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TOKYO, JAPAN

July 10, 2009

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-09369

Subject: MHI's Responses to US-APWR DCD RAI No.385-2293 REVISION 1

Reference: 1) "Request for Additional Information No. 385-2293 Revision 1, SRP Section: 17.04 - Reliability Assurance Program (RAP), Application Section: 17.4 Reliability Assurance Program," dated June 11, 2009.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Responses to Request for Additional Information No. 385-2293 Revision 1".

Enclosed are the responses to the RAIs 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. Responses to Request for Additional Information No.385-2293 Revision 1.

CC: J. A. Ciocco
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Enclosure 1

UAP-HF-09369
Docket Number 52-021

Responses to Request for Additional Information No. 385-2293
Revision 1

July 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.285-2293 REVISION 1**

SRP SECTION: **17.04 – Reliability Assurance Program (RAP)**

APPLICATION SECTION: **17.4 Reliability Assurance Program**

DATE OF RAI ISSUE: **6/11/2009**

QUESTION NO. : 17.04-40

In response to RAI 17.04-31, MHI stated that the reactor coolant pump (RCP) seal water injection filter (i.e., CVC10 in Figure 6A.4-1 of MUAP-07030(R1) or AFT-003B in Figure 9.3.4-1 of US-APWR DCD, Revision 1) is not risk-significant because of the redundancy provided by filter AFT-003A. For the following reasons, the staff found that MHI's response to RAI 17.04-31 does not provide a sufficient basis for excluding filter CVC10 from Table 17.4-1 of the US-APWR DCD.

1) Figure 9.3.4-1 of the US-APWR DCD shows that during normal operations, one seal water injection filter is aligned for flow, while the redundant filter is isolated by two manual isolation valves (i.e., VLV-170A/171A or VLV-170B/171B). If the nonisolated filter becomes plugged while operating during an initiating event, then is it realistic to take credit for operator action to open the manual isolation valves of the redundant filter (e.g., is this operator action proceduralized?).

2) Since valves CVC02, CVC03, CVC04 and CVC06 have a RAW of 24 and are considered risk-significant, it suggests that the common cause failure of the seal water injection filters (assuming successful operator action to open isolation valves of the redundant filter) may have a similar RAW and be risk-significant. Note, the PRA assumption that the seal water injection filters have a low failure probability does not provide a sufficient basis for excluding these filters from D-RAP. This assumption is only true if the filters are subjected to appropriate reliability assurance activities. Therefore, the assumption in the PRA that these filters have high reliability further emphasizes the need to include them in D-RAP (the intent of DRAP is to ensure the reliability assurance activities that were accomplished prior to initial fuel load for the risk-significant systems, structures, and components (SSCs) provide reasonable assurance that the plant is designed and constructed in a manner that is consistent with the key assumptions and risk insights for the risk-significant SSCs).

3) Filters AFT-003A and AFT-003B are equal in function and failure behavior. The dissimilar risk significance between the two filters arise from assumptions made in the PRA (i.e., AFT-003B is aligned for service and AFT-003A is isolated).

Similarly, isolation valves for filter AFT-003A (i.e., VLV-170A and VLV-171A) may be considered risk-significant for the following reasons.

1) Isolation valves VLV-170B and VLV-171B are considered risk-significant in Table 17.4-1 of the US-APWR DCD.

2) Isolation valves VLV-170A and VLV-171A would need to be manually opened in order to credit use of RCP seal water injection filter AFT-003A.

3) Isolation valves 170A/171A and 170B/171B are equal in function and failure behavior. The dissimilar risk significance between these isolation valves arise from assumptions made in the PRA (i.e., valves 170B/171B are open to align flow through filter AFT-003B and 170A/171A are isolated).

The staff requests that MHI provide an acceptable basis for not including RCP seal water injection filters (i.e., AFT-003A and AFT-003B) and RCP seal water injection isolation valves (VLV-170A and VLV-171A) in Table 17.4-1 of the US-APWR DCD.

ANSWER:

In response to RAI 17.04-31, MHI mentioned that there is a redundant line containing VLV-170A, KFT-003A and VLV-171A parallel to the original seal water line which contains CVC09, CVC10 and CVC11 (VLV-170B,KFT-003B and VLV-171B) and this redundancy reduces the risk importance concerning these SSCs.

Nevertheless, as pointed out in this RAI, the common cause failure of these filters (e.g. plugging / large external leaking of KFT-003A and 003B) and valves (e.g. plugging / large external leaking of VLV-170A and 170B or plugging / large external leaking of VLV-171A and 171B) will have similar RAWs to those (i.e. 24) of upstream and downstream valves on this line.

Therefore these filters (KFT-003A and KFT-003B) and valves (VLV-170A, VLV-171A, VLV-170B and VLV-171B) will be included in Table 17.4-1 incorporating the discussion of expert panel.

Impact on DCD

List of risk significant SSCs will be revised as shown in the next page, considering the discussion of expert panel in response to RAI 17.04-40. (Also see the Attachment to this RAI response, page 17.4-10.)

Impact on COLA

There is no impact on COLA from this RAI.

Impact on PRA

There is no impact on PRA from this RAI.

