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

June 27, 2013

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

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-13162

Subject: MHI's Response to US-APWR DCD RAI No. 1032-7098 (SRP 9.1.2)

Reference: 1) "Request for Additional Information No.1032-7098, Review Section: 09.01.02 – New and Spent Fuel Storage, Application Section: 9.1.2," dated May 13, 2013.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") the document entitled "Response to Request for Additional Information No. 1032-7098."

Enclosed are the responses to the twelve RAI questions contained within Reference 1.

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittal. His contact information is below.

Sincerely,

Yoshiki Ogata,
Executive Vice President
Mitsubishi Nuclear Energy Systems, Inc.
On behalf of Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Response to Request for Additional Information No.1032-7098

D081
NRO

CC: J. A. Ciocco
J. Tapia

Contact Information
Joseph Tapia, General Manager of Licensing Department
Mitsubishi Nuclear Energy Systems, Inc.
1001 19th Street North, Suite 710
Arlington, VA 22209
E-mail: joseph_tapia@mnes-us.com
Telephone: (703) 908 – 8055

Docket No.52-021
MHI Ref: UAP-HF-13162

Enclosure 1

UAP-HF- 13162
Docket Number 52-021

Response to Request for Additional Information No.1032-7098

June 2013

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/27/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 1032-7098**

SRP SECTION: **09.01.02 - New and Spent Fuel Storage**

APPLICATION SECTION: **9.1.2**

DATE OF RAI ISSUE: **5/13/2013**

QUESTION NO.: 09.01.02-28:

In MUAP-07033P (R0), Section 3.1.3, "Simulation and Solution Methodology," the paragraph at the top of Page 7 states, in part, "The solver computer algorithm, implemented in the Holtec Proprietary Code MR2v300 (a.k.a. DYNARACK) ..." and in Section 3.5, "Computer Codes," (Page 13) the paragraph states that "All computer codes used in this analysis are presented in Table 3-3."

The staff notices that the computer code, MR2v300, is not listed in Table 3-3. The applicant is requested to correct this error.

ANSWER:

Because MR2v300 means MR216 version 3.00, MR2v300 is the same computer code as MR216 listed in Table 3-3. To ensure consistency in terminology, the text in Subsection 3.1.3 and other sections will be revised to "MR216" instead of "MR2v300". This change will be incorporated in the next revision of technical report MUAP-07033-P.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

The computer code name, "MR2v300" in Subsection 3.1.3, Subsection 3.7.2.4 and Section 6 of MUAP-07033-P will be replaced with "MR216".

The revision of technical report MUAP-07033-P will be submitted in December 2013 as committed to in the seismic closure plan (UAP-HF-13034).

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/27/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 1032-7098**

SRP SECTION: **09.01.02 - New and Spent Fuel Storage**

APPLICATION SECTION: **9.1.2**

DATE OF RAI ISSUE: **5/13/2013**

QUESTION NO.: 09.01.02-29:

In MUAP-07033P (R0), Section 2.0, "US-APWR Fuel Racks," (Page 1) the last sentence of the second paragraph states that "The cell wall thickness of the new fuel rack (NFR) is 0.209 inches. For conservatism, however, the structural calculations for the NFR presented in this report assume that the cell wall thickness is only 0.18 inches."

The staff disagrees with the applicant's conclusion on conservatism by using a thinner cell wall thickness for the NFR rather than its actual thickness. Changing the wall thickness may not be always conservative because the stiffness and mass will also be changed; as a result of this, the natural frequency of the structure will change. This shift of natural frequency may result in a higher or lower acceleration for the thinner cell wall than that corresponds to the natural frequency calculated from a thicker cell wall. The applicant is requested to use the actual thickness in the analysis or provide a justification for the stated conservatism.

ANSWER:

In MUAP-07033-P (R0), the structural calculations for the NFR were presented assuming the thickness is 0.18 inches although the actual thickness is 0.209 inches. The actual thickness of 0.209 inches will be used in the next revision of technical report MUAP-07033-P.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

The change described in the response will be incorporated in the next revision of technical report MUAP-07033-P.

The revision of technical report MUAP-07033-P will be submitted in December 2013 as committed to in the seismic closure plan (UAP-HF-13034).

