

REQUEST FOR ADDITIONAL INFORMATION 606-4827 REVISION 2

7/20/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 17.04 - Reliability Assurance Program (RAP)

Application Section: 17.04 - Reliability Assurance Program

QUESTIONS for PRA and Severe Accidents Branch (SPRA)

17.04-50

Section 17.4.4 ("Quality Controls") of the US-APWR DCD, Revision 2, describes the quality controls for D-RAP activities. Part e ("Corrective Action") of Section 17.4.4 states: "The CAP utilized to support the QAPD can be used to implement the corrective actions related to the RAP." The use of the word "can" in the above statement suggests that there may be a possible alternative method for implementing the corrective actions related to the RAP (e.g., if the CAP described under the QAPD is not utilized, then what method would be used to implement the corrective actions related to the RAP).

The staff requests that MHI clarify the above statement. For example, the following clarification would be acceptable: "The CAP utilized to support the QAPD is used to implement the corrective actions related to the RAP."

17.04-51

The non-safety-related systems, structures, and components in the scope of RAP (RAP SSCs) should be subjected to quality assurance (QA) controls in accordance with the provisions of Subsection V ("Nonsafety-Related SSC Quality Controls") in Section 17.5 of the Standard Review Plan (SRP) for all phases of the D-RAP. Therefore, during Phase 1 of the D-RAP for the design certification (DC), the non-safety-related RAP SSCs should be subjected to the appropriate QA controls described in Section 17.5 ("Quality Assurance Program Description") of the US-APWR DCD, Revision 2. During Phases II and III of the D-RAP for the combined license (COL) applicant and holder, the non-safety-related RAP SSCs should be subjected to the appropriate QA controls described in the COL's QA program description (QAPD). However, it is not clear in Section 17.4 of the US-APWR DCD that the non-safety-related RAP SSCs will be subjected to these QA controls. In addition, the boundaries (e.g., electrical and mechanical boundaries) of the RAP SSCs should be defined so that the RAP SSCs can be effectively communicated to the organizations that implement the D-RAP and to provide a common basis for understanding the RAP SSCs (e.g., it is important to know the boundaries of the RAP SSCs for which the QA controls are applicable).

The staff requests that MHI clarify in Section 17.4 of the US-APWR DCD that the non-safety-related RAP SSCs would be subjected to the appropriate QA controls that are described in the QAPD of the DC and COL for all phases of the D-RAP. Also, MHI should define or identify in Section 17.4 the boundaries (e.g., electrical and mechanical

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boundaries) of the RAP SSC (it is acceptable to cite specific documents where the RAP SSC boundaries are defined).

17.04-52

SECY-95-132, Item E, states that an application for advanced reactor design certification must describe the process to determine dominant failure modes that considers industry operating experience, analytical models, and applicable requirements. It is not clear in Part b (“Dominant Failure Mode Identification”) in Section 17.4.7.1 (“SSCs Identification”) of the US-APWR DCD, Revision 2, that industry operating experience was considered by the expert panel in the identification of the dominant failure modes.

The staff requests that MHI include in their process for determining dominant failure modes (which is described in Part b of Section 17.4.7.1 of the US-APWR DCD) the consideration or review of industry operating experience.

17.04-53

Section 17.4.7.2 (“Expert Panel”) of the US-APWR DCD, Revision 2, describes the qualification requirements for members of the reliability assurance program (RAP) expert panel. Section 17.4.7.2 states:

“The level of education and experience of voting member of the RAP EP is defined in the Expert Panel Implementing Procedure for US-APWR Reliability Assurance Program as follows:

- A person who has graduated science and technology university or who has identical educational background, and who has more than 10 years of experience in the specific area of Nuclear Power Plant, such as design, or has identical experience.

or

- A person who has graduated high school or who has identical educational background, and who has more than 15 years of experience in the specific area of Nuclear Power Plant, such as design, or has identical experience.”