Table 17.4-1 Risk significant SSCs (sheet 5 of 36)

#	Systems, Structures and Components (SSCs)	Rationale	Insights and Assumptions
2	Charging injection system		
29	Charging line manual valves [VLV-145] [VLV-147]	RAW/LPSD	The "Insights and Assumptions" for these SSCs are described on the previous page.
30	Charging line by-pass line manual valve [VLV-144]	RAW/LPSD	
31	RCP seal water injection line manuavalves [VLV-164] [VLV-166] [VLV-168] [VLV-170A(B)] [VLV-171 A(B)] [VLV-173]	RAW	
32	RCP seal water injection line filters [KFT-003A(B)]	-(*1)	
33	RCP seal water injection by-pass line manual valve [VLV-163]	RAW	
34	RCP seal water injection line manual valves [VLV-180A (B,C,D)]	RAW	
35	RCP seal water injection line needle valves [VLV-177A (B,C,D)]	RAW	
36	Low-pressure letdown line air operated valve [HCV-102]	LPSD	

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.285-2293 REVISION 1**

SRP SECTION: **17.04 – Reliability Assurance Program (RAP)**

APPLICATION SECTION: **17.4 Reliability Assurance Program**

DATE OF RAI ISSUE: **6/11/2009**

QUESTION NO. : 17-04-41

In response to RAI 17.04-26, MHI stated "ST01 and ST07 [EWS-OSR-001 A and D] is also considered to be equal to the ST03 and ST05 in their functions and failure behavior. Therefore, these 4 strainers will be included as 'A1-D1 ESWS sump outlet strainers 1 [EWS-OSR-001A (B,C,D)]' under Item 5 of ESWS in Table 17.4-1..." MHI excluded from Table 17.4-1 the strainers EWS-OSR-002A (B,C,D) because the US-APWR PRA showed them to have low risk importance. The dissimilar risk significance between strainers EWS-OSR-001A (B,C,D) and EWS-OSR-002A (B,C,D) may not be real and arise from assumptions made in the PRA (i.e., EWS-OSR-001A,B,C,D is aligned for service and EWS-OSR-002A,B,C,D is isolated). Based on the description provided in Section 9.2.1 of the US-APWR DCD, Revision 1, strainers EWS-OSR-002A (B,C,D) are equal to EWS-OSR-001A (B,C,D) in function and failure behavior. Therefore, strainers EWS-OSR-002A (B,C,D) should also be included in Table 17.4-1 of the US-APWR DCD.

The staff requests that MHI include strainers EWS-OSR-002A (B,C,D) in Table 17.4-1 of the US-APWR DCD. Otherwise, provide a basis for not including these strainers in Table 17.4-1 of the US-APWR DCD.

ANSWER:

As mentioned in this RAI, strainers ST02(04,06,08) [EWS-OSR-002A (B,C,D)] are equal to ST01(03,05,07) [EWS-OSR-001A (B,C,D)] in function and failure behavior.

Therefore these strainers ST02(04,06,08) [EWS-OSR-002A (B,C,D)] will be included in Table 17.4-1

incorporating the discussion of expert panel.

Impact on DCD

List of risk significant SSCs will be revised as shown in the next page, considering the discussion of expert panel in response to RAI 17.04-41 (Also see the Attachment to this RAI response, page 17.4-38).

Impact on COLA

There is no impact on COLA from this RAI.

Impact on PRA

There is no impact on PRA from this RAI.

Table 17.4-1 Risk significant SSCs (sheet 33 of 36)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
25	Essential service water system (ESWS)		
1	Pump discharge line check valves [VLV-502A (B,C,D)]	RAW/CCF/LPSD	The essential service water system (ESWS) transfers heat from the CCW system as Ultimate Heat Sink (UHS). This system supports the CCW system, which supports various safety and non-safety mitigation systems. Accordingly, reliability of CCWS EFW system has significant impact on risk. Since ESWS consists of four independent trains, failure of one train does not have significant impact on risk. However, failures of SSCs that impact multiple trains have risk significant impact on risk. Accordingly, SSCs that have potential to cause common cause failures among multiple trains are risk significant.
2	Essential service water pump motor cooling line check valves [VLV-602A (B,C,D)]	RAW/CCF/LPSD	
3	A~D-Essential service water pump [EWS-OPP-001A (B,C,D)]	FV/RAW/CCF/LPSD	
4	A (B,C,D) -CCW heat exchanger inlet strainers[TBD]	RAW/LPSD	
5	**A1~D1-Essential service water pump outlet strainers** A2~D2-Essential service water pump outlet strainers **[EWS-OSR-001A (B,C,D) :** between EWS-VLV-506A(B,C,D) and -508A(B,C,D)] [EWS-OSR-002A (B,C,D): between EWS-VLV-507A(B,C,D) and -509A(B,C,D)]	**RAW(FLOOD,FIRE, L2,L2-FLOOD)**	
6	Valves located in essential service water pump motor cooling line of train B & C [VLV-601B (C)]	RAW/LPSD	
7	ESW pump motor cooling line valves of train A & D [VLV-601A (D)]	RAW(L2)	