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/27/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 1032-7098**

SRP SECTION: **09.01.02 - New and Spent Fuel Storage**

APPLICATION SECTION: **9.1.2**

DATE OF RAI ISSUE: **5/13/2013**

QUESTION NO.: 09.01.02-30:

In MUAP-07033P (R0), Section 3.1.1, "Acceleration Time Histories," (Page 2) the first paragraph states, in part, that "The synthetic time-histories must meet the criteria of statistical independence, envelope the target design response spectra, and envelope the target Power Spectral Density function associated with the target response spectra." Based on the above sentence, the staff assumes that the target design response spectra is located at the pit level, and then the synthetic time-histories are generated to envelope them. The applicant is requested to provide the following information:

- Provide the target response spectra at the pit slab location that were used to generate the synthetic time histories
- Were the target response spectra derived from the soil-structure-interaction analysis? If not, provide justification for not including the soil-structure-interaction effect.
- What are the seeds of earthquake ground motions used to generate the synthetic time histories?
- What are the record length and the time increment of the synthetic time histories?

ANSWER:

For the first and second bulleted items, the current target response spectra for the fuel storage racks in MUAP-07033-P (R0) did not take into consideration the soil-structure-interaction effect. The target response spectra derived from the soil-structure-interaction analysis will be provided in the next revision of MUAP-07033-P.

For the third bulleted item, the seeds used to generate the synthetic time histories in the calculation for the current technical report MUAP-07033-P (R0) are random phase seeds. Seeds based on real recorded time histories are to be used in the next revision of MUAP-07033-P.

For the fourth bulleted item, the record length and time increment of the synthetic time histories will be 30 seconds and 0.01 seconds, respectively.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

The target response spectra are to be provided in the next revision of MUAP-07033-P.

The information of seeds based on real recorded time histories are to be added to the next revision of MUAP-07033-P.

The information for the record length and time increment of the synthetic time histories are to be added to the next revision of MUAP-07033-P.

The revision of technical report MUAP-07033-P will be submitted in December 2013 as committed to in the seismic closure plan (UAP-HF-13034).

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/27/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 1032-7098**

SRP SECTION: **09.01.02 - New and Spent Fuel Storage**

APPLICATION SECTION: **9.1.2**

DATE OF RAI ISSUE: **5/13/2013**

QUESTION NO.: 09.01.02-31:

In MUAP-07033P (R0), Section 3.1.1, "Acceleration Time Histories," (Page 2) the first sentence of the second paragraph states that "The SFRs [spent fuel racks] and NFRs [new fuel racks] have been analyzed using four different sets of acceleration time histories, which correspond to different soil conditions."
The applicant is requested to provide the following information:

- Identify the soil profiles used and confirm that they are consistent with those used in the seismic analysis of the standard plant.
- Explain why the fuel rack analysis did not include the remaining two soil profiles.
- Explain the applicant's plan to show the safety of the rack design under the remaining two soil profiles.

ANSWER:

The explanation of the soil profiles used in the seismic analysis of the US-APWR standard plant has been reported in MUAP-10006 (R3).

All the soil profiles used in the seismic analysis of the US-APWR standard plant is considered in the development of the target spectra for the fuel rack seismic analysis.

As described in the response to Question No.09.01.02-30, the target response spectra for fuel rack seismic analysis will be added to the next revision of MUAP-07033-P.

The safety of the rack design with consideration of all the soil profiles is to be shown in the next revision of MUAP-07033-P.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

The target spectra developed by considering all the soil profiles are to be shown in the next revision of MUAP-07033-P.

The revision of technical report MUAP-07033-P will be submitted in December 2013 as committed to in the seismic closure plan (UAP-HF-13034).

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/27/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 1032-7098**

SRP SECTION: **09.01.02 - New and Spent Fuel Storage**

APPLICATION SECTION: **9.1.2**

DATE OF RAI ISSUE: **5/13/2013**

QUESTION NO.: 09.01.02-32:

In MUAP-07033P (R0), Section 3.1.1, "Acceleration Time Histories," the first sentence of the first paragraph (page 2) states that "The response of a freestanding rack module to seismic inputs is highly nonlinear and involves a complex combination of motions (sliding, rocking, twisting, and turning), resulting in impacts and frictional effects. Linear methods, such as modal analysis and response spectrum techniques, cannot accurately replicate the response of such a highly nonlinear structure to seismic excitation," and the first sentence of the second paragraph states that "The SFRs [spent fuel racks] and NFRs [new fuel racks] have been analyzed using four different sets of acceleration time histories, which correspond to different soil conditions."

