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November 25, 2011

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

Attention: Mr. Jeffery A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-11411

Subject: MHI's Response to US-APWR DCD RAI No. 847-6064 Revision 3 (SRP 03.09.03)

References: 1) "Request for Additional Information No. 847-6064 Revision 3, SRP Section: 03.09.03 –ASME Code Class 1, 2, and 3 Components Application Section: Section 3.9.3," dated 10/20/2011.

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. 847-6064, Revision 3."

Enclosed is the response to question 27 of the RAI (Enclosure 1). The response to question 27 of this RAI has a 30-day response time as agreed to between the NRC and MHI.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,

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

Enclosures:

1. Response to Request for Additional Information No.847-6064, Revision 3

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NRO

CC: J. A. Ciocco
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Enclosure 1

UAP-HF-11411
Docket No. 52-021

Response to Request for Additional Information No.847-6064, Revision 3

November 2011

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

11/25/2011

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 847-6064 REVISION 3**
SRP SECTION:	**03.09.03 – ASME Code Class 1, 2, and 3 Components**
APPLICATION SECTION:	**3.9.3**
DATE OF RAI ISSUE:	**10/20/2011**

QUESTION NO. RAI 03.09.03-27:

This RAI is a supplemental RAI of RAI 209, Question 03.09.03-5:
The identification of individual loads and the appropriate combination of these loads (i.e., sustained loads, loads due to system operating transients (SOT), OBE, SSE, LOCA, DBPB, MS/FWPB and their dynamic effects) are following the SRP Section 3.9.3, subsection 1.3 guidance. The appropriate method of combination of these loads is provided in NUREG-0484, "Methodology for Combining Dynamic Loads."

In DCD Tier 2 Section 3.9.3, Table 3.9-3 and 3.9.3-4, Rev. 3, MHI has the load combinations for components and component supports associated with ASME Service Levels A, B, C and D. The load combinations of dynamic loads in Level D Service have not demonstrated the methodology used of NUREG-0484. The staff requests MHI to provide additional clarification and justification for the third and fourth load combination lines of Level D Service Tables 3.9-3 and 3.9-4, as follows:

DCD Tier 2, Section 3.9.3, Table 3.9-3, Level D Service, 3rd and 4th lines

- 3rd load combination line: Not clear why SRSS is used for SSEI and SSEA. They should be combined absolute sum as in all other load combination lines. Clarify this discrepancy.

- 4th load combination line: SRSS is used for (SSEI+SSEA), DBPB, and LDF load combinations. No justification is given as to why this is acceptable except note 8 states that the timing sequence and initiating conditions that occur between PM, LDF and LEM are considered. Please clarify what this means and provide justifications for using SRSS for these dynamic loads.

DCD Tier 2, Section 3.9.3, Table 3.9-4, Level D Service, 3rd and 4th lines

- 3rd load combination line: Not clear why SRSS is used for DBPB, (SSEI + SSEA + SE). First, SRSS for LOCA and SSE load combinations must be established using guidance given in NUREG-0484. Second, note 6 should be for the combination of (SSEI + SSEA + SE), not the SRSS for DBPB and (SSEI + SSEA + SE). Clarify the discrepancy.

- 4th load combination line: SRSS is used for (SSEI+SSEA), DBPB, and L_{DFF} load

combinations. No justification is given why this is acceptable except note 7 states that the timing sequence and initiating conditions that occur among THi and L_{DFF} are considered. Please clarify what this means and provide justifications for using SRSS for these dynamic loads.

ANSWER:

For DCD Tier 2, Revision 3, Table 3.9-3, in the third equation of the Level D Design Loading Combinations, there was a typographical error that included "SRSS(2)" in the equation. The "SRSS(2)" will be deleted to remedy this error, and SSEI and SSEA will be combined by the absolute sum method. In the fourth equation of the Level D Design Loading Combinations, there was a typographical error that included ")" after the "L_{DF}" in the equation. The ")" will be moved before the "L_{DF}" to remedy this error, thus L_{FD} will not be combined with (SSEI+SSEA) and DBPB by SRSS.

