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July 20, 2012

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-12202

Subject: MHI's Second Amended Response to US-APWR DCD RAI No. 571-4365 Revision 0 (SRP 09.02.02)

Reference: 1) "Request for Additional Information 571-4365 Revision 0, SRP Section 09.02.02 – REACTOR AUXILIARY COOLING WATER SYSTEM, Application Section: 9.2.2, dated April 10, 2010.
2) "MHI's Responses to US-APWR DCD RAI No. 571-4365", UAP-HF-10160, dated June 8, 2010.
3) "MHI's Revised Responses to US-APWR DCD RAI No. 571-4365 Revision 0", UAP-HF-11237, dated July 29, 2011.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Second Amended Response to Request for Additional Information No. 571-4365 Revision 0".

Enclosed is the second amended response to Question 09.02.02-58 that is contained within Reference 1. The previous responses to Question 09.02.02-58 were provided in References 2 and 3. MHI supersedes the previous response to Question 09.02.02-58 with this amended response letter.

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittal. His contact information is provided below.

Sincerely,

Hiroki Nishio for

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

D081
NRO

Enclosure:

1. Second Amended Response to Request for Additional Information No. 571-4365 Revision 0

CC: J. A. Ciocco
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Docket No. 52-021
MHI Ref: UAP-HF-12202

Enclosure 1

UAP-HF-12202
Docket No. 52-021

Second Amended Response to Request for Additional Information No. 571-4365 Revision 0

July 2012

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/20/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 571-4365 REVISION 0**

SRP SECTION: **09.02.02 – REACTOR AUXILIARY COOLING WATER SYSTEM**

APPLICATION SECTION: **9.2.2**

DATE OF RAI ISSUE: **4/13/2010**

QUESTION NO.: 09.02.02-58
Follow-up to RAI 362-2278, question 09.02.02-34

Based on the staff's review of the applicant's response to RAI 09.02.02-34, the following items should be addressed.

Item 2: The discussion in response to RAI 09.02.02-34, item 2 should be added to the DCD.

Item 3: Although the additional text explained the re-supply water function and operation of the associated valves (NCS-MOV-445A/B, MOV-447A/B, and MOV-448A/B), it does not discuss the bases for the 4 diameter bypass lines. The discussion should be added to the DCD.

The US-APWR design related to the CCWS supply to the RCPs isolates on a containment isolation signal (MOV-401A and B, MOV-402A and B, MOV-436A and B, and MOV 438A and B) which is counter to the guidance of SRP 9.2.2, Section II. "Acceptance Criteria", Item 4. D which states: "Remote manual isolation of the RCP seal coolant water by the main control room operator for continued long-term pump operation in an actual event".

In addition, SRP 9.2.2. Section III, "Review Procedure," Item 4.F. states:

"Design provisions are made for isolation of component cooling water supply and return lines to the RCP by remote manual means only".

In accordance with 10 CFR 52.47 (a) (9), an evaluation shall discuss how the proposed alternative provides an acceptable method of complying with the Commission's regulations. The applicant should revise Table 1.9.2-9, "US-APWR Conformance with Standard Review Plan Chapter 9 Auxiliary Systems," stating the bases for an exception or departure related to GDC 44 and the guidance of SRP Section 9.2.2.

Reference: MHI's Responses to US-APWR DCD RAI No. 362-2278; MHI Ref: UAP-HF-09333; dated June 19, 2009; ML091760624.

ANSWER:
Item 2: Tier 2, DCD Subsection 9.2.2.3.2 will be revised to describe why there is low potential for leakage into the RCS, as stated in the response to Question 09.02.02-34, Item 2.

Item 3: The 8-inch lines and valves are sized for all plant operating conditions. The isolation signals that were described in DCD Revision 3 for the header tie line isolation valves (NCS-MOV-020A/B and 007A/B), RCP CCW supply line isolation valves (NCS-MOV-401A/B) and RCP CCW supply line containment isolation valves (NCS-MOV-402A/B), RCP CCW return line containment isolation valves (NCS-MOV-436A/B and NCS-MOV-438A/B) will be removed. Thus, RCP thermal barrier cooling is not automatically isolated, consistent with SRP 9.2.2. As a result, the 4-inch bypass lines and valves (NCS-MOV-445A/B, MOV-447A/B, and MOV-448A/B), which were intended only to provide sufficient cooling for the RCP thermal barrier under the conditions associated with containment isolation, are not necessary. Thus, this alternate flow path and associated valves will be deleted. The additional description discussed in Question 09.02.02-34 will also be removed.

