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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-11030

Subject: **Update of Chapters 17 and 19 of US-APWR DCD**

Reference: 1) Letter MHI Ref: UAP-HF-09521 from Y. Ogata (MHI) to U.S. NRC, "Update of Chapter 9 of US-APWR DCD" dated November 17, 2009.
2) Letter MHI Ref: UAP-HF-09490 from Y. Ogata (MHI) to U.S. NRC, "Submittal of US-APWR Design Control Document Revision 2 in Support of Mitsubishi Heavy Industries, Ltd.'s Application for Design Certification of the US-APWR Standard Plant Design" dated October 27, 2009.

Reference 1) contains updates to Chapter 9 of our US-APWR Design Control Document ("DCD") to inform that the Essential Service Water Pump ("ESWP") motor cooling method shall be determined by the Combined License ("COL") Applicant and that the air cooling is Standard Plant Design Information ("SPDI").

Similarly, MHI has determined that updates of Chapters 17 and19 of the MHI US-APWR DCD are required to reflect the information regarding the ESWP motor cooling shown above.

With this letter, MHI transmits proposed DCD updates to the NRC Staff based on Reference 1). These updates will be incorporated into future DCD revisions.

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

Y. Ogata

Sincerely,

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

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Enclosure:

1. Update of Chapters 17 and 19 of the US-APWR DCD

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Enclosure 1

UAP-HF-11030
Docket No. 52-021

Update of Chapters 17 and 19 of US-APWR DCD

February 2011

MHI has determined that updates of Chapters 17 and19 of the MHI US-APWR Design Control Document are required to reflect the information regarding the ESWP motor cooling described in the Letter MHI Ref: UAP-HF-09521 from Y. Ogata (MHI) to U.S. NRC, "Update of Chapter 9 of US-APWR DCD" dated November 17, 2009.

Tables 1 and 2 shows the change list for Chapters 17 and 19 of the DCD respectively, which gives the positions, the contents and the reasons of changing DCD. Mark-up drafts of the DCD are also attached to this document.

Table 1 Change List of Chapter 17 of DCD

Page	**Location** (e.g., subsection with paragraph/ sentence/ item, table with row/column, or figure)	Description of Change
17.4-36	Table 17.4-1 Sheet 29	Add ESW pump room exhaust fans as risk-significant SSCs in heating, ventilation, and air conditioning (HVAC) system, based on Engineering Judge.
17.4-51	Table 17.4-1 Sheet 44	Delete the following equipment which is related to essential water pump motor cooling: - Essential service water pump motor cooling line check valve (EWS-VLV-602A, B, C, D) - Valves located in essential service water pump motor cooling line (EWS-VLV-601A, B, C, D) - ESW pump motor cooling line transmitters (EWS-FT-070, 071, 072, 073) - ESW pump motor cooling line orifice (EWS-SRO-002A, B, C, D)

Table 2 Change List of Chapter 19 of DCD

Page	**Location** (e.g., subsection with paragraph/ sentence/ item, table with row/column, or figure)	Description of Change
19.1-34	19.1.4.1.1, Last bullet	Add the key assumption regarding essential service water pump motor cooling system as follows: "The essential service water (ESW) pump motor is water –cooled in the base case. When air cooling is applied to ESW pump motor cooling, the estimation assuming operator backup to prevent room heatup in the event ESW pump room ventilation loss is performed.
19.1-36	19.1.4.1.2 Third paragraph of importance analyses	Add the following paragraph. "The case where the ESW pump motors are air-cooled has small impact on the PRA results because the HVAC system for the ESW pump room has high reliability due to its backup action. The CCF of ESW pump room exhaust fans to run is identified to be risk-significant for RAW based on importance analysis, the results of which are used as input to the reliability assurance program (RAP) in Section 17.4. The exhaust fans are listed as risk-significant SSCs instead of components on the ESW pump motor water-cooling line.
19.1-953	Table 19.1-119 Second item in No.13 Essential service water system (Sheet 6)	Add the key assumption as follows: The case where ESW pump motors are air-cooled has a small impact on PRA results because the HVAC system for the ESW pump room is reliable due to operator backup.