For DCD Tier 2, Revision 3, Table 3.9-4, in the third equation of the Level D Service Design Loading Combinations, there was a typographical error in the position of "(6)." To correct this error, "(6)" will be moved to be included within the last parenthesis. In the fourth equation of the Level D Service Design Loading Combinations, the position of "(6)" will be moved to reflect the previous correction and the ")" after "L_{DF}" will be deleted because it was also a typographical error. The DBPB and (SSEI+SSEA+SE) were combined via SRSS according to NUREG-0484. Furthermore, the "TH_i" in note 7 was an error, and will be corrected to "$L_{EM,}$" as originally intended.

After re-examining the DCD, MHI has identified a typographical error in Table 3.12-4. MHI would like to take this opportunity to proactively amend this typographical error, as shown in the attached DCD Tier 2 Revision 3 Chapter 3.12 mark-up

Impact on DCD

See Attachment 1 for the mark-up of DCD Tier 2, Section 3.9 and Section 3.12 for the changes to be incorporated.

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 concludes MHI's response to the NRC's question.

Table 3.9-3 Design Loading Combinations for ASME Code, Section III, Class 1, 2, and 3 CS Systems and Components

ASME Service Level	Design Loading Combinations[3][6]
Design	$P + DL + L_{DM} + L_{EM}$
Level A	P_M[1] $+ DL + L_{EM}$
	P_M[1] $+ DL + L_{DFN}$[7] $+ L_{EM}$[7] $+ TH_{TRN} + TH_{MTL}$
Level B	P_M[1] $+ DL + L_{EM}$[7] $+ TH_{TRN} + TH_{MTL} + SRSS$[2] $((SSEI + SSEA)$[11] $+ L_{DFU}$[7]$)$
Level C	P_M[1] $+ DL + L_{DFE}$[7] $+ L_{EM}$[7]
	P_M[1] $+ DL + L_{DF} + L_{EM}$[8]
Level D	P_M[1] $+ DL + L_{DFF}$[7] $+ L_{EM}$[7]
	P_M[1] $+ DL + SRSS$[2] $((SSEI + SSEA) + DBPB) + L_{EM}$[4]
	P_M[1] $+ DL + RV_{OS} + $ ~~$SRSS$[2]~~ $(SSEI + SSEA) + L_{EM}$[9]
	P_M[1] $+ DL + L_{DFS} + SRSS$[2] $((SSEI + SSEA) + DBPB) + $ ~~L_{DF}~~ $+ L_{EM}$[8]
Hydrostatic Test	H_{DL}[10]

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Notes:

1. P_M is the maximum operational pressure for various ASME service levels of operation and dependent on the type of transient that occurs at a particular service level. During an earthquake P_M is considered normal operational pressure at 100% power levels.
2. SRSS sums the squares of each load and determines the resultant square root.
3. Loadings generated by static displacement of the concrete containment vessel and building settlement are added to the loading combinations for ASME Code, Section III, Class 2 and 3 systems.
4. When determining appropriate load combinations involving L_{EM}, a determination of the timing sequence and initiating conditions that occur between P_M and L_{EM} are considered.
5. Deleted.
6. Table 3.9-5 provides a description of loads listed in this table.
7. In determining service level A, B, C, and D load combinations, the timing sequence and initiating conditions that occur between P_M, L_{DFN}, L_{DFU}, L_{DFE}, L_{DFF}, and L_{EM}, are considered respectively.
8. In determining appropriate service level load combination, the timing sequence and initiating conditions that occur between P_M, L_{DF}, and L_{EM}, are considered.
9. In determining appropriate service level load combination, the timing sequence and initiating conditions that occur between P_M, RV_{OS}, and L_{EM}, are considered.
10. If, during operation, the system normally carries a medium other than water (air, gas, steam), sustained loads should be checked for weight loads during hydrostatic testing as well as normal operation weight loads.
11. The earthquake inertial and anchor movement loads used in the Level B Stress Intensity Range and Alternating Stress calculations are taken as 1/3 of the peak SSE inertial and anchor movement loads or as the peak SSE inertial and anchor movement loads. If the earthquake loads are taken as 1/3 of the peak SSE loads then the number of cycles to be considered for earthquake loading are 300 as derived in accordance with Institute of Electrical and Electronic Engineers Standard 344-2004 (Reference. 3.9-34). If the earthquake loads are taken as the peak SSE loads then 20 cycles of earthquake loading are considered.