The approach stated above does not meet the acceptance criteria in SRP 3.7.1 for the design time histories Option 2, "Multiple Sets of Time Histories," which states that for nonlinear structural analyses, the number of time histories must be greater than four and the technical basis for appropriate number of time histories are reviewed on a case-by-case basis." The applicant is requested to provide a technical basis for considering only four time histories.

ANSWER:

MHI agrees that at least five sets of time histories are required in accordance with the SRP 3.7.1 Rev.3. Five sets of time histories will be constructed based on in-structural response spectra (ISRS) obtained by soil structure interaction (SSI) analysis reported in MUAP-10006 (R3). Five sets of seeds based on recorded natural earthquakes will be employed to construct five sets of time histories. This change will be incorporated in the next revision of MUAP-07033-P.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

Five sets of time histories will be used in the next revision of MUAP-07033-P.

The revision of technical report MUAP-07033-P will be submitted in December 2013 as committed to in the seismic closure plan (UAP-HF-13034).

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/27/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 1032-7098**

SRP SECTION: **09.01.02 - New and Spent Fuel Storage**

APPLICATION SECTION: **9.1.2**

DATE OF RAI ISSUE: **5/13/2013**

QUESTION NO.: 09.01.02-33:

In MUAP-07033P (R0), Section 3.1.4, "Conservatisms Inherent in the Methodology," (Page 8) item (2) states "All stored fuel assemblies are conservatively assumed to rattle in unison," which exaggerates the impact momentum between the fuel and the rack."

This sentence appears to imply that all racks are fully loaded. The staff is not convinced that assuming the full loading for every rack is conservative. Considering the following scenario: Assume a fully loaded rack subjected to an earthquake does not slide; Now consider two racks with one rack empty; and the other rack fully loaded. During the same earthquake, the lighter rack slides because its friction force at the base is now less than if it were fully loaded. The fully loaded one by itself would not slide; however, it may slide due to the impact from the lighter rack; thus, the whole system (the lighter rack and the fully loaded rack) slides. Based on the above example, the applicant is requested to provide a technical rationale that the assumption of all fully loaded racks is conservative. Otherwise, the applicant needs to consider the loading patterns in the analyses. The loading patterns considered should include the case of all racks completely empty.

ANSWER:

In the current technical report MUAP-07033-P (R0), the analysis cases corresponding to partial or empty loads were not performed.

A mixed loading configuration, in which only some of the racks are fully loaded and the others are partially loaded or empty, will be included in the next revision of technical report MUAP-07033-P. The mixed loading configuration will include a fully loaded rack directly adjacent to an empty rack and these results will be incorporated in the next revision of MUAP-07033-P. There is no need to consider the case of all racks completely empty since there is no risk of fuel damage or a criticality accident without any fuel in the spent fuel pool.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

The mixed loading configuration will include a fully loaded rack directly adjacent to an empty rack and these results will be incorporated in the next revision of MUAP-07033-P.

The revision of technical report MUAP-07033-P will be submitted in December 2013 as committed to in the seismic closure plan (UAP-HF-13034).

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/27/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 1032-7098**

SRP SECTION: **09.01.02 - New and Spent Fuel Storage**

APPLICATION SECTION: **9.1.2**

DATE OF RAI ISSUE: **5/13/2013**

QUESTION NO.: 09.01.02-34:

In MUAP-07033P (R0), Section 3.1.2.2, "Specific Modeling Details for Rack," the second paragraph under the title "Stiffness Matrix," (Page 6) states that "The SFR [spent fuel rack] and NFR [new fuel rackk] are subject to the SSE [safe-shutdown earthquake] earthquakes described in Section 3.1.1. Eight runs have been performed (Four each for the SFR and NFR) using a random value of coefficient of friction, with an upper and lower bound limits of 0.8 and 0.2 respectively."
The applicant is requested to provide the following information:
1. The value of coefficient of friction (COF) used with a particular analysis for all analyses.
2. Use the actual value of COF to replace the word "Random" in Tables 3-4 thru 3-8.

ANSWER:

For the current technical report MUAP-07033-P (R0), the coefficient of friction (COF) values are randomly assigned to each support pedestal included in the WPMR model at the beginning of the solution. Once the simulation begins, the COF values are held constant, which is to insure that the results are repeatable and recoverable as required by Holtec's QA program. Since there are 6 racks in the SFP and each rack has 5 pedestals, there are 30 COF values associated with each run. The 30 COF values are randomly assigned based on a Gaussian distribution having a mean value of 0.5 and upper and lower bound limits of 0.8 and 0.2, respectively.