Removal of automatic closure of the header tie line isolation valves (NCS-MOV-020A/B and 007A/B) during an accident condition introduces the potential for additional loading on one train of a subsystem if a single failure is postulated in the other train. (Note, the response to Question 09.02.02-48 describes the design change to the automatic isolation of the A2 header heat loads.) The potential exists only for the period in which the header tie line valves are open. For example, if the B-CCW pump fails to actuate upon the receipt of an ECCS actuation signal, the heat load on the A-CCW heat exchanger will be increased as follows:

Additional load from B header

- B-CCW pump: Pump fails to start: 0.0 Btu/hr
- B-SI pump: Pump actuated by ECCS signal: 0.84×10^6 BTU/hr
- B-CS/RHR pump: Pump actuated by containment spray signal: 0.48×10^6 BTU/hr
- B-CS/RHR heat exchanger: CCW will not be provided to the heat exchanger because the outlet isolation valve (NCS-MOV-145B) opens only on receipt of both B-CCW pump actuation and ECCS actuation signal: 0.0 Btu/hr

Thus, the total additional A-CCW heat exchanger heat load is 1.32×10^6 BTU/hr.

Additional load from A1 header

The heat load from A1 header is already included in DCD Revision 3 Table 9.2.2-4. Therefore, removal of the auto closure for the header tie line will not affect the A-CCW heat exchanger heat load.

Additional load from A2 header

- The heat load from the A-instrument air system in the Turbine Building and non-safety related components in the Auxiliary Building (no CCWS supporting components for C2 header) will be isolated by ECCS actuation, containment spray signal or low-low surge tank level: 0.0 Btu/hr
- The heat load from excess letdown heat exchanger (letdown heat exchanger for C2 header) will also be isolated by containment isolation signal: 0.0 Btu/hr

Revised Table 9.2.2-4 provided in the response to Question 9.2.2-52 lists the total "A or B header" heat load as 161.7×10^6 BTU/hr for the accident condition. Adding 1.32×10^6 BTU/hr

to account for open header tie line isolation valves and a single failure would increase this value to 163.02 x 10^6 BTU/hr. This value would increase the required heat exchanger UA value for accident condition; Table 9.2.2.52-1 in the response to Question 9.2.2-52 lists this value as 5.0 x 10^6 Btu/°F-hr. However, such a change would not affect the design basis of the CCW heat exchanger as it is small in comparison to the required UA value of 7.2 x 10^6 BTU/hr for the refueling condition. Thus, the system would not overheat in this configuration as the available heat exchanger could accommodate the increased heat load.

For the case of all B-train failure due to the failure of B-Class 1E GTG during the accident condition concurrent with a LOOP, the non-safety components and all the B-train safety components powered from the B-Class 1E will stop. Thus, the heat load from B and A2 header will be zero and this situation is bounded by the case of B-CCW pump failure.

For the case of A, C and D-train failure, an analogous approach results in similar conclusions. In summary, removal of auto closure for the header tie line isolation valves (NCS-MOV-020A/B and 007A/B) does not affect the CCWS design from a heat removal perspective.

Removal of the automatic closure of the header tie line isolation valves during an accident could result in a situation that CCW flow to a potentially a non-functioning CS/RHR heat exchanger must be terminated to assure that adequate flow is provided to the functioning CS/RHR heat exchanger in the subsystem. The response to RAI 919-6392, Question 09.02.02-86 describes a change to the CCWS design described in DCD Revision 3 to address this situation.