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.285-2293 REVISION 1**

SRP SECTION: **17.04 – Reliability Assurance Program (RAP)**

APPLICATION SECTION: **17.4 Reliability Assurance Program**

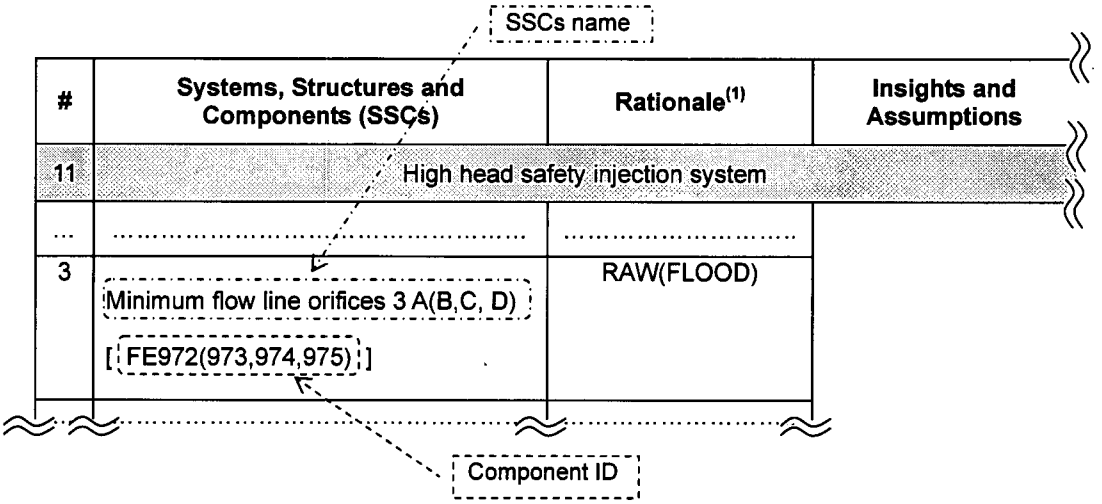
DATE OF RAI ISSUE: **6/11/2009**

QUESTION NO. : 17.04-42

In response to RAI 17.04-33, MHI stated "these 4 orifices will be included as "Minimum flow line orifices 3 A(B,C,D) [FE972(973,974,975)]." These orifices correspond to PRA orifices FE862A(B,C,D). Orifices 3A(B,C,D) in the PRA correspond to RV injection line orifices (between VLV-012 A(B,C,D) and MOV-0011 A(B,C,D). A similar occurrence exists in Table 17.4-1, page 17.4-22, item 2 "Safety injection pump outlet orifices 1A(B,C,D) [FE962(963,964,965)]" which in the PRA correspond to FE858A(B,C,D).These two cases should be clarified here as well as any other similar DCD occurrences.For example, simply removing the text 1A(B,C,D) and 3A(B,C,D) in these two occurrences may clarify these instances since orifices 1A(B,C,D) and 3A(B,C,D) exist elsewhere in the PRA within the same system.The staff requests that MHI further clarify what is meant by 1A(B,C,D) and 3A(B,C,D) in these two occurrences and any other DCD occurrences.

ANSWER:

In column of "Systems, Structures and Components (SSCs)" of Table 17.4-1, SSCs names and component IDs are contained as follows. And PRA IDs like as "FE-862A(B,C,D)" or "OR003A" are not contained in this column.



Although SSCs names are so named as to identify SSCs for each system, it is true that SSCs can be identified by component ID. Therefore the SSCs name will be simplified as indicated in this RAI.

Impact on DCD

List of risk significant SSCs will be revised as shown in the next page, in response to RAI 17.04-42. (Also see the Attachment to this RAI response, page 17.4-13, 18, 24 and 30)

Impact on COLA

There is no impact on COLA from this RAI.

Impact on PRA

There is no impact on PRA from this RAI.

Table 17.4-1 Risk significant SSCs (sheet 8, 13, 19 and 25 of 36)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
3	Component cooling water system (CCWS)		
32	CHI seal water heat exchanger inlet manual valves ~~A(B)~~ [NCS-VLV-311A(B)]	LPSD	…… …… ……
33	CHI oil cooler inlet manual valves ~~A(B)~~ [NCS-VLV-312A(B)]	LPSD	
34	CHI pump motor inlet manual valves ~~A(B)~~ [NCS-VLV-301A(B)]	LPSD	
6	Emergency feedwater system (EFWS)		
25	EFW pit water level transmitter ~~1(2, 3, 4)~~ [EFS-LT-3760, 3761, 3770, 3771]	-[*2]	…… …… ……
11	High head safety injection system		
2	Safety injection pump outlet orifices ~~1A(B,C,D)~~ [FE962(963,964,965)]	RAW(FLOOD)	…… …… ……
3	Minimum flow line orifices ~~3 A(B,C, D)~~ [FE972(973,974,975)]	RAW(FLOOD)	
18	Main steam supply system (MSS)		
4	Main steam line isolation check valves ~~A(B,C and D)~~ [VLV-516A(B,C and D)]	RAW(FLOOD)	

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.285-2293 REVISION 1**

SRP SECTION: **17.04 – Reliability Assurance Program (RAP)**

APPLICATION SECTION: **17.4 Reliability Assurance Program**

DATE OF RAI ISSUE: **6/11/2009**

QUESTION NO. : 17.04-43

In response to RAI 17.04-23, MHI stated that inlet manual valves CCW0002A(B,C,D) of the Safety Injection (SI) pump cooling line are not risk-significant based on risk importance. For the following reason, the staff found that MHI's response to RAI 17.04-23 does not provide a sufficient basis for excluding these components from Table 17.4-1 of the US-APWR DCD.

- Manual valves CCW0002A(B,C,D) are equal in function and failure behavior. The risk achievement worth (RAW) for manual valve CCW0002C is 6.7 (internal events) as shown in Table 19.1-42 of Chapter 19 of the US-APWR DCD, Revision 1. The shutdown and flooding PRA models also show this valve to have a high RAW. The RAW values associated with manual valve CCW0002C are consistent with the RAW values associated with the other manual valves in the SI pump cooling lines (i.e.,133A(B,C,D), 132A(B,C,D), 160A(B,C,D), and 161A(B,C,D)), which are considered risk-significant. This would suggest that manual valves CCW0002A(B,C,D) may also be risk-significant.

The staff requests that MHI include SI pump cooling line inlet manual valves CCW0002A(B,C,D) in Table 17.4-1 of the US-APWR DCD. Otherwise, provide a sufficient basis for not including these components in Table 17.4-1 of the US-APWR DCD. Also, given that the plugging of outlet orifices 1260A(B,C,D) or 1266A(B,C,D) would fail the SI pump cooling lines (RAW of 8.1 in Table 19.1-69 of Chapter 19 of the US-APWR DCD, Revision 1), provide the basis for not including these orifices in Table 17.4-1 of the US-APWR DCD (note that similar orifices of the RHR pump cooling line were included in Table 17.4-1, see MHI's response to RAI 17.04-24).

