

# REQUEST FOR ADDITIONAL INFORMATION NO. 150-1635 REVISION 1

1/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 17.04 - Reliability Assurance Program (RAP)

Application Section: 17.4 Reliability Assurance Program

QUESTIONS for PRA Licensing, Operations Support and Maintenance Branch 1 (AP1000/EPR Projects) (SPLA)

17.04-19

In Table 17.4-1 ("Risk Significant SSCs") of the US-APWR DCD, Revision 1, many risk-significant SSCs are identified through text descriptions only (i.e., specific component identification numbers are not provided). As a result, it is unclear as to what specific components are in RAP. For example, under the Component Cooling Water System (CCWS) in Table 17.4-1, Item 6, it is not clear as to what specific components are included under the description "SSCs that compose CCW boundary." Another example, under the Fire Suppression System (FSS) in Table 17.4-1, Item 7, the description "FSS - CCWS Boundary Motor Operated Valves (ACWCH-1A/B, 2A/B, 3A/B, 4A/B, 6A/B, 7A/B, 8A/B)" is clearer (assuming these are the applicable valves) than the current description "FSS - CCWS Boundary Motor Operated Valves [TBD]."

The staff requests that the applicant more clearly describe the risk-significant SSCs in Table 17.4-1 of the US-APWR DCD by using text descriptions and specific component identification numbers, when applicable.

17.04-20

In general, the component identification numbers provided in Table 17.4-1 ("Risk Significant SSCs") of the US-APWR DCD, Revision 1, are not consistent with the component identification numbers used in the US-APWR Probabilistic Risk Assessment (PRA), MUAP-07030(R0). For example, Refueling Water Storage System (RWS) check valve 012A(B) in Table 17.4-1 of the US-APWR DCD, Revision 1, corresponds to check valve 006A(B) in the US-APWR PRA, MUAP-07030(R0).

The staff requests that the applicant make consistent the component identification numbers provided in the US-APWR DCD (for example, the component identification numbers in Table 17.4-1 and Chapter 19) and the component identification numbers used in the US-APWR PRA, MUAP-07030(R0).

17.04-21

The applicant did not include in Table 17.4-1 of the US-APWR DCD, Revision 1, the Emergency Feedwater System (EFWS) pit water level indicators/sensors (i.e., LA3760,

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LA3761, LA3762, LA3763). The evidence presented below suggests these water level indicators are risk-significant and should be included in D-RAP:

- a) HRA event EFWOO04LAAA ("Miscalibration of EFW Pit A Water Level Sensors LA3760, LA3761") has a RAW of 41.9 and FV of  $9.11E-03$  for internal flooding at power (Table 22.6-6 of US-APWR Probabilistic Risk Assessment, MUAP-07030(R0)). The common cause failure of these indicators would have a similar RAW value.
- b) HRA event EFWOO04LAAA has a RAW of 2.3 for internal events at power (Table 18.6-2 of US-APWR Probabilistic Risk Assessment, MUAP-07030(R0)). The common cause failure of these indicators would have a similar RAW value.
- c) HRA event EFWOO04LAAA has a RAW of 2.4 for internal fire at power (Table 23R-10 of US-APWR Probabilistic Risk Assessment, MUAP-07030(R0)). The common cause failure of these indicators would have a similar RAW value.

The staff requests that the applicant include in Table 17.4-1 of the US-APWR DCD the EFWS pit water level indicators. Otherwise, provide the basis for not including these water level indicators in Table 17.4-1 of the US-APWR DCD (include in the basis a discussion of the associated risk importance measures from the various PRA models, consideration of deterministic methods, e.g., defense-in-depth, consideration of seismic margins analysis, and the expert panel's deliberation for not including these SSCs in D-RAP).

### 17.04-22

The applicant did not include in Table 17.4-1 of the US-APWR DCD, Revision 1, the High Head Safety Injection (HPI) motor-operated valves (MOV) 014A, B, C, D (i.e., MOV-8810A, B, C, D of the US-APWR Probabilistic Risk Assessment, MUAP-07030(R0)). The evidence presented below suggests these MOVs are risk-significant and should be included in D-RAP:

- a) Basic event HPIMVIL8810C ("M/V 8810C INTERNAL LEAK L") has a RAW of 10.9 for internal flooding at power (Table 22.6-7 of US-APWR Probabilistic Risk Assessment, MUAP-07030(R0)).
- b) Basic event HPIMVEL8810C ("M/V 8810C EXTERNAL LEAK L") has a RAW of 10.9 for internal flooding at power (Table 22.6-7 of US-APWR Probabilistic Risk Assessment, MUAP-07030(R0)).
- c) Basic event HPIMVOM8810C ("M/V 8810C MIS-OPENING") has a RAW of 10.9 for internal flooding at power (Table 22.6-7 of US-APWR Probabilistic Risk Assessment, MUAP-07030(R0)).
- d) Basic event HPIMVIL8810D ("M/V 8810D INTERNAL LEAK L") has a RAW of 5.5 for internal flooding at power (Table 22.6-7 of US-APWR Probabilistic Risk Assessment, MUAP-07030(R0)).