The qualification requirements described in the statement above is not clear. For example, “A person who has graduated science and technology university” does not necessarily imply a science or technical/engineering degree. “A person who has graduated high school” includes those who have “graduated science and technology university.” It should be noted that MHI’s response to RAI 17.04-14 (in the letter dated December 12, 2008) satisfactorily described the qualification requirements for members of the expert panel. However, this description was not used in Section 17.4.7.2 of the US-APWR DCD, Revision 2.

The staff requests that MHI more clearly describe in Section 17.4.7.2 of the US-APWR DCD the qualification requirements for members of the expert panel.

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17.04-54

Regulatory Guide 1.206, Section C.III.1, Subsection C.I.17.4.4 states that the COL applicant should provide in Chapter 17 of the final safety analysis report (FSAR), in accordance with the provisions in SRP Section 17.4, the quality controls (organization, design control, procedures and instructions, records, corrective action, and audit) for developing and implementing the D-RAP. Section 17.4.4 ("Quality Controls") of the US-APWR DCD, Revision 2, discusses the quality controls for developing and implementing the D-RAP that MHI imposed during the design certification phase. While the D-RAP quality controls that are applied by a COL applicant referencing the US-APWR DCD may be similar to that described in the Section 17.4.4 of the US-APWR DCD, the COL applicant should impose its own quality controls for developing and implementing D-RAP.

The staff requests that MHI add a COL license information item to Section 17.4.9 of the US-APWR DCD for the COL applicant to describe the D-RAP quality controls (organization, design control, procedures and instructions, records, corrective action, and audit) that will be applied by the COL applicant during Phases II and III of the D-RAP (e.g., the COL applicant should update Section 17.4.4 with their plant-specific design, programmatic, procedural, and organizational information).

17.04-55

COL License Information Item 17.4(2) in Section 17.4.9 ("Combined License Information") of the US-APWR DCD, Revision 2, states:

"The COL Applicant shall be responsible for the development and implementation of the O-RAP, in which the RAP activities should be integrated into the existing operational program (i.e., Maintenance Rule, surveillance testing, in-service inspection, in-service testing, and QA)."

The use of the text "i.e.," (which means "that is") in the above statement implies that the RAP activities should be integrated into maintenance rule, surveillance testing, in-service inspection, in-service testing, and QA. While, the RAP activities would likely be integrated into the above mentioned programs, the COL applicant may also identify other applicable programs (e.g., maintenance program). As such, the use of the text "i.e.," in the above quoted statement is not appropriate. However, replacing that text with "e.g.," (which means "for example") would be more appropriate.

The staff requests that MHI make this appropriate change in COL License Information Item 17.4(2) in Section 17.4.9 of the US-APWR DCD; otherwise provide a justification for not making this change.

17.04-56

The staff requests that MHI address the following comments on Table 17.4-1 ("Risk-Significant SSCs") of the US-APWR DCD, Revision 2:

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- a) In general, the SSCs within the scope of RAP in Table 17.4-1 are clearly identified using text descriptions and specific SSC identification numbers, when applicable. However, the acronym “TBD” (to be determined) is used throughout Table 17.4-1 and needs to be completed. Note, it is acceptable to clearly identify the risk-significant SSCs using text descriptions when specific SSC identification numbers are not available.
- b) Item 1 on page 17.4-17 in Table 17.4-1 for the “Containment Isolation System” states:

“Instrument air system check valves
[IAS-MOV-002], [CAS-VLV-003]”

The Instrument Air system containment isolation valves include a motor-operated valve and a check valve. Therefore, there is an inconsistency between the above component text description and the component identification numbers.