ANSWER:

As pointed out in this RAI, it is confirmed in Table 19.1-42 of Chapter 19 of the US-APWR DCD, Revision 1, that RAWs for CCW0002C,D[NCS-VLV-111C,D], 1260C,D[NCS-FE-1272,1273] and 1266C,D[NCS-FE-1276,1277] are greater than RAW criteria (i.e. RAW >2.0). And also these SSCs of train A and B are equal to those of train C and B in function and failure behavior.

Therefore these SSCs (SI pump inlet manual valve CCW0002A(B,C,D) [NCS-VLV-111A(B,C,D)] , SI pump outlet orifice1260 A(B,C,D) NCS-FE-1270,1271,1272,1273] and SI pump motor outlet orifice 1266 A(B,C,D) [NCS-FE-1274,1275,1276,1277]) will be included in Table 17.4-1 incorporating the discussion of expert panel.

Impact on DCD

List of risk significant SSCs will be revised as shown in the next page, considering the discussion of expert panel in response to RAI 17.04-43. (Also see the Attachment to this RAI response, page 17.4-12)

Impact on COLA

There is no impact on COLA from this RAI.

Impact on PRA

There is no impact on PRA from this RAI.

Table 17.4-1 Risk significant SSCs (sheet 7 of 36)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
3	Component cooling water system (CCWS)		
13	Safety Injection pump motor outlet manual valve [NCS-VLV-114A(B,C,D)]	RAW(L2)	These valves are used (opened) to provide alternative CCW from the fire suppression system or the non-essential chilled water system to the charging pump cooling line under loss of CCW events. These are important SSCs at loss of CCW events to prevent RCP seal LOCA.
14	Safety Injection oil cooler outlet manual valve [NCS-VLV-115A(B,C,D)]	RAW(L2)	
15	Safety Injection pump outlet manual valve [NCS -VLV- 116A(B,C,D)]	RAW(L2)	
16	Safety Injection pump outlet manual valve [NCS -VLV- 119A(B,C,D)]	RAW(L2)	
17	A(B,C,D)- Safety Injection pump outlet orifice [NCS-FE-1270 (1271,1272,1273)]	RAW(FLOOD)	
18	A(B,C,D)- Safety Injection pump motor outlet orifice [NCS-FE-1274 (1275,1276,1277)]	RAW(FLOOD)	
19	A(B,C,D)- Safety Injection pump inlet manual valve [NCS-VLV-111 A(B,C,D)]	RAW(FLOOD,L2) /LPSD	
20	CS/RHR heat exchanger discharge line motor operated valves [MOV-145A (B,C,D)]	FV/RAW/CCF /LPSD	
21	CS/RHR pump outlet manual valve [NCS-VLV-131A(B,C,D)]	RAW(L2)/LPSD	
22	CS/RHR pump motor outlet manual valve [NCS-VLV-128A(B,C,D)]	RAW(L2)/LPSD	
23	CS/RHR pump outlet orifices [NCS-FE1246 (1247,1248,1249)]	RAW(L2)/LPSD	
24	CS/RHR pump motor outlet orifices [NCS-FE1250(1251,1252,1253)]	RAW(L2)/LPSD	

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.285-2293 REVISION 1**

SRP SECTION: **17.04 – Reliability Assurance Program (RAP)**

APPLICATION SECTION: **17.4 Reliability Assurance Program**

DATE OF RAI ISSUE: **6/11/2009**

QUESTION NO. : 17.04-44

In response to RAI 17.04-30, MHI did not include outlet manual valves 300A(B) of the Charging Injection System (CHI) pump cooling line (see Figure 19.1-2 of Chapter 19 of the US-APWR DCD, Revision 1). Outlet manual valves 300A(B) are equal in function and failure behavior. The risk achievement worth (RAW) for manual valve 300A is 120 (from Low Power/Shutdown PRA) as shown in Table 19.1-90 of Chapter 19 of the USAPWR DCD, Revision 1. The RAW values associated with manual valves 300A(B) are consistent with the RAW values associated with the other manual valves in the CHI pump cooling lines (i.e., 224A(B), 225A(B), and 226A(B)), which are considered risk-significant.

This would suggest that outlet manual valves 300A(B) may also be risk-significant. The staff requests that MHI include CHI pump cooling line outlet manual valves 300A(B) in Table 17.4-1 of the US-APWR DCD. Otherwise, provide a sufficient basis for not including these components in Table 17.4-1 of the US-APWR DCD.

Also, given that the plugging of outlet orifices FE1257(8) or 1254(5) would fail the CHI pump cooling lines, provide the basis for not including these orifices in Table 17.4-1 of the US-APWR DCD (note that similar orifices of the RHR pump cooling line were included in Table 17.4-1, see MHI's response to RAI 17.04-24).

ANSWER:

As pointed out in this RAI, it is confirmed in Table 19.1-90 of Chapter 19 of the US-APWR DCD, Revision 1, that RAWs for CHI pump motor line manual valve 300A(B) [NCS-VLV-315A (B)] are greater than RAW criteria (i.e. RAW >2.0).

And also it is confirmed that RAWs for the event of the plugging of outlet orifices FE1257(1258)[NCS-FE-1266(1267)] or FE1254(1255)[NCS-FE-1260(1261)] are not greater than RAW criteria (i.e. RAW <2.0).

Nevertheless, RAWs for the event of the large external leaking of other manual valves in the CHI pump cooling lines (224A(B), 225A(B), and 226A(B)[NCS-VLV-311A(B), 312A(B) and 301A(B)]) are greater than RAW criteria(i.e. RAW >2.0). From this results, it will be suggested that RAWs for the large external leaking of FE1257(1258) or 1254(1255) are greater than RAW criteria.