Closure of the header tie line valves is required to achieve separation of trains within each subsystem. In the event of a design basis accident, train separation prevents drainage of the subsystem in the event of a subsequent passive component failure such as pipe break. Based on the discussion in SECY-77-439 (§2.D, "Passive Failure in a Fluid System"), leakage is typically assumed during the long-term post-accident response, but not additional gross failure of passive components. SECY-77-439 refers to long-term cooling as "24 hours or greater after the event". Thus, it is assumed that the operator will close the header tie line isolation valves within 24 hours to configure the CCWS for long-term operation after a design basis accident. The DCD will be modified to identify that operators must close the header tie line isolation valves to achieve train separation.

Impact on DCD

DCD Tier 1 Subsection 2.7.3.3.1 will be revised to delete references to NCS-MOV-445A/B, MOV-447A/B, MOV-448A/B; and update information for NCS-MOV-401A/B, MOV-402A/B, MOV-436A/B and MOV-438A/B as follows:

- Table 2.7.3.3-1
- Table 2.7.3.3-2
- Table 2.7.3.3-3
- Table 2.7.3.3-4
- Figure 2.7.3.3-1 (Revised figure provided in Question 9.2.2-49 response reflects deletion of NCS-MOV-445A/B, MOV-447A/B, and MOV-448A/B)

DCD Tier 1 Subsection 2.11.2.1 will be revised to delete references to NCS-MOV-445A/B, MOV-447A/B, MOV-448A/B and update information for NCS-MOV-401A/B, MOV-402A/B, MOV-436A/B and MOV-438A/B, as follows:

- Table 2.11.2-1
- Table 2.11.2-2

DCD Tier 2 Table 3.2-2 will be revised as follows:

- Delete reference to NCS-MOV-445A/B, 447A/B, 448A/B

DCD Tier 2 Table 3.9-14 will be revised as follows:

- Delete reference to NCS-MOV-445A/B, 447A/B, 448A/B

DCD Tier 2 Table 3D-2 will be revised as follows:

- Delete reference to NCS-MOV-445A/B, 447A/B, 448A/B

DCD Tier 2 Subsections 6.2.4.2 and 6.2.4.3.2 will be revised as follows:

- Clarify isolation function and actuation of CCW supply and return line to the RCPs valves.

DCD Tier 2 Table 6.2.4-3 will be revised as follows:

- Delete reference to NCS-MOV-445A/B, 447A/B, 448A/B
- Change "Valve Position, Post-Accident" from "C" to "O" for NCS-MOV-402A/B, 436A/B, 438A/B

DCD Tier 2 Subsection 9.2.2.2.2.4 will be revised as follows:

- Delete automatic closure discussion for header tie line isolation valves
- Add header tie line isolation valve closure time discussion
- Reference COL item for closure header tie line isolation valve closure.

DCD Tier 2 Subsection 9.2.2.3.2 will be revised as follows:

- Revise discussion of closure of header tie line isolation valves to eliminate reference to automatic closure.
- Add discussion provided in the response to RAI Question 09.02.02-34, Item 2, to the DCD.

DCD Tier 2 Subsection 9.2.2.3.5 will be revised as follows:

- Revise discussion to reflect that thermal barrier cooling will not be automatically isolated and that 4-inch bypass valves have been removed from the design.

DCD Tier 2 Table 9.2.2-3 will be revised as follows:

- Delete reference to NCS-MOV-445A/B, 447A/B, 448A/B and update the FMEA.
- Update to reflect that automatic closure of NCS-MOV-020A/B and 007A/B has been deleted; see the response to Question 9.2.2-48 for this change.
- Reflect RCP cross tie operation in Item 1.
- Add a note to provide additional information for "Effect on System Safety Function" with regard to header tie line isolation valves.

Impact on R-COLA
There is no impact on the R-COLA.

Impact on S-COLA
There is no impact on the S-COLA.

Impact on PRA
There is no impact on the PRA.

