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November 11, 2010

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-10309

Subject: MHI's Response to US-APWR DCD RAI No. 647-4651 Revision 1 (SRP 09.01.01)

Reference: 1) "Request for Additional Information No. 647-4651 Revision 1, SRP Section 09.01.01 - Criticality Safety of Fresh and Spent Fuel Storage and Handling - Application Section: 9.1.1 dated 10, 7, 2010.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Response to Request for Additional Information No. 647-4651 Revision 1."

Enclosed is the response to a question contained within Reference 1.

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 below.

Sincerely,

Y. Ogata

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

Enclosure:

1. Response to Request for Additional Information No. 647-4651 Revision 1

CC: J. A. Ciocco
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Enclosure 1

UAP-HF-10309
Docket No. 52-021

Response to Request for Additional Information No. 647-4651
Revision 1

November, 2010

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

11/11//2010

US-APWR Design Certification

Mitsubishi Heavy Industries, Ltd.

Docket No. 52-021

RAI NO.:	**NO. 647-4651 REVISION 1**
SRP SECTION:	**9.1.1 – Criticality Safety of Fresh and Spent Fuel Storage and Handling**
APPLICATION SECTION:	**9.1.1**
DATE OF RAI ISSUE:	**10/7/2010**

QUESTION NO.: 09.01.01-22
Standard Review Plan Section 9.1.1 (NUREG-0800) states "accidental or erroneous placement of a fuel assembly outside of, but next to, the fuel storage racks should be considered as an abnormal condition". Section 2.2.1.2 of MUAP-07032-P, Criticality Analysis for US-APWR New and Spent Fuel Storage Racks, Revision 1, states, "The rack structure and the fuel handling equipment are designed to preclude the fuel assembly misplacement and drop as the fuel handling accident." Provide justification or calculation to validate this conclusion.

QUESTION NO.: 09.01.01-23
Standard Review Plan 9.1.1 (NUREG-0800) states that abnormal conditions such as dropped load should be considered. Section 2.2.1.2 of MUAP-07032-P, Criticality Analysis for US-APWR New and Spent Fuel Storage Racks, Revision 1, states, "The rack structure and the fuel handling equipment are designed to preclude the fuel assembly misplacement and drop as the fuel handling accident." Provide justification or calculation to validate this conclusion.

ANSWER:

For both questions, the following sentence in Section 2.2.1.2 of MUAP-07032-P is a concern:

> "The rack structure and the fuel handling equipment are designed to preclude the fuel assembly misplacement and drop as the fuel handling accident."

However, this statement is not correct because it is possible to place a fuel assembly outside the new fuel storage racks and for the new fuel handling equipment to drop an assembly.

Therefore, MHI will delete the above sentence in MUAP-07032-P and insert the following:

> "The new fuel pit is normally dry. Per paragraphs 2 and 3 of 10 CFR 50.68(b), the presence of moderator in the pit is an accident condition. Fuel misplacement and fuel drop are also accident conditions. In accordance with the double-contingency principle as defined in Section 3 of the Kopp memorandum (19 August 1998) "two unlikely independent and concurrent incidents or postulated accidents are beyond the scope of the required analysis." Section 4 of the Kopp memorandum further clearly defines two events with moderator in the pit (the two events also defined in paragraphs 2 and 3 of 10

CFR 50.68(b)) as accidents and states "Under the double-contingency principle, the accident conditions identified above are the principle conditions that require evaluation. The simultaneous occurrence of other accident conditions need not be considered."

Based on this regulatory guidance, there is no requirement to evaluate moderator intrusion coincident with a misplaced or dropped fuel assembly.

Even though the regulatory guidance discussed above would not require evaluating a fuel assembly dropped onto the new fuel racks coincident with moderator intrusion, statements in the SRP do appear to require these evaluations (even though the double contingency principle precludes any possibility of a criticality event). Three drop evaluations have been performed for the new fuel racks under a dry (moderator-free) condition to conservatively predict deformation as compared to a water-filled vault condition, as follows:

1. Shallow Drop – A fuel assembly falls and strikes the top of the new fuel storage rack.
2. Deep Drop 1 – A fuel assembly falls and strikes the baseplate of the new fuel storage rack in a location not above a rack support pedestal.
3. Deep Drop 2 – A fuel assembly falls and strikes the baseplate of the new fuel storage rack in a location above a rack support pedestal.

The results for these evaluations are as follows.

The shallow drop event results in plastic deformation in the top 10" (approximately) of material at the top of the rack. There is, however, over 17" of material above the active zone of the fuel assemblies, so the sub-critical geometry of the fuel assemblies is maintained.

The deep drop 1 event results in failure of several cell-to-baseplate welds, but the rack baseplate is not pierced and does not impact the floor, so there is no risk of damage to the new fuel vault structure from this event. Because there is no requirement to assume coincident moderator intrusion, as discussed above, there is no potential for any criticality consequences.

The deep drop 2 event results in a maximum force of 740,000 lbf being applied to the new fuel vault floor. This force will be used to design the embedment plates in the new fuel vault floor on which the rack would sit, to ensure that the embedment plates properly distribute the force generated by this event. There is no plastic deformation of the rack from this event (all impact energy is transferred through the rack pedestal to the vault floor). Because there is no requirement to assume coincident moderator intrusion, as discussed above, there is no potential for any criticality consequences.

Also, although not specifically mentioned in the RAI itself, it is our understanding that the NRC Staff has requested that a basis be provided for not evaluating the pit under dry (i.e., moderator free) conditions. From a regulatory perspective, it is noted that both the Kopp memorandum and SRP 9.1.1.would seem to preclude the need for evaluating the dry condition. With respect to the Kopp memorandum, we note that Section 4, which is titled "New Fuel Storage Facility (Vault)," recognizes the normally-dry nature of the new fuel storage facility, and only requires evaluation of conditions with moderator present as accident. With respect to SRP 9.1.1, Item 1.A and 1.B in Section III only describe requiring that new fuel be maintained in subcritical condition in the presence of moderator and that provision be provided for draining moderator from the storage vault. Based on this regulatory guidance, there is no requirement to evaluate the new fuel pit under dry conditions.

Impact on DCD
No impact on DCD

Impact on COLA

No impact on COLA

Impact on PRA
No impact on PRA