Therefore these SSCs (CHI pump motor line manual valve 300A(B) [NCS-VLV-315A(B)], CHI pump motor line orifice FE1257(1258)[NCS-FE-1266(1267)] and CHI oil cooler line orifice FE1254(1255)[NCS-FE-1260(1261)]) will be included in Table 17.4-1 incorporating the discussion of expert panel.

Impact on DCD

List of risk significant SSCs will be revised as shown in the next page, considering the discussion of expert panel in response to RAI 17.04-44. (Also see the Attachment to this RAI response, page 17.4-14)

Impact on COLA

There is no impact on COLA from this RAI.

Impact on PRA

There is no impact on PRA from this RAI.

Table 17.4-1 Risk significant SSCs (sheet 9 of 36)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
3	Component cooling water system (CCWS)		
35	Charging injection pump motor line manual valve [NCS- VLV -315A (B)]	LPSD	The "Insights and Assumptions" for these SSCs are described on the previous page.
36	Charging injection pump motor line orifice [NCS-FE-1266(1267)]	-(*1)	
37	Charging injection oil cooler line orifice [NCS-FE-1260(1261)]	-(*1)	
38	CCWS - fire suppression system boundary motor operated valves [TBD]	RAW/CCF/LPSD	
39	CCWS - RWSP line boundary check valves [VLV-065A (B)]	RAW/LPSD	
40	CCWS - RWSP line boundary manual valves [VLV-066A (B)]	RAW/LPSD	

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.285-2293 REVISION 1**

SRP SECTION: **17.04 – Reliability Assurance Program (RAP)**

APPLICATION SECTION: **17.4 Reliability Assurance Program**

DATE OF RAI ISSUE: **6/11/2009**

QUESTION NO. : 17.04-45

In RAI 17.04-19 the staff asked "what specific components are included under the description "SSCs that compose CCW boundary." This question is answered in part by responses to RAIs 17.04-23, 17.04-24, and 17.04-30, but the phrase "SSCs that compose CCW boundary" is not removed from the Table 17.4-1 markup provided in this RAI response. Are there other components that are covered by the "SSCs that compose CCW boundary," or do RAI responses 17.04-23, 17.04-24, and 17.04-30 cover all these components in their entirety? If the above mentioned RAI responses contain all the "SSCs that comprise CCW boundary," should this phrase be removed from Table 17.4-1? If the above mentioned RAI responses are not a complete list of the "SSCs that comprise CCW boundary" then please provide the complete list in Table 17.4-1.

ANSWER:

In addition to the SSCs listed in the responses to RAI 17.04-23, 17.04-24, and 17.04-30, the following SSCs will be provided to Table 17.4-1 in accordance with risk importance analysis results of PRA.

CCW surge tank outlet manual valves	[NCS-VLV-005 A(B,C,D)]
CCW pump inlet manual valves	[NCS-VLV-008 A(B,C,D)]
CCW heat exchanger outlet manual valves	[NCS-VLV-018 A(B,C,D)]
CCW pump motor inlet manual valves	[NCS-VLV-101 A(B,C,D)]
CCW pump motor outlet manual valve	[NCS-VLV-104 A(B,C,D)]
A-A(B-B,C-C,D-D) supply header orifice	[NCS-FE-1224 (1225,1227,1228)]
A-A(B-B,C-C,D-D) return header orifice	[NCS-FE-1230 (1231,1232,1233)]

These SSCs will be included in Table 17.4-1 and the phrase "SSCs that compose CCW boundary" will be removed from this table, incorporating the discussion of expert panel.

Impact on DCD

List of risk significant SSCs will be revised as shown in the next page, considering the discussion of expert panel in response to RAI 17.04-45. (Also see the Attachment to this RAI response, page 17.4-11)

Impact on COLA

There is no impact on COLA from this RAI.

Impact on PRA

There is no impact on PRA from this RAI.

Table 17.4-1 Risk significant SSCs (sheet 6 of 36)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
3	Component cooling water system (CCWS)		
1	CCW pump discharge line check valves [VLV-016A (B,C,D))	RAW/CCF/LPSD	The component cooling water system (CCWS) transfer heat from plant safety-related components to the essential service water system (ESWS). This system supports various safety and non-safety mitigation systems. Accordingly, reliability of CCWS emergency feedwater system (EFWS) has significant impact on risk. CCWS has four trains, each having a component cooling water pump and a component cooling water heat exchanger. Two trains compose a subsystem, which shares a supply / return header and a surge tank. SSCs that have either of the following characteristics are risk significant. - SSCs that have potential to cause common cause failures among multiple trains. Common cause failure of such system will result in loss of multiple trains. - SSCs that have potential to cause large external leak are risk significant. Since the two trains that compose a subsystem are not physically isolated, large external leak from SSCs that result in loss of inventory is assumed to result in degradation or failure of two trains.
2	A~D-Component cooling water pumps [NCS-RPP-001A (B,C,D)]	FV/RAW/CCF /LPSD	
3	A~D-Component cooling water heat exchangers [NCS-RHX-001A (B,C,D)]	RAW/CCF/LPSD	
4	CCW pump discharge cross tie-line motor operated valves [MOV-020A (B,C,D)]	RAW/CCF/LPSD	
5	CCW pump suction line cross tie-line motor operated valves [MOV-007A (B,C,D)]	RAW/CCF/LPSD	
~~6~~	~~SSCs that compose CCW boundary~~	~~RAW/EJ/LPSD~~	
6	CCW surge tank outlet manual valves [NCS-VLV-005A(B,C,D)]	RAW(FLOOD/L2)	
7	CCW pump inlet manual valves [NCS-VLV-008 A(B,C,D)]	RAW(FLOOD/L2 /LPSD)	
8	CCW heat exchanger outlet manual valves [NCS-VLV-018 A(B,C,D)]	RAW(FLOOD/L2 /LPSD)	
9	CCW pump motor inlet manual valves [NCS-VLV-101 A(B,C,D)]	RAW(L1/FLOOD/ FIRE/L2/L2-FLOOD/L2-FIRE/LPSD)	
10	CCW pump motor outlet manual valve [NCS-VLV-104 A(B,C,D)]	RAW(L1/FLOOD/FIRE/L2/L2-FLODD/L2-FIRE/LPSD)	
11	A-A(B-B,C-C,D-D) supply header orifice [NCS-FE-1224(1225,1227,1228)]	RAW(L1/FLOOD/L2/L2-FLODD/L2-FIRE/LPSD)	
12	A-A(B-B,C-C,D-D) return header orifice[NCS-FE-1230(1231,1232,1233)]	RAW(L1/FLOOD/L2/ L2-FLODD/L2-FIRE/LPSD)	