- c) Emergency Feedwater System (EFWS) motor-operated valves MOV-101A,B,C,D (see Figure 4.1-7 in the US-APWR Probabilistic Risk Assessment, PRA, MUAP-07030(R2)) are not considered risk-significant in Table 17.4-1 of the US-APWR DCD. Provide the basis for not including these valves in Table 17.4-1 of the US-APWR DCD. Please include in your discussion: the associated risk importance measures (e.g., RAWs and FVs) if available, the consideration of risk evaluations that cover the full spectrum of potential events and the range of plant operating modes considered in Chapter 19 of the US-APWR DCD, and the expert panel’s deliberation for not including these valves in RAP.
- d) The Emergency Feedwater Pump Actuation Cabinets are included in the Seismic Equipment List (see Table 24.4-1, page 24-66, in the US-APWR PRA, MUAP-07030(R2)). Provide the basis for not including these cabinets in Table 17.4-1 of the US-APWR DCD.
- e) Fire Suppression System valve FSS-MOV-004, check valve FSS-VLV-006, and orifice FS02 (see Figure 4.1-13 in the US-APWR PRA, MUAP-07030(R2)) are not considered risk-significant in Table 17.4-1 of the US-APWR DCD. Provide the basis for not including these components in Table 17.4-1 of the US-APWR DCD. Please include in your discussion: the associated risk importance measures (e.g., RAWs and FVs) if available, the consideration of risk evaluations that cover the full spectrum of potential events and the range of plant operating modes considered in Chapter 19 of the US-APWR DCD, and the expert panel’s deliberation for not including these components in RAP.
- f) MHI stated in their response to RAI 17.04-15 (dated December 12, 2008) that the fire suppression pumps will be added to Table 17.4-1 considering the expert panel deliberations. Based on the US-APWR DCD, Revision 2, the fire suppression pumps were not added to Table 17.4-1. Provide the basis for not including these pumps in Table 17.4-1 of the US-APWR DCD. Please include in your discussion: the associated risk importance measures (e.g., RAWs and FVs) if available, the consideration of risk evaluations that cover the full spectrum of potential events and the range of plant operating modes considered in Chapter

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19 of the US-APWR DCD, and the expert panel's deliberation for not including these pumps in RAP.

- g) Item 14 on page 17.4-31 in Table 17.4-1 states:

“Minimum flow line manual valves
[SIS-MOV-024 A(B,C,D)]”

However, according to Figure 6.3-2 of the US-APWR DCD and Figure 4.1-2 of the US-APWR PRA, valves SIS-MOV-024A,B,C,D are motor-operated valves and not manual valves. Therefore, there is an inconsistency between the above component text description and the component identification numbers.

- h) Item 5 on page 17.4-37 in Table 17.4-1 states that Main Steam Safety Valves MSS-VLV-509A-D and MSS-VLV-510A-D are risk-significant. However, Main Steam Safety Valves MSS-VLV-511A-D, 512A-D, 513A-D, 514A-D (see Figure 4.1-9 of the US-APWR PRA) are not considered risk-significant in Table 17.4-1. Provide the basis for not including these valves in Table 17.4-1 of the US-APWR DCD. Please include in your discussion: the associated risk importance measures (e.g., RAWs and FVs) if available, the consideration of risk evaluations that cover the full spectrum of potential events and the range of plant operating modes considered in Chapter 19 of the US-APWR DCD, and the expert panel's deliberation for not including these valves in RAP.
- i) Item 13 on page 17.4-40 in Table 17.4-1 considers the piping for CS/RHR Train A as risk-significant. Provide the basis for not including in Table 17.4-1 of the US-APWR DCD the piping for CS/RHR Trains B, C, and D. Please include in your discussion: the associated risk importance measures (e.g., RAWs and FVs) if available, the consideration of risk evaluations that cover the full spectrum of potential events and the range of plant operating modes considered in Chapter 19 of the US-APWR DCD, and the expert panel's deliberation for not including this piping in RAP.
- j) Chilled Water System (VWS) check valves VWS-VLV-005B,C (see Figure 4.1-19 of the US-APWR PRA) are not considered risk-significant in Table 17.4-1. However, common cause failure of these check valves could fail VWS Trains B and C; and therefore, fail HVAC to the motor-driven EFWS pumps. Provide the basis for not including in Table 17.4-1 of the US-APWR DCD these check valves. Please include in your discussion: the associated risk importance measures (e.g., RAWs and FVs) if available, the consideration of risk evaluations that cover the full spectrum of potential events and the range of plant operating modes considered in Chapter 19 of the US-APWR DCD, and the expert panel's deliberation for not including these check valves in RAP.
- k) During an ATWS (anticipated transient without scram) event, the operators initiate boric acid transfer to concentrate the boron in the reactor coolant. Provide the basis for not including in Table 17.4-1 of the US-APWR DCD the boric acid transfer SSCs. Please include in your discussion: the associated risk