Table 2.7.3.3-1 Component Cooling Water System Location of Equipment and Piping (Sheet 2 of 2)

System and Components	Location	
Component cooling water system piping and valves between and including the containment isolation valves NCS-MOV-402A,436A,438A~~,445A,447A,448A~~ and NCS-VLV-403A,437A	Containment Reactor Building	DCD_09.02.02-58
Component cooling water piping and valves between and including the containment isolation valves NCS-MOV-402B,436B,438B~~,445B,447B,448B~~ and NCS-VLV-403B,437B	Containment Reactor Building	DCD_09.02.02-58
Component cooling water system piping and valves related to components installed in A/B from and excluding ~~isolation~~stop valve NCS-~~AOV-602~~VLV-601 up to and excluding stop valve NCS-VLV-651	Auxiliary Building Reactor Building	DCD_09.02.02-49
Component cooling water system piping and valves related to components installed in T/B from and excluding ~~isolation~~stop valves NCS-~~AOV-662~~VLV-661A,B up to and excluding stop valves NCS-VLV-669A,B	Turbine Building Reactor Building	DCD_09.02.02-49
Component cooling water system piping and valves related to reactor coolant pumps between the containment isolation valves NCS-MOV-436A,447A (excluding) and NCS-VLV-403A,437A (excluding) and the valves NCS-SRV-406A,B,435A (including)	Containment	
Component cooling water system piping and valves related to reactor coolant pumps between the containment isolation valves NCS-MOV-436B,447B (excluding) and NCS-VLV-403B,437B (excluding) and the valves NCS-SRV-406C,D,435B (including)	Containment	
~~Component cooling water system piping and valves between and including the valves NCS-AOV-601 and 602~~	~~Reactor Building~~	DCD_09.02.02-49
~~Component cooling water system piping and valves between and including the valves NCS-VLV-651 and 653~~	~~Reactor Building~~	DCD_09.02.02-49
~~Component cooling water system piping and valves between and including the valves NCS-AOV-661A,B and 662A,B~~	~~Reactor Building~~	DCD_09.02.02-49
~~Component cooling water system piping and valves between and including the valves NCS-VLV-669A,B and 671A,B~~	~~Reactor Building~~	DCD_09.02.02-49
Component cooling water surge tank surge line piping	Reactor Building	

Table 2.7.3.3-1 Component Cooling Water System Location of Equipment and Piping (Sheet 2 of 2)

System and Components	Location	
Component cooling water system piping and valves between and including the containment isolation valves NCS-MOV-402A,436A,438A~~,445A,447A,448A~~ and NCS-VLV-403A,437A	Containment Reactor Building	DCD_09.02.02-58
Component cooling water piping and valves between and including the containment isolation valves NCS-MOV-402B,436B,438B~~,445B,447B,448B~~ and NCS-VLV-403B,437B	Containment Reactor Building	DCD_09.02.02-58
Component cooling water system piping and valves related to components installed in A/B from and excluding ~~isolation~~stop valve NCS-~~AOV-602~~VLV-601 up to and excluding stop valve NCS-VLV-651	Auxiliary Building Reactor Building	DCD_09.02.02-49
Component cooling water system piping and valves related to components installed in T/B from and excluding ~~isolation~~stop valves NCS-~~AOV-662~~VLV-661A,B up to and excluding stop valves NCS-VLV-669A,B	Turbine Building Reactor Building	DCD_09.02.02-49
Component cooling water system piping and valves related to reactor coolant pumps between the containment isolation valves NCS-MOV-436A,447A (excluding) and NCS-VLV-403A,437A (excluding) and the valves NCS-SRV-406A,B,435A (including)	Containment	
Component cooling water system piping and valves related to reactor coolant pumps between the containment isolation valves NCS-MOV-436B,447B (excluding) and NCS-VLV-403B,437B (excluding) and the valves NCS-SRV-406C,D,435B (including)	Containment	
~~Component cooling water system piping and valves between and including the valves NCS-AOV-601 and 602~~	~~Reactor Building~~	DCD_09.02.02-49
~~Component cooling water system piping and valves between and including the valves NCS-VLV-651 and 653~~	~~Reactor Building~~	DCD_09.02.02-49
~~Component cooling water system piping and valves between and including the valves NCS-AOV-661A,B and 662A,B~~	~~Reactor Building~~	DCD_09.02.02-49
~~Component cooling water system piping and valves between and including the valves NCS-VLV-669A,B and 671A,B~~	~~Reactor Building~~	DCD_09.02.02-49
Component cooling water surge tank surge line piping	Reactor Building	