Including all 30 COF values for each run in Tables 3-4 through 3-8 would make the tables overly complex since MHI believes that the significant information is that the COF values are controlled to have a mean value 0.5 and the COF for each pedestal is randomly assigned within the bound limits of 0.8 and 0.2. The individual COF values for each pedestal do not have significant meaning. For this reason, all of the detailed COF values are not included in the licensing document, MUAP-07033-P.

Furthermore, the COFs will be changed when the fuel rack analysis is conducted for the next revision of MUAP-07033-P (i.e., the random values will be regenerated).

However, in order to more clearly explain the meaning of "Random" in Tables 3-4 through 3-8, the following footnote will be added to the tables in the next revision of MUAP-07033-P.

Note: "Random" means that the coefficient of friction (COF) values are randomly assigned to each support pedestal based on a Gaussian distribution having a mean value of 0.5 and upper and lower bound limits of 0.8 and 0.2, respectively.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

The change described in the response will be incorporated in the next revision of technical report MUAP-07033-P.

The revision of technical report MUAP-07033-P will be submitted in December 2013 as committed to in the seismic closure plan (UAP-HF-13034).

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/27/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 1032-7098**

SRP SECTION: **09.01.02 - New and Spent Fuel Storage**

APPLICATION SECTION: **9.1.2**

DATE OF RAI ISSUE: **5/13/2013**

QUESTION NO.: 09.01.02-35:

In MUAP-07033P (R0), Section 3.1.2, "Modeling Methodology," the applicant described that "added mass" is used to model the effect of hydrodynamics. The staff notices that "added mass" appears to represent the impulsive part of the effect of hydrodynamics. The "sloshing" part of the effect of hydrodynamics is not mentioned in the report. The applicant is requested to explain how sloshing effects are addressed in the analysis.

ANSWER:

Based on the methodology in TID-7024 "Nuclear Reactors and Earthquakes, (1963)" Chapter 6, the stable water height is 3/8 times the height of the fluid. For the US-APWR, the SFP water depth is more than 44 feet. Then the stable water height can be calculated to be approximately 200 inches (16.7 feet) above the bottom of the SFP. The fuel racks, including pedestals, rest on the bottom of SFP and are approximately 210 inches (17.5 feet) tall. Only the upper 10 inches (approximately) of the racks, which represents approximately 5% of the overall rack height, extend above the constrained water mass. Moreover, the sloshing effect is most pronounced near the surface of the SFP water. At the top of the fuel racks, approximately 26.5 feet below the surface (44 feet – 17.5 feet), the sloshing effect would be almost non-existent. Therefore, seismic sloshing of the SFP water does not influence the dynamic response of the spent fuel racks.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

There is no impact on the Topical Report / Technical Report.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/27/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 1032-7098**

SRP SECTION: **09.01.02 - New and Spent Fuel Storage**

APPLICATION SECTION: **9.1.2**

DATE OF RAI ISSUE: **5/13/2013**

QUESTION NO.: 09.01.02-36:

In MUAP-07033P (R0), Section 3.7.3.2, "Weld Stress," the item (3), "Cell-to-Cell-Welds," (Page 17) the paragraph states that "These weld stresses are conservatively calculated by assuming that fuel assemblies in adjacent cells are moving out of phase with one another so that impact loads in two adjacent cells are in opposite directions."

The 3-D dynamic model described in Section 3.1.2, "Modeling Methodology," does not have individual cells. The applicant is requested to describe how the weld stresses in adjacent cells are obtained when the adjacent cells are moving out of phase with one another.

ANSWER:

The reviewer is correct that the 3-D dynamic model does not have individual cells. The dynamic model conservatively assumes that all of the stored fuel assemblies move in-phase, and therefore the total mass of all of the stored fuel assemblies is assigned to five lumped masses equally spaced over the height of the storage cells. After solution, the maximum impact load associated with a single lumped fuel mass is divided by the total number of stored fuel assemblies to obtain the maximum impact load per assembly. For the cell-to-cell weld evaluation, which is performed outside of DYNARACK using strength of materials formula, the maximum impact load per assembly is assumed to occur simultaneously in two adjacent storage cells in opposite directions.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

There is no impact on the Topical Report / Technical Report.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/27/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 1032-7098

SRP SECTION: 09.01.02 - New and Spent Fuel Storage

APPLICATION SECTION: 9.1.2

DATE OF RAI ISSUE: 5/13/2013

QUESTION NO.: 09.01.02-37:

In MUAP-07033P (R0), Section 3.1.2.2, "Specific Modeling Details for Rack," (Page 4) the first paragraph, in part, states that "While the horizontal motion of the rattling fuel mass is associated with five separate masses, the totality of the fuel mass is associated with the vertical motion and it is assumed that there is no fuel rattling in the vertical direction. In other words, the vertical displacement of the fuel is coupled with the vertical displacement of the rack (i.e., degree of freedom "P3" in Figure 3-1) by lumping the entire stored fuel mass (in the vertical direction only) with the vertical rack mass at the baseplate level."
In reality, the fuel assembly may separate from the baseplate during vertical ground motion. Therefore, the applicant is requested to provide a technical rationale for lumping the entire stored fuel mass at the baseplate level in the vertical direction.

ANSWER:

The zero period acceleration (ZPA) for the vertical earthquake direction in the current technical report MUAP-07033-P (R0) is less than 1-g. Therefore, the stored fuel assemblies will not separate from the base plate during a seismic event.

The ZPA for the vertical earthquake direction in the next revision of MUAP-07033-P will also be less than 1-g, thus no change to this methodology is required.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

There is no impact on the Topical Report / Technical Report.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/27/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 1032-7098**

SRP SECTION: **09.01.02 - New and Spent Fuel Storage**

APPLICATION SECTION: **9.1.2**

DATE OF RAI ISSUE: **5/13/2013**

QUESTION NO.: 09.01.02-38:

In MUAP-07033P (R0), Section 3.1.2.2, "Specific Modeling Details for Rack," the paragraph under the title of "Stiffness Matrix," (page 6) states that "The spring stiffnesses associated with the elastic elements that model the behavior of the assemblage of cells within a rack are based on the representation developed in (Reference 6-11). Tension-compression behavior and twisting behavior are each modeled by a single spring with linear or angular extension involving the appropriate coordinates at each end of the rack beam model. For simulation of the beam bending stiffness, a model is used consistent with the techniques of the reference based on a bending spring and a shear spring for each plane of bending, which connects the degrees of freedom associated with beam bending at each end of the rack."
There are a number of spring stiffnesses mentioned in this paragraph. Is there a study for the sensitivity of the impact forces to the variations in the spring stiffnesses used to model the behavior of the rack? If yes, the applicant is requested to provide a discussion and tabulate the results. If no, the applicant is requested to provide a technical rationale to support that the spring stiffnesses used will lead to conservative results.

ANSWER:

The mass-spring representation of a spent fuel rack in DYNARACK has been benchmarked against a full three-dimensional finite element model (in LS-DYNA) of the same rack. The benchmark study, which was performed as part of a previous project, showed that DYNARACK produced conservative results as compared to LS-DYNA. The results of the benchmark study have been previously provided to the NRC under docket number 50-412 in the form of a response to RAI #20 from a March 19, 2010 NRC letter (ML100760584).

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

There is no impact on the Topical Report / Technical Report.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/27/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 1032-7098

SRP SECTION: 09.01.02 - New and Spent Fuel Storage

APPLICATION SECTION: 9.1.2

DATE OF RAI ISSUE: 5/13/2013

QUESTION NO.: 09.01.02-39:

In MUAP-07033P (R0), Section 3.2.4, "Stress Limits for Various Conditions Per ASME," (Page 8) the paragraph, in part, states that "The SFR [spent fuel rack] and NFR [new fuel rack] are freestanding; thus, there is minimal or no restraint against free thermal expansion at the base of the rack. Moreover, thermal stresses are secondary which, strictly speaking, have no stipulated stress limits in Class 3 structures or components. Thermal loads applied to the rack are, therefore, not included in the stress combinations."

The staff agrees with the applicant that the thermal stress may be excluded from the stress combination. However, the thermal expansion will reduce the gaps between the fuel assembly and the cell as well as between racks. The gap reduction increases the possibility for impact between the fuel assembly and the cell as well as between racks. The applicant is requested to conduct the stress analyses considering the reduced gaps due to thermal expansions.

ANSWER:

MHI agree with the NRC staff. The reduced gaps due to thermal expansion and their effect on the stress analyses will be considered in the next revision of MUAP-07033-P.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

The reduced gaps due to thermal expansion, and their effect on the stress analyses, will be added to the next revision of MUAP-07033-P.

The revision of technical report MUAP-07033-P will be submitted in December 2013 as committed to in the seismic closure plan (UAP-HF-13034).