Table 17.4-1 Risk-significant SSCs (sheet - 2845 of 44)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Failure Mode[2]	Insights and Assumptions
12	Heating, ventilation, and air conditioning (HVAC) system			
1	B,C-Emergency feedwater pump room fans [VRS-MFN-401B, C]	FV(FL1, FR2) RAW(FL1, FL1-CC, FR1, FR1-CC, FR2, FR2-CC), LP	AD, LR, SR	EFW M/D pump room fans maintain room temperature when pumps are running. EFW M/D pumps are assumed to be unavailable within the mission time without room cooling due to high room temperature. HVAC systems of other rooms are considered not to be risk significant for the following reasons. - HVAC of emergency gas turbine room Gas turbine units itself has function to intake outer air to remove heat out to atmosphere. Accordingly, HVAC is considered not essential to maintain gas turbine function. - HVAC of ESF room (RHR/CSS pump, SI pump) According to room temperature analysis, room temperature will not exceeds limit of the system during the mission time regardless of availability of HVAC. - HVAC of class1E electric power room (Class 1E I&C, switch gear, battery, battery charger) This system is running during normal operation and continues to run after initiating events. Reliability of normally operating HVAC systems are considered to be high and failure of this system is unlikely to occur during the mission time. - HVAC of EFW T/D pump room Since T/D driven EFW pump room can operate under high room temperature conditions, they are assumed to be available regardless of room cooling during the mission time.
2	B,C-Emergency feedwater pump air handling unit [VRS-MAH-401B, C]	RAW(L1-CC, L2-CC)	AD, LR, SR	

Table 17.4-1 Risk-significant SSCs (sheet - 2945 of 44)

#	Systems, Structures and Components (SSCs)	Rationale(1)	Failure Mode(2)	Insights and Assumptions
3	ESW pump room exhaust fans	EJ	LR	Based on the assumption that the ESW pump motors are air-cooled, the ESW pump room ventilation system is included in this table. The ESW pump room ventilation system provides convection air cooling to ESW pump motors in the ESW room.
13	Containment fan cooler system			
1	Containment fan cooler units [VCS-MAH-001A (B, C, D)]	EP RAW(L2)	EL, PR	Temperature control of Containment Vessel atmosphere is judged important by experts from a point of view of keeping function of safety components in Containment Vessel.
14	Main control room HVAC system			
1	Main control room air handling units [VRS-MAH-101A (B, C, D)]	EP	FC	Temperature control of main control room atmosphere is judged important by experts from the viewpoint of operator habitability during an accident.
2	Air conditioner ducts	SM	SS	

Table 17.4-1 Risk-significant SSCs (sheet - 43~~45~~ of 44)

#	Systems, Structures and Components (SSCs)	Rationale(1)	Failure Mode(2)	Insights and Assumptions
25	Essential service water system (ESWS)			
1	EWS pump discharge line check valves [EWS-VLV-502A (B,C,D)]	RAW(L1, L1-CC, L2,L2-CC, LP ,LP-CC, FL1, FL1-CC, FR1, FR1-CC, FL2, FR2, FR2-CC,)	EL,PR,OD	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~~ ~~[EWS-VLV-602A (B,C,D)]~~	~~RAW(L1, L1-CC, L2,L2-CC, LP , LP-CC, FL1, FL1-CC, FR1, FR1-CC, FL2, FR2, FR2-CC)~~	~~EL, PR, OD~~	
~~3~~2	Essential service water pumps [EWS-MPP-001A (B,C,D)]	FV(L1-CC, L2-CC, LP-CC, FL1, FR1,-CC, FL2, FR2, FR2-CC) RAW(L1, L1-CC, L2, L2-CC, LP, LP-CC, FL1, FL1-CC, FR1, FR1-CC, FL2, FL2-CC,FR2, FR2-CC) SM	BD, YR, EL, SS, FS	
43	CCW heat exchanger inlet strainers [EWS-SST-003A (B, C, D)]	RAW(L1, L2, LP, FL1, FR1, FL2) LP	PR	
~~5~~4	Essential service water pump outlet strainers [EWS-SST-001A (B,C,D)] [EWS-SST-002A(B,C,D)]	RAW(L1, L2, LP, L1, R2, L2)	PR	
~~6~~	~~Valves located in essential service water pump motor cooling line~~ ~~[EWS-VLV-601A(B,C,D)]~~	~~RAW(L1, 2, P, L1, R1, L2, R2)~~	~~EL, PR~~	