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- e) Basic event HPIMVEL8810D ("M/V 8810D EXTERNAL LEAK L") has a RAW of 5.5 for internal flooding at power (Table 22.6-7 of US-APWR Probabilistic Risk Assessment, MUAP-07030(R0)).

The staff requests that the applicant include in Table 17.4-1 of the US-APWR DCD MOV-014A, B, C, D. Otherwise, provide the basis for not including these MOVs in Table 17.4-1 of the US-APWR DCD (include in the basis a discussion of the associated risk importance measures from the various PRA models, consideration of deterministic methods, e.g., defense-in-depth, consideration of seismic margins analysis, and the expert panel's deliberation for not including these SSCs in D-RAP).

### 17.04-23

The applicant did not include in Table 17.4-1 of the US-APWR DCD, Revision 1, the SSCs (e.g., valves/orifices/coolers) necessary to provide component cooling water (CCW) cooling to the High Head Safety Injection (HPI) pumps. Since the HPI pumps are considered risk-significant in Table 17.4-1, it would suggest the SSCs necessary to provide CCW cooling to these pumps may also be risk-significant.

The staff requests that the applicant include in Table 17.4-1 of the US-APWR DCD the SSCs (e.g., valves/orifices/coolers) necessary to provide CCW cooling to the HPI pumps. Otherwise, provide the basis for not including these SSCs in Table 17.4-1 of the US-APWR DCD (include in the basis a discussion of the associated risk importance measures from the various PRA models, consideration of deterministic methods, e.g., defense-in-depth, consideration of seismic margins analysis, and the expert panel's deliberation for not including these SSCs in D-RAP).

### 17.04-24

The applicant did not include in Table 17.4-1 of the US-APWR DCD, Revision 1, the SSCs (e.g., valves/orifices/coolers) necessary to provide component cooling water (CCW) cooling to the Containment Spray/Residual Heat Removal (CS/RHR) pumps and heat exchangers. Since the CS/RHR pumps and heat exchangers are considered risk-significant in Table 17.4-1, it would suggest the SSCs necessary to provide CCW cooling to these pumps and heat exchangers may also be risk-significant.

The staff requests that the applicant include in Table 17.4-1 of the US-APWR DCD the SSCs (e.g., valves/orifices/coolers) necessary to provide CCW cooling to the CS/RHR pumps and heat exchangers. Otherwise, provide the basis for not including these SSCs in Table 17.4-1 of the US-APWR DCD (include in the basis a discussion of the associated risk importance measures from the various PRA models, consideration of deterministic methods, e.g., defense-in-depth, consideration of seismic margins analysis, and the expert panel's deliberation for not including these SSCs in D-RAP).

### 17.04-25

The applicant did not include in Table 17.4-1 of the US-APWR DCD, Revision 1, the following SSCs of the Refueling Water Storage System (RWS) (as shown in Figure

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6A.14.3-1 of the US-APWR Probabilistic Risk Assessment (PRA), MUAP-07030(R0)): Manual Valve (X/V)-027, X/V-028, Orifice 025, and RWS Auxiliary Tank. Based on Table 20.11-3 of the US-APWR PRA, MUAP-07030(R0), these SSCs have a RAW of at least 3.8 for the internal events low-power and shutdown risk assessment, which exceeds the RAW criteria for risk significance (i.e.,  $RAW > 2$ ).

Also, RWS valves VLV-051, VLV-052 and AOV-022 are considered risk-significant in Table 17.4-1 of the US-APWR DCD, Revision 1. However, it is not clear as to which valve numbers these valves correspond to in the US-APWR PRA, MUAP-07030(R0). For example, does VLV-051 in Table 17.4-1 correspond to VLV-027, VLV-028 or another valve in Figure 6A.14.3-1 of the US-APWR PRA.

The staff requests that the applicant:

- a) Include in Table 17.4-1 of the US-APWR DCD the X/V-027, X/V-028, Orifice 025, and RWS Auxiliary Tank. Otherwise, provide the basis for not including these SSCs in Table 17.4-1 of the US-APWR DCD (include in the basis a discussion of the associated risk importance measures from the various PRA models, consideration of deterministic methods, e.g., defense-in-depth, consideration of seismic margins analysis, and the expert panel's deliberation for not including these SSCs in D-RAP).
- b) For RWS valves VLV-051, VLV-052, and AOV-022 identify the corresponding valve numbers used in the US-APWR PRA, MUAP-07030(R0).