for Item 29 - 36 DCD_17.04-32

for Item 31&32 DCD_17.04-40

Note: This will be revised incorporating the discussion of expert panel.

Table 17.4-1 Risk significant SSCs (sheet 5 of ~~36~~34)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
~~28~~29	Charging line manual valves [VLV-145] [VLV-147]	RAW/LPSD	The "Insights and Assumptions" for these SSCs are described on the previous page.
~~29~~30	Charging line by-pass line manual valve [VLV-144]	RAW/LPSD	
~~30~~31	RCP seal water injection line manual valves [VLV-164] [VLV-166] [VLV-168] [VLV-170A(B)] [VLV-171A(B)] [VLV-173]	RAW	
32	RCP seal water injection line filters [KFT-003A(B)]	-[1]	
~~31~~ ~~32~~ 33	RCP seal water injection by-pass line manual valve [VLV-163]	RAW	
~~32~~ ~~33~~ 34	RCP seal water injection line manual valves [VLV-180A (B,C,D)]	RAW	
~~33~~ ~~34~~ 35	RCP seal water injection line needle valves [VLV-177A (B,C,D)]	RAW	
~~34~~ ~~35~~ 36	Low-pressure letdown line air operated valve [HCV-102]	LPSD	

For Item6-12 RAI 17.04-45 (This will be revised incorporating the discussion of expert panel.)

Table 17.4-1 Risk significant SSCs (sheet 6 of ~~3~~34)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
3	Component cooling water system (CCWS)		
1	CCW pump discharge line check valves [VLV-016A (B,C,D))	RAW/CCF/LPSD	The component cooling water system (CCWS) transfer heat from plant safety-related components to the essential service water system (ESWS). This system supports various safety and non-safety mitigation systems. Accordingly, reliability of CCWS emergency feedwater system (EFWS) has significant impact on risk. CCWS has four trains, each having a component cooling water pump and a component cooling water heat exchanger. Two trains compose a subsystem, which shares a supply / return header and a surge tank. SSCs that have either of the following characteristics are risk significant. - SSCs that have potential to cause common cause failures among multiple trains. Common cause failure of such system will result in loss of multiple trains. - SSCs that have potential to cause large external leak are risk significant. Since the two trains that compose a subsystem are not physically isolated, large external leak from SSCs that result in loss of inventory is assumed to result in degradation or failure of two trains.
2	A~D-Component cooling water pumps [NCS-RPP-001A (B,C,D)]	FV/RAW/CCF /LPSD	
3	A~D-Component cooling water heat exchangers [NCS-RHX-001A (B,C,D)]	RAW/CCF/LPSD	
4	CCW pump discharge cross tie-line motor operated valves [MOV-020A (B,C,D)]	RAW/CCF/LPSD	
5	CCW pump suction line cross tie-line motor operated valves [MOV-007A (B,C,D)]	RAW/CCF/LPSD	
~~6~~	~~SSCs that compose CCW boundary~~	~~RAW/EJ/LPSD~~	
6	CCW surge tank outlet manual valves [NCS-VLV-005A(B,C,D)]	RAW(FLOOD/L2)	
7	CCW pump inlet manual valves [NCS-VLV-008 A(B,C,D)]	RAW(FLOOD/L2 /LPSD)	
8	CCW heat exchanger outlet manual valves [NCS-VLV-018 A(B,C,D)]	RAW(FLOOD/L2 /LPSD)	
9	CCW pump motor inlet manual valves [NCS-VLV-101 A(B,C,D)]	RAW(L1/FLOOD/ FIRE/L2/L2-FLOOD/L2-FIRE/LPSD)	
10	CCW pump motor outlet manual valve [NCS-VLV-104 A(B,C,D)]	RAW(L1/FLOOD/FIRE/L2/L2-FLODD/L2-FIRE/LPSD)	
11	A-A(B-B,C-C,D-D) supply header orifice [NCS-FE-1224(1225,1227,1228)]	RAW(L1/FLOOD/L2/L2-FLODD/L2-FIRE/LPSD)	
12	A-A(B-B,C-C,D-D) return header orifice[NCS-FE-1230(1231,1232,1233)]	RAW(L1/FLOOD/L2/ L2-FLODD/L2-FIRE/LPSD)	

For Item13-15 RAI 17.04-23

For Item 16 RAI 17.04-23

For Item17-19 RAI 17.04-43

For Item21-24 RAI 17.04-24

(This will be revised incorporating the discussion of expert panel.)