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importance measures (e.g., RAWs and FVs) if available, the consideration of risk evaluations that cover the full spectrum of potential events and the range of plant operating modes considered in Chapter 19 of the US-APWR DCD, and the expert panel's deliberation for not including these SSCs in RAP.

17.04-57

Some component identification numbers (IDs) provided in Table 17.4-1 ("Risk Significant SSCs") of the US-APWR DCD, Revision 2, are not consistent with the component IDs used in the US-APWR Probabilistic Risk Assessment (PRA) (MUAP-07030(R2)). For the following listed components, the staff requests that MHI make the component IDs used in the US-APWR PRA consistent with that used in the US-APWR DCD (e.g., the component IDs in Table 17.4-1 and Chapter 19).

Component ID in Table 17.4-1 of DCD Associated Component ID in MUAP-07030(R2)

CVS-FCV-048 (Page 17.4-8) FCV-138 (Figure 4.1-5)

CVS-FCV-050 (Page 17.4-8) FCV-140 (Figure 4.1-5)

CVS-LCV-031B,C (Page 17.4-8) LCV-121B,C (Figure 4.1-5)

CVS-LCV-031D,E,F,G (Page 17.4-8) LCV-121D,E,F,G (Figure 4.1-5)

CVS-FE-048 (Page 17.4-10) FE-138 (Figure 4.1-5)

CVS-FE-060,070,080,090 (Page 17.4-10) FE-150,160,170,180 (Figure 4.1-5)

NCS-FE-034, 035, 037, 038 (Page 17.4-13) FE-1224, 1225, 1227, 1228 (Figure 4.1-14)

NCS-FE-040, 041, 042, 043 (Page 17.4-13) FE-1230, 1231, 1232, 1233 (Figure 4.1-14)

NCS-FE-080, 081, 082, 083 (Page 17.4-13) FE-1270, 1271, 1272, 1273 (Figure 4.1-14)

NCS-FE-084, 085, 086, 087 (Page 17.4-13) FE-1274, 1275, 1276, 1277 (Figure 4.1-14)

NCS-FE-056, 057, 058, 059 (Page 17.4-14) FE-1246, 1247, 1248, 1249 (Figure 4.1-14)

NCS-FE-060, 061, 062, 063 (Page 17.4-14) FE-1250, 1251, 1252, 1253 (Figure 4.1-14)

NCS-FE-052, 053, 054, 055 (Page 17.4-14) FE-1242, 1243, 1244, 1245 (Figure 4.1-14)

NCS-FE-076, 077 (Page 17.4-15) FE-1266, 1267 (Figure 4.1-14)

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NCS-FE-070, 071 (Page 17.4-15) FE-1260, 1261 (Figure 4.1-14)

NCS-FE-036, 039 (Page 17.4-15) FE-1226, 1229 (Figure 4.1-14)

VWS-TCV-041A,041B,042A,042B (Page 17.4-27) TCV-2420A,B, 2423C,D (Figure 4.1-10)

MSS-HCV-565, 575, 585, 595 (Page 17.4-37)HCV-3615, 3625, 3635, 3645 (Figure 4.1-9)

MSS-TCV-550A through Q (Page 17.4-37)TCV-500A through Q (Figure 4.1-9)