### 17.04-26

The applicant did not include in Table 17.4-1 of the US-APWR DCD, Revision 1, the Essential Service Water System (ESWS) strainers ST02A, B, C, D as shown in Figure 6A.9-2 of the US-APWR Probabilistic Risk Assessment (PRA), MUAP-07030(R0). Based on Table 20.11-3 of the US-APWR PRA, MUAP-07030(R0), these strainers have a RAW of at least 5 for the internal events low-power and shutdown risk assessment, which exceeds the RAW criteria for risk significance (i.e.,  $RAW > 2$ ). Also, the description of the ESWS strainers listed under Item 4 of ESWS in Table 17.4-1 of the US-APWR DCD, Revision 1, is unclear and appears to be duplicated under Item 5 of ESWS in Table 17.4-1 (page 17.4-36).

The staff requests that the applicant:

- a) Include in Table 17.4-1 of the US-APWR DCD the ESWS strainers ST02A, B, C, D. Otherwise, provide the basis for not including these strainers in Table 17.4-1 of the US-APWR DCD (include in the basis a discussion of the associated risk importance measures from the various PRA models, consideration of deterministic methods, e.g., defense-in-depth, consideration of seismic margins analysis, and the expert panel's deliberation for not including these strainers in D-RAP).
- b) Clarify in Table 17.4-1 of the US-APWR DCD the description of the ESWS strainers listed under Items 4 and 5 of ESWS in Table 17.4-1 (page 17.4-36).

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17.04-27

Under Item 8 of Essential Service Water System (ESWS) in Table 17.4-1 of the US-APWR DCD, Revision 1 (page 17.4-37), the applicant did not include the flow meters located in ESWS pump motor cooling lines A and D (i.e., FT-2060, 2063). The evidence presented below suggests that FT-2060 and 2063 are risk-significant and should be included in D-RAP:

- a) Based on Table 20.11-3 of the US-APWR Probabilistic Risk Assessment (PRA), MUAP-07030(R0), FT-2060 has a RAW of 5.4 for the internal events low-power and shutdown risk assessment, which exceeds the RAW criteria for risk significance (i.e.,  $RAW > 2$ ).
- b) Based on Items 6 and 7 of ESWS in Table 17.4-1 of the US-APWR DCD, Revision 1 (page 17.4-36), the ESWS pump motor cooling lines A, B, C, and D are considered risk-significant.

Also, Item 8 of ESWS in Table 17.4-1 of the US-APWR DCD, Revision 1 (page 17.4-37), should include orifices ESS0003A, B, C, D as shown in Figure 6A.9-2 of the US-APWR PRA, MUAP-07030(R0) since these orifices would have RAW values similar to FT-2060, 2061, 2062, and 2063.

The staff requests that the applicant provide the basis for not including FT-2060, FT-2063 and orifices ESS0003A, B, C, D in Table 17.4-1 of the US-APWR DCD (include in the basis a discussion of the associated risk importance measures from the various PRA models, consideration of deterministic methods, e.g., defense-in-depth, consideration of seismic margins analysis, and the expert panel's deliberation for not including these SSCs in D-RAP).

17.04-28

Under Item 9 of Essential Service Water System (ESWS) in Table 17.4-1 of the US-APWR DCD, Revision 1 (page 17.4-37), the applicant states "Main Piping Orifices of Train B and D [FE2025 , FE2026]." The applicant's statement should refer to main piping orifices of Trains B and C since FE2026 is associated with Train C.

The staff requests that the applicant amend the text description, based on the above discussion, under Item 9 of ESWS in Table 17.4-1 of the US-APWR DCD (page 17.4-37).

17.04-29

Alternate containment cooling by the containment fan cooler system is developed in Chapter 6A.14.1 of the US-APWR Probabilistic Risk Assessment (PRA), MUAP-07030(R0). The modeling of alternate containment cooling includes Human Reliability Analysis (HRA) event NCCOO02CCW ("Operator Fails to Line Up for Alternative Containment Cooling"). Actions associated with HRA event NCCOO02CCW is provided in Chapter 9 (page 9-28, 29) of the US-APWR PRA, MUAP-07030(R0), which include manipulating various valves (for example, opening the nitrogen supply valve 890, closing the non-safety chiller isolation valves CH-1 and CH-3, opening the CV recirculation unit

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inlet valves CH-5 through CH-8, and so on). Based on Table 18.6-1 of the US-APWR PRA, MUAP-07030(R0), HRA event NCCOO02CCW is considered risk-significant since it has a RAW of 6.4 and FV of 0.14 for large release frequency (LRF) internal events at power, which exceeds the RAW and FV criteria for risk significance (i.e., RAW > 2 or FV>0.005). Therefore, the SSCs that are manipulated/operated during execution of HRA event NCCOO02CCW could be considered risk-significant also.