Table 17.4-1 Risk significant SSCs (sheet 7 of ~~36~~34)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
~~7~~ 13	Safety Injection pump motor outlet manual valve [NCS-VLV-114A(B,C,D)]	RAW(L2)	These valves are used (opened) to provide alternative CCW from the fire suppression system or the non-essential chilled water system to the charging pump cooling line under loss of CCW events. These are important SSCs at loss of CCW events to prevent RCP seal LOCA.
~~8~~ 14	Safety Injection oil cooler outlet manual valve [NCS-VLV-115A(B,C,D)]	RAW(L2)	
~~9~~ 15	Safety Injection pump outlet manual valve [NCS -VLV- 116A(B,C,D)]	RAW(L2)	
~~10~~ 16	Safety Injection pump outlet manual valve [NCS -VLV- 119A(B,C,D)]	RAW(L2)	
17	A(B,C,D)- Safety Injection pump outlet orifice [NCS-FE-1270 (1271,1272,1273)]	RAW(FLOOD)	
18	A(B,C,D)- Safety Injection pump motor outlet orifice [NCS-FE-1274 (1275,1276,1277)]	RAW(FLOOD)	
19	A(B,C,D)- Safety Injection pump inlet manual valve [NCS-VLV-111 A(B,C,D)]	RAW(FLOOD,L2) /LPSD	
~~7~~ ~~11~~ 20	CS/RHR heat exchanger discharge line motor operated valves [MOV-145A (B,C,D)]	FV/RAW/CCF /LPSD	
~~12~~ 21	CS/RHR pump outlet manual valve [NCS-VLV-131A(B,C,D)]	RAW(L2)/LPSD	
~~13~~ 22	CS/RHR pump motor outlet manual valve [NCS-VLV-128A(B,C,D)]	RAW(L2)/LPSD	
~~14~~ 23	CS/RHR pump outlet orifices [NCS-FE1246 (1247,1248,1249)]	RAW(L2)/LPSD	
~~15~~ 24	CS/RHR pump motor outlet orifices [NCS-FE1250(1251,1252,1253)]	RAW(L2)/LPSD	

For Item25-29 & 32-34 RAI 17.04-24

For Item32-34 RAI 17.04-42

(This will be revised incorporating the discussion of expert panel.)

Table 17.4-1 Risk significant SSCs (sheet 8 of ~~36~~34)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
~~16~~ 25	CS/RHR pump inlet manual valves [NCS-VLV-125A(B,C,D)]	RAW(L2)/LPSD	The "Insights and Assumptions" for these SSCs are described on the previous page.
~~17~~ 26	CS/RHR heat exchanger inlet manual valves [NCS-VLV-141A(B,C,D)]	RAW(L2)/LPSD	
~~18~~ 27	CS/RHR heat exchanger outlet orifices [NCS-FE1242 (1243,1244,1245)]	RAW(L2)/LPSD	
~~19~~ 28	CS/RHR CS/RHR heat exchanger outlet manual valves [NCS-VLV-144A(B,C,D)]	RAW(L2)/LPSD	
~~20~~ 29	CS/RHR heat exchanger outlet valves [NCS-MOV-145A(B,C,D)]	RAW/FV,RAW(L2)/ LPSD/FV,RAW(FLOOD) /RAW(FIRE)	
~~8~~ ~~21~~ 30	Charging injection Pump Cooling Line Check Valves [TBD]	RAW/CCF/LPSD	
~~9~~ ~~22~~ 31	Charging injection pump cooling discharge line motor operated valves [TBD]	RAW/CCF/LPSD	
~~23~~ 32	Charging injection seal water heat exchanger inlet manual valves ~~A(B)~~ [NCS-VLV-311A(B)]	LPSD	
~~24~~ 33	Charging injection oil cooler inlet manual valve ~~A(B)~~ [NCS-VLV-312A(B)]	LPSD	
~~25~~ 34	Charging injection pump motor inlet manual valves~~A(B)~~ [NCS-VLV-301A(B)]	LPSD	

For Item35-37 RAI 17.04-42

(This will be revised incorporating the discussion of expert panel.)

Table 17.4-1 Risk significant SSCs (sheet 9 of 36~~34~~)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
35	Charging injection pump motor line manual valve [NCS- VLV -315A (B)]	LPSD	The "Insights and Assumptions" for these SSCs are described on the previous page.
36	Charging injection pump motor line orifice [NCS-FE-1266(1267)]	-(*1)	
37	Charging injection oil cooler line orifice [NCS-FE-1260(1261)]	-(*1)	
~~26~~ 38	CCWS - fire suppression system boundary motor operated valves [TBD]	RAW/CCF/LPSD	
~~27~~ 39	CCWS - RWSP line boundary check valves [VLV-065A (B)]	RAW/LPSD	
~~28~~ 40	CCWS - RWSP line boundary manual valves [VLV-066A (B)]	RAW/LPSD	

For Item 25
DCD_17.04-21
For Item 25
DCD_17.04-42

Note: This will be revised incorporating the discussion of expert panel.

Table 17.4-1 Risk significant SSCs (sheet 13 of ~~36~~34)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
22	EFW pit discharge line manual valves [VLV-007A (B)]	RAW/LPSD	The "Insights and Assumptions" for these SSCs are described on the previous page.
23	Secondary demineralizer water tank discharge line manual valves [VLV-006A (B)]	RAW/LPSD	
24	Secondary demineralizer water tank discharge line check valve [VLV-005]	RAW(FLOOD)	
25	EFW pit water level transmitter ~~1(2, 3, 4)~~ [EFS-LT-3760, 3761, 3770, 3771]	-[2]	

For Item 3
DCD_17.04-33
For Item 2&3
DCD_17.04-42
Note: This will be revised incorporating the discussion of expert panel.