Table 17.4-1 Risk-significant SSCs (sheet - 44~~45~~ of 44)

#	Systems, Structures and Components (SSCs)	Rationale(1)	Failure Mode(2)	Insights and Assumptions
~~7~~	~~ESW pump motor cooling line transmitters [EWS-FT-070(071,072,073)]~~	~~RAW(L1, L2, LP, FL1, FR1, FL2, FR2)~~	~~PR~~	
~~8~~	~~ESW pump motor cooling line orifices [EWS-SRO-002A (B, C, D)]~~	~~RAW(FL/FR) LP~~	~~PR~~	
5~~9~~	Main piping orifices [EWS-FE-034(035, 036, 037)]	RAW(L1, L2, LP, FL1, FR1, FL2, FR2)/ SM	PR, SS	
6~~10~~	ESW pump discharge line motor operated valves [EWS-MOV-503 A(B,C,D)]	RAW(L1, L2, LP, FL 1, FR1, FL2)	CM, EL, OD, PR,	

is not enough available time to take corrective action, recovery credit is not considered.

- For operator actions at local area (action that take place outside control room) auxiliary operators (licensed and non-licensed) are available:

    - The auxiliary operator 1

    - The auxiliary operator 2

  Normally the auxiliary operators are stational in the MCR. If the local manipulation of equipment is required to mitigate accidents or to prevent core damage, the auxiliary operator moves to the appropriate area in the reactor building or auxiliary building, to access equipment such as manual valves. It is assumed that auxiliary operator 1 operates equipments and auxiliary operator 2 checks the actions of auxiliary operator 1. If auxiliary operator 1 commits an error during the operation, auxiliary operator 2 corrects it

- Misalignment of remote-operated valves (e.g. motor-operated valves, air-operated valves), pumps and gas turbine generators after test and maintenance will be fixed before initiating events occur. Remote-operated valve open/close positions and control switch positions are monitored in the main control room, so they will be detected in a short time

- The controls and displays available in the US-APWR control room are superior to conventional control room HSIs and, therefore, human error probabilities in the US-APWR operation would be less than those in conventional plants

- The essential service water (ESW) pump motor is water-cooled in the base case. When air cooling is applied to ESW pump motor cooling, the estimation assuming operator backup to prevent room heatup in the event ESW pump room ventilation loss is performed.

19.1.4.1.2 Results from the Level 1 PRA for Operations at Power

This subsection provides the results from the Level 1 PRA for operations at power

Sixteen separate initiating event categories are defined to accurately represent the US-APWR design. Six of the initiating events are related to LOCA and ten of the initiating events are related to non-LOCA events.

The US-APWR PRA developed a total of 516 potential core damage event sequences for internal initiating events at power. These core damage sequences are the combination of initiating event occurrences and subsequent successes/failures of mitigation systems/operator actions. The failure probabilities for the modeled front line and support systems are given in Tables 19.1-20 and 19.1-21, respectively. The unreliability of EFWS under various loss-of-main feedwater transients, which is required in 10 CFR 50.34(f)(1)(ii)(A), is given in Table 19.1-20.

level in the RCS decreases, and two hours after initiation of RCP seal LOCA (three hours after LOOP), core is uncovered. The frequency of this sequence is 3.4E-07/RY and accounts for 32.9 % of the total CDF.

(2) LOCCW with reactor trip: EFWS successfully functions, but RCP seal LOCA occurs due to failure of the alternate component cooling of the charging pump utilizing FSS or non-essential chilled water system. In addition, functions to mitigate RCP seal LOCA are also unavailable due to loss of CCW. RCS inventory gradually decreases, and finally the core is damaged. The frequency of this sequence is 1.7E-07/RY and accounts for 15.9 % of the total CDF.