Table 3.9-4 Design Loading Combinations for Supports for ASME Code, Section III, Class 1, 2, and 3 Components

Condition	Design Loading Combinations[3]	
Design	$DL + L_{DM}$	
Level A Service	$DL + TH_i + L_{EM} + L_{DFN}$[4] $+ F$	
Level B Service	$DL + TH_i + L_{EM} + L_{DFU}$[4]	
Level C Service	$DL + TH_E + L_{EM} + L_{DFE}$[4]	
Level D Service	$DL + TH_i + L_{EM} + RV_{OS} + SSEI + SSEA + SE$[6][8]	
	$DL + TH_F + L_{EM} + L_{DFF}$[4]	
	$DL + TH_i + L_{EM} + SRSS\ (DBPB + (SSEI + SSEA + SE))$[6]	DCD_03.09.03-27
	$DL + TH_i + L_{EM}$[7] $+ L_{DFS} + SRSS\ (DBPB + (SSEI + SSEA + SE))$[6] $+ L_{DF}$[7]	DCD_03.09.03-27
Hydrostatic Test	H_{DL}[9]	

Notes:

1. SRSS sums the squares of each load and determines the resultant square root.
2. Deleted.
3. Table 3.9-5 provides a description of loads listed in this table.
4. In determining service level A, B, C, and D load combinations, the timing sequence and initiating conditions that occur between TH_E, TH_F, L_{DFN}, L_{DFU}, L_{DFE}, L_{DFF}, and L_{EM}, are considered respectively.
5. Deleted.
6. *SE* is support self weight excitation of the support, caused by seismic building inertial loads. *SSEI*, *SSEA*, and *SE* are combined using absolute summation.
7. In determining appropriate service level load combination, the timing sequence and initiating conditions that occur among ~~TH_i~~ L_{EM} and L_{DF} are considered. DCD_03.09.03-27
8. In determining appropriate service level load combination, the timing sequence and initiating conditions that occur among TH_i and RV_{OS} are considered.
9. If, during operation, the system normally carries a medium other than water (air, gas, steam), sustained loads should be checked for weight loads during hydrostatic testing as well as normal operation weight loads.

Table 3.12-4 Loading Combinations for Piping Supports

Condition	Design Loading Combinations[3]
Level A Service	$DL + L_{DMS} + L_{DFN} + TH_{MTL} + F + SET$
Level B Service	$DL + L_{DMS} + L_{DFU} + TH_{MTL} + W + SET$
Level C Service	$DL + L_{DMS} + L_{DFE} + TH_{E} + W_{T} + SET$
Level D Service	$DL + L_{DMS} + L_{DFF} + TH_{F} + SET$ $DL + L_{DMS} + L_{DFF} + TH_{MTL} + DBPB + SET$ $DL + L_{DMS} + L_{DFF} + TH_{MTL} + SET + SRSS(DBPB + (SSEI + SSEA + SE)^{(2)})^{(1)}$ ~~(2), (3)~~

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Notes:

1. SRSS sums the squares of each load and determines the resultant square root.

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2. ~~Dynamic loads are combined by the *SRSS*.~~

3. Combine *SSEI*, *SSEA*, and *SE* by absolute sum method. *SE* is support self weight excitation, the effect of the acceleration of the support mass caused by building inertial loads such as *SSEI*.

4. If, during operation, the system normally carries a medium other than water (air, gas, steam), sustained loads should be checked for weight loads during hydrostatic testing as well as normal operation weight loads.