Table 17.4-1 Risk significant SSCs (sheet 19 of 36~~34~~)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
11	High head safety injection system		
1	Safety injection pump discharge check valves [VLV-004A (B,C,D)]	FV/RAW/CCF/LPSD	In the case of LOCA, high head safety injection system injects coolant from refueling water storage pit (RWSP) into the reactor vessel via the Direct Vessel Injection (DVI) line by the safety injection pumps. This system is also essential for bleed and feed operation. Since this system consists of four independent trains, failure of one train does not have significant impact on risk. However, failures of SSCs that impact multiple trains are risk significant. SSCs that have either of the following characteristics are risk significant. - SSCs that have potential to cause common cause failures among multiple trains. Common cause failure of such system will result in loss of multiple trains. - SSCs that have potential to cause loss of RWSP inventory out side the containment due to large external leaks. Loss of RWSP inventory impacts not only all four trains of high head safety injection system but also other systems that use RWSP as water source.
2	Safety injection pump outlet orifices ~~1A(B,C,D)~~ [FE962(963,964,965)]	RAW(FLOOD)	
3	Minimum flow line orifices ~~3 A(B,C(, D)~~ [FE972(973,974,975)]	RAW(FLOOD)	
4	Containment isolation check valves [VLV-010A (B,C,D)]	RAW/CCF/LPSD	
5	Containment isolation motor operated valves [MOV-011 A(B,C,D)]	RAW(FLOOD) FV(FLOOD)	
6	RV injection line orifices (between VLV-012 A(B,C,D) and MOV-0011 A(B,C,D))	RAW(FLOOD)	
7	Injection line secondary isolation check valves [VLV-012A (B,C,D)]	RAW/CCF/LPSD	
8	Injection line boundary check valves [VLV-013A (B,C,D)]	RAW/CCF/LPSD	
9	A~D-Safety injection pumps [SIS-RPP-001A (B,C,D)]	FV/RAW/CCF/LPSD	
10	Containment isolation motor operated valves [MOV-009A (B,C,D)]	RAW FV(FLOOD)	

For Item 4
DCD_17.04-42
Note: This will be revised incorporating the discussion of expert panel.

Table 17.4-1 Risk significant SSCs (sheet 25 of ~~34~~ 36)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
18	Main steam supply system (MSS)		
1	A~D-Main steam isolation valves [NMS-AOV-515A (B,C,D)]	RAW/CCF FV/CCF(FIRE)	Main steam isolation valve isolates the ruptured Steam Generator (SG) at the Steam Generator Tube Rupture (SGTR). In case of secondary line break, main steam isolation is required to prevent unlimited steam release. Main steam line piping is required to be intact to isolate the ruptured SG at SGTR events.
2	A~D-Main steam bypass isolation valves [NMS-HCV-3615,3625,3635,3645]	RAW(L2)	
3	Main steam line piping	RAW	
4	Main steam line isolation check valve~~s~~ ~~A(B,C and D)~~ [VLV-516A(B,C and D)]	RAW(~~FIRE~~FLOOD)	
5	A1~A2-Main steam safety valves B1~B2-Main steam safety valves C1~C2-Main steam safety valves D1~D2-Main steam safety valves [NMS-VLV-509A (B,C,D)] [NMS-VLV-510A (B,C,D)]	RAW(L2)	
6	A,B,C,D,E,F,G,H,J,K,L,M,N,P,Q-Turbine bypass valves [NMS-TCV-500A(B,C,D,E,F,G,H,J,K,L,M,N,P,Q)]	RAW(L2)	

For Item 4 &5 DCD_17.04-26

For Item 5 DCD_17.04-41

Note: This will be revised incorporating the discussion of expert panel.

Table 17.4-1 Risk significant SSCs (sheet 33 of ~~34~~ 36)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
25	Essential service water system (ESWS)		
1	Pump discharge line check valves [VLV-502A (B,C,D)]	RAW/CCF/LPSD	The essential service water system (ESWS) transfers heat from the CCW system as Ultimate Heat Sink (UHS). This system supports the CCW system, which supports various safety and non-safety mitigation systems. Accordingly, reliability of CCWS EFW system has significant impact on risk. Since ESWS consists of four independent trains, failure of one train does not have significant impact on risk. However, failures of SSCs that impact multiple trains have risk significant impact on risk. Accordingly, SSCs that have potential to cause common cause failures among multiple trains are risk significant.
2	Essential service water pump motor cooling line check valves [VLV-602A (B,C,D)]	RAW/CCF/LPSD	
3	A~D-Essential service water pump [EWS-OPP-001A (B,C,D)]	FV/RAW/CCF/LPSD	
4	~~A1,B1-Essential service water pump outlet strainers [EWS-OSR-001A (B)]~~ A (B,C,D) -CCW heat exchanger inlet strainers[TBD]	RAW/LPSD	
5	A1~D1-Essential service water pump outlet strainers ~~A2~D2-Essential service water pump outlet strainers~~ A2~D2-Essential service water pump outlet strainers [EWS-OSR-001A (B,C,D):between EWS-VLV-506A(B,C,D) and -508A(B,C,D)] ~~[EWS-OSR-002A (B,C,D)]~~ [EWS-OSR-002A(B,C,D):between EWS-VLV-507A(B,C,D) and -509A(B,C,D)]	RAW(FLOOD,FIRE, L2,L2-FLOOD)~~/LPSD~~	
6	Valves located in essential service water pump motor cooling line of train B & C [VLV-601B (C)]	RAW/LPSD	
7	ESW pump motor cooling line valves of train A & D [VLV-601A (D)]	RAW(L2)	

Table 17.4-1 Risk significant SSCs (sheet 36 of 36)

Notes:

1. Definition of Rationale Terms:
   CCF = Common Cause Failure
   FV = Fussell-Vesely
   RAW = Risk Achievement Worth
   FV(L2) = Fussell-Vesely for L2
   RAW(L2) = Risk Achievement Worth for L2
   CCF(L2) = Common Cause Failure for L2
   LPSD =Low Power and Shut Down Operation
   EJ = Engineering Judge
   FLOOD = FLOOD Event
   FIRE = FIRE Event
   EP = Expert Panel

*1 = Based on the equality and similarity in function and failure behavior to other SSCs, which are risk significant

*2 = Based on the risk significant human error concerning the SSCs

*3 = Based on the risk significant signal error concerning the SSCs