The staff requests that the applicant provide the basis for not including in Table 17.4-1 of the US-APWR DCD the SSCs that are manipulated/operated during execution of HRA event NCCOO02CCW.

### 17.04-30

The applicant did not include in Table 17.4-1 of the US-APWR DCD, Revision 1, the SSCs (e.g., valves/orifices/coolers) necessary to provide component cooling water (CCW) cooling to the Charging Injection System (CHI) pumps. Since the CHI pumps are considered risk-significant in Table 17.4-1, it would suggest the SSCs necessary to provide CCW cooling to these pumps may also be risk-significant.

The staff requests that the applicant include in Table 17.4-1 of the US-APWR DCD the SSCs (e.g., valves/orifices/coolers) necessary to provide CCW cooling to the CHI pumps. Otherwise, provide the basis for not including these SSCs in Table 17.4-1 of the US-APWR DCD (include in the basis a discussion of the associated risk importance measures from the various PRA models, consideration of deterministic methods, e.g., defense-in-depth, consideration of seismic margins analysis, and the expert panel's deliberation for not including these SSCs in D-RAP).

### 17.04-31

The applicant did not include in Table 17.4-1 of the US-APWR DCD, Revision 1, charging injection filter CVC10 from Figure 6A.4-1 of the US-APWR Probabilistic Risk Assessment (PRA), MUAP-07030(R0). Since the valves in series with filter CVC10 are considered risk-significant in Table 17.4-1 of the US-APWR DCD, Revision 1, it would suggest that filter CVC10 may also be risk-significant (e.g., CVC10 fails due to plugging).

The staff requests that the applicant provide the basis for not including filter CVC10 in Table 17.4-1 of the US-APWR DCD (include in the basis a discussion of the associated risk importance measures from the various PRA models, consideration of deterministic methods, e.g., defense-in-depth, consideration of seismic margins analysis, and the expert panel's deliberation for not including filter CVC10 in D-RAP).

### 17.04-32

The applicant did not include in Table 17.4-1 of the US-APWR DCD, Revision 1, charging injection motor-operated valves (MOV) 121D and 121E from Figure 6A.4-1 of the US-APWR Probabilistic Risk Assessment (PRA), MUAP-07030(R0). The downstream check valve 169 has a RAW of about 32 (for large release frequency of internal events at power, see Table 18.6-2 of the US-APWR PRA, MUAP-07030(R0))

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and is considered risk-significant. Though the RAWs for MOV-121D, E are likely to be less than 32 since the two valves are in parallel, the staff was not able to confirm that the RAWs for MOV-121D, E are less than 2.

The staff requests that the applicant provide the basis for not including MOV-121D, E in Table 17.4-1 of the US-APWR DCD (include in the basis a discussion of the associated risk importance measures from the various PRA models, consideration of deterministic methods, e.g., defense-in-depth, consideration of seismic margins analysis, and the expert panel's deliberation for not including these MOVs in D-RAP).

### 17.04-33

Under Item 3 of High Head Safety Injection System (HPI) in Table 17.4-1 of the US-APWR DCD, Revision 1 (page 17.4-22), the text description "Minimum flow line orifices 3 C(D)" does not match the listed component identification numbers (i.e., FE972(973, 974, 975)). The component identification numbers appear to be correct.

The staff requests that the applicant make consistent the text description and component identification numbers under Item 3 of HPI in Table 17.4-1 of the US-APWR DCD, Revision 1.

### 17.04-34

Under Items 5 and 6 of High Head Safety Injection System (HPI) in Table 17.4-1 of the US-APWR DCD, Revision 1 (page 17.4-22), MOV-011A(B,C,D) and MOV-0011A(B,C,D) are listed. It is unclear if these are the same valves or different valves. Also under Items 5 and 11 it is unclear if these are the same valves since both item descriptions are "Containment isolation motor operated valves" but in item 5 the valves listed are MOV-011A(B,C,D) while in item 11 the valves listed are MOV-001A(B,C,D).

The staff requests that the applicant clarify the text descriptions and component identification numbers under Items 5, 6, and 11 of HPI in Table 17.4-1 of the US-APWR DCD, Revision 1.

### 17.04-35

In Table 17.4-1 ("Risk Significant SSCs") of the US-APWR DCD, Revision 1, B,C-Emergency feedwater pump room fans are listed as risk-significant SSCs while in Revision 0, A,D-Emergency feedwater pump room fans were listed twice as risk-significant SSCs. It is unclear as to why the A,D-Emergency feedwater pump room fans were listed twice in Revision 0 while only the B,C-Emergency feedwater pump room fans are listed in Revision 1.

The staff requests that the applicant clarify why the A,D-Emergency feedwater pump room fans were listed twice in Revision 0 of the US-APWR DCD while only the B,C-Emergency feedwater pump room fans are listed in Revision 1 of the US-APWR DCD.