RHS-FCV-021, 031 (Page 17.4-39) Associated ID's in the PRA seem to be different

RHS-HCV-023, 033 (Page 17.4-39) Associated ID's in the PRA seem to be different

RHS-FE-011, 021, 031, 041 (Page 17.4-39) Associated ID's in the PRA seem to be different

EWS-FT-070, 071, 072, 073 (Page 17.4-46) FT-2060, 2061, 2062, 2063 (Figure 4.1-15)

EWS-FE-034, 035, 036, 037 (Page 17.4-46) FE-2024, 2025, 2026, 2027 (Figure 4.1-15)

Associated ID in DCD seem to be different RHS-FCV-611 (Item 13 on Page 17.4-40)

17.04-58

Table 17.4-1 ("Risk-Significant SSCs") of the US-APWR DCD, Revision 2, provides the dominant failure modes for each risk-significant SSC. For the following listed SSCs, the staff requests that MHI provide the basis for not considering the associated failure modes as dominant failure modes in Table 17.4-1. [Note, some of the failure modes listed below are exhibited during implementation of risk-significant operator actions. For example, during the risk-significant operator action to operate alternate containment cooling, the operator closes isolation valves VWS-MOV-401, 409. Therefore, failure modes OM (spurious opening) and CD (fail to close) could be dominant failure modes for these valves.]

Component ID in Table 17.4-1 of DCD Potentially Dominant Failure Modes

NCS-MOV-020C,D (Page 17.4-12) OD (fail to open), CM (spurious closure)
[Note, operator action for alternate containment cooling by containment fan cooler unit requires opening these valves.]

NCS-MOV-007C,D (Page 17.4-12) OD (fail to open), CM (spurious closure)
[Note, operator action for alternate containment cooling by containment fan cooler unit requires opening these valves.]

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Piping (Item 49 on Page 17.4-16) Failure mode "SF" (software failure) in Table 17.4-1 does not appear to be correct.

EFS-VLV-020A, B, C, D (Page 17.4-19) OD (fail to open)

EFS-VLV-022A, B, C, D (Page 17.4-19) OD (fail to open)

EFS-MOV-014A, B, C, D (Page 17.4-19) OD (fail to open), CD (fail to close), CM (spurious closure), OM (spurious opening)

EFS-MOV-019A, B, C, D (Page 17.4-19) OD (fail to open), CD (fail to close), CM (spurious closure), OM (spurious opening)

EFS-VLV-102A, B, C, D (Page 17.4-20) OD (fail to open), PR (plug)

VWS-MOV-401, 409 (Page 17.4-27) CD (fail to close), OM (spurious opening)

SIS-VLV-010A, B, C, D (Page 17.4-30) FS (functional failure by seismic hazard)

MSS-MOV-507A, B, C, D (Page 17.4-37) Is failure mode "CF" correct in Table 17.4-1? This failure mode is not defined in Table 17.4-1.

RHS-MOV-021A, B, C, D (Page 17.4-39) OD (fail to open), CD (fail to close), CM (spurious closure), OM (spurious opening)

RWS-VLV-012A,B (Page 17.4-42) OD (fail to open)

RWS-VLV-006A,B (Page 17.4-42) PR (plug)

RWS-VLV-013A,B (Page 17.4-42) PR (plug)

RWS-VLV-005 (Page 17.4-42) PR (plug)

RWS-VLV-014 (Page 17.4-43) PR (plug)

RWS-VLV-101 (Page 17.4-43) OD (fail to open), PR (plug)

RWS-AOV-022 (Page 17.4-43) OD (fail to open), CD (fail to close), CM (spurious closure), OM (spurious opening)

RWS-VLV-023 (Page 17.4-43) OD (fail to open)

Control Rods (Page 17.4-44) Is failure mode "CF" correct in Table 17.4-1? This failure mode is not defined in Table 17.4-1.

Control Rod Drive Mechanism (Page 17.4-44) Is failure mode "CF" correct in Table 17.4-1?

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This failure mode is not defined in

Table 17.4-1.