(3) Reactor vessel rupture: This event directly leads to core damage since the reactor vessel can no longer maintain RCS coolant inside. The frequency of this sequence is 1.0E-07/RY and accounts for 9.7 % of the total CDF.

(4) LOOP with reactor trip: Emergency power supply and EFWS successfully function, but CCWS pumps fail to restart and loss of CCW flow occurs. Alternate component cooling of charging pump utilizing FSS or non-essential chilled water system fails and eventually RCP seal LOCA occurs. In addition, functions to mitigate RCP seal LOCA are unavailable due to loss of CCW. RCS inventory gradually decreases, and finally the core is damaged. The frequency of this sequence is 9.0E-08/RY and accounts for 8.7 % of the total CDF.

The top 20 cutsets for these sequences are shown in Table 19.1-27, Table 19.1-28, and Table 19.1-29. Each of the other event sequences represents less than 5% of the total CDF. Cutsets for the reactor vessel rupture event are not listed here because the initiating event is assumed to directly lead to core damage.

Importance analyses have been performed to determine the following:

- Basic event importance
- CCF importance
- Human error importance
- Component importance

The results of importance are organized by a Fussell Vesely (FV) importance and risk achievement worth (RAW). Risk significant basic events which have FV importance equal or greater than 0.005 and RAW equal or greater than 2.0 are listed in Table 19.1-30 and Table 19.1-31, respectively.

The case where the ESW pump motors are air-cooled has small impact on the PRA results because the HVAC system for the ESW pump room has high reliability due to its backup action. The CCF of ESW pump room exhaust fans to run is identified to be risk-significant for RAW based on importance analysis, the results of which are used as input to the reliability assurance program (RAP) in Section 17.4. The exhaust fans are listed as risk-significant SSCs instead of components on the ESW pump motor water-cooling line.

Table 19.1-119 Key Insights and Assumptions (Sheet 6 of 23)

Key Insights and Assumptions	Dispositions
- CCWS supplies cooling water to containment fan cooler unites to when performing alternate CV cooling during severe accident conditions. The cooling water system is switched from the non-essential chilled water system to CCW system to supply the cooling water to the containment fan cooler units.	9.4.6.2.1
- In the case of loss of CCW, a non-essential chilled water system or a fire suppression system is able to connect to the CCWS in order to cool the charging pump and maintain RCP seal water injection.	
13. Essential Service water system	
- The ESWS is arranged into four independent trains (A, B, C, and D). Each train consists of one ESWP, two 100% strainers in the pump discharge line, one 100% strainer upstream of the CCW HX, one CCW HX, one essential chiller unit, and associated piping, valves, instrumentation and controls.	9.2.1.2.1 COL19.2(3) COL19.2(4)
- The case where ESW pump motors are air-cooled has a small impact on PRA results because the HVAC system for the ESW pump room is reliable due to operator backup.	COL 9.2(6) COL 13.5(5)
14. Onsite Electric Power System	
- The onsite Class 1E electric power systems comprise four independent and redundant trains, each with its own power supply, buses, transformers, and associated controls.	8.3.1.1.2.1
- One independent Class 1E GTG is provided for each Class 1E train.	8.3.1.1.2.1
- Non-Class 1E 6.9kV permanent buses P1 and P2 are also connected to the non-Class 1E A-AAC GTG and B-AAC GTG, respectively. The loads which are not safety-related but require operation during LOOP are connected to these buses.	8.3.1.1.1
- In the event of SBO, power to one Class 1E 6.9kV bus can be restored manually from the AAC GTG.	8.3.1.1.2.4
- Common cause failure between class 1E GTG and non-class 1E GTG supply is minimized by design characteristics. Different rating GTGs with diverse starting system, independent and separate auxiliary and support systems are provided to minimize common cause failure.	8.4.1.3
- The non-safety GTG can be started manually when	8.4.1.3