ISSUE: 11/15/10

QUESTION NO. RAI 03.07.02-26 (03.07.02-53):

This request for additional information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR Part 50, Appendix A, General Design Criteria 2; 10 CFR Part 50 Appendix S; and 10 CFR Part 100; as well as the guidance in NUREG-0800, 'Standard Review Plan for the Review of Safety Analysis for Nuclear Power Plants,' Chapter 3.7.2, "Seismic System Analysis."

Several subgrade conditions are used for the SSI analyses described in MHI's Topical Reports, MUAP-10001 (R1) and MUAP-10006 (R0). However, the potential effect of structural fill (backfill) on SSI evaluation and the seismic response of the structures is not discussed.

The staff requests the applicant to provide a basis and technical justification for how the evaluation meets the guidelines of SRP 3.7.2.II.4 and how the potential effects of structural fill in the SSI analysis are considered.

ANSWER:

This answer revises and replaces the previous MHI answer that was transmitted by letter UAP-HF-10355 (ML110040071).

Technical Report MUAP-10001, Rev. 1 is superseded and incorporated into Technical Report MUAP-10006, Rev. 3.

The seismic design of the reactor building (R/B) complex is based on envelop of maximum seismic responses obtained from site-independent soil-structure interaction (SSI) analyses of the R/B complex for the generic layered soil/rock profiles presented in Tables 03.3.1-1 to 03.3.1-6 of MUAP-10006. As described in Section 01.4.2 of MUAP-10006, Rev. 3, these generic profiles are developed based on a database of measured soil properties and are representative of dynamic strain compatible properties of in-situ materials at typical candidate sites. The updated set of site-independent SSI analyses consider the R/B complex embedded in horizontally infinite strata of in-situ material with depth of approximately 42 ft from plant grade. The US-APWR standard design SSI and structure-soil-structure interaction analyses consider the effects of the near field structural fill (backfill) present on the sides of the basement exterior walls and the top of the essential service water pipe chase. Engineered fill materials below the foundation are not explicitly included in the standard plant generic layered profiles, and any use on a site-specific

basis is addressed in the site-specific SSI analyses, as required by COL Item 3.7(25). These near field backfill materials are represented in the finite element (FE) models for SSI and structure-soil-structure interaction analyses by solid elements connecting the free field in-situ soils and the basement structural elements. Figure 03.3.4.1-4, and 03.3.4.1-5 in Technical Report MUAP-10006 show the solid elements modeling the near field backfill materials in the model used for SSI analyses of R/B complex. Figure 03.3.4.2-3 presents the solid elements of combined model for structure-soil-structure interaction analyses representing the backfill placed around the R/B complex and between the R/B complex and the turbine building.

Section 03.3.1 of Technical Report MUAP-10006 describes the methodology used for development of the backfill properties. Two sets of small strain properties presented in Tables 03.3.1-8 and 03.3.1-9 of Technical Report MUAP-10006 that are typical for granular engineered fill material are used as input for the development of the strain compatible backfill properties. In order to cover a wide range of soil-structure frequencies, a backfill with relatively soft properties is used in conjunction with the generic soil profiles. A backfill with relatively stiff properties is used in conjunction with the generic rock profiles. Tables 03.3.1-10 through Table 03.3.1-15 of Technical Report MUAP-10006 provide the strain compatible backfill properties assigned to the near field elements used for SSI and structure-soil-structure interaction analyses of the different generic profiles.

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

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