Table 2.7.3.3-2 Component Cooling Water System Equipment Characteristics (Sheet 2 of 8)

Equipment Name	Tag No.	ASME Code Section III Class	Seismic Category I	Remotely Operated Valve	Class 1E/ Qual. For Harsh Envir	PSMS Control	Active Safety Function	Loss of Motive Power Position
CCW return header tie line isolation valves	NCS-MOV-007 A, B, C, D	3	Yes	Yes	Yes/No	~~ECCS Actuation and undervoltage signal~~	~~Transfer Closed~~	As Is
						~~Containment Spray~~	~~Transfer Closed~~	
						~~Low low CCW surge tank water level~~	~~Transfer Closed~~	
						Remote Manual	Transfer Open/ Transfer Closed	
CS/RHR heat exchanger CCW outlet valves	NCS-MOV-145 A, B, C, D	3	Yes	Yes	Yes/No	ECCS Actuation and CCW pump start	Transfer Open	As Is
						Remote Manual	Transfer Open/ Transfer Closed	
RCP CCW supply line outside containment isolation valves	NCS-MOV-402 A, B	2	Yes	Yes	Yes/No	~~Containment Isolation Phase B~~	~~Transfer Closed~~	As Is
						Remote Manual	Transfer Open/ Transfer Closed	

DCD_09.02.02-48

DCD_09.02.02-58

As of 6/29/2012

As of 6/29/2012

Table 2.7.3.3-2 Component Cooling Water System Equipment Characteristics (Sheet 3 of 8)

Equipment Name	Tag No.	ASME Code Section III Class	Seismic Category I	Remotely Operated Valve	Class 1E/ Qual. For Harsh Envir.	PSMS Control	Active Safety Function	Loss of Motive Power Position	
RCP CCW supply line inside containment check valves	NCS-VLV-403 A, B	2	Yes	-	-/-	-	Transfer Open/ Transfer Closed	-	
Reactor coolant pump thermal barrier heat exchanger component cooling water supply check valves	NCS-VLV-405 A, B, C, D	3	Yes	-	-/-	-	Transfer Open/ Transfer Closed	-	
~~RCP CCW supply line outside containment isolation valve bypass valves~~	~~NCS-MOV-445 A, B~~	~~2~~	~~Yes~~	~~Yes~~	~~Yes/No~~	~~Remote Manual~~	~~Transfer Open/ Transfer Closed~~	~~As Is~~	DCD_09.02.02-58
RCP CCW return line inside containment isolation valves	NCS-MOV-436 A, B	2	Yes	Yes	Yes/Yes	~~Containment Isolation Phase B~~	~~Transfer Closed~~	As Is	
						Remote Manual	Transfer Open/ Transfer Closed		
RCP CCW return line inside containment check valves	NCS-VLV-437 A, B	2	Yes	-	-/-	-	Transfer Closed	-	
Reactor coolant pump component cooling water return line check valves	NCS-VLV-439 A, B	3	Yes	-	-/-	-	Transfer Open/ Transfer Closed	-	
~~RCP CCW return line inside containment isolation valve bypass valves~~	~~NCS-MOV-447 A, B~~	~~2~~	~~Yes~~	~~Yes~~	~~Yes/Yes~~	~~Remote Manual~~	~~Transfer Open/ Transfer Closed~~	~~As Is~~	DCD_09.02.02-58

Table 2.7.3.3-2 Component Cooling Water System Equipment Characteristics (Sheet 4 of 8)

Equipment Name	Tag No.	ASME Code Section III Class	Seismic Category I	Remotely Operated Valve	Class 1E/ Qual. For Harsh Envir.	PSMS Control	Active Safety Function	Loss of Motive Power Position	
RCP CCW return line outside containment isolation valves	NCS-MOV-438 A, B	2	Yes	Yes	Yes/No	~~Containment Isolation Phase B~~	~~Transfer Closed~~	As Is	DCD_09.02.02-58
						Remote Manual	Transfer Open/ Transfer Closed		
~~RCP CCW return line outside containment isolation valve bypass valves~~	~~NCS-MOV-448 A, B~~	~~2~~	~~Yes~~	~~Yes~~	~~Yes/No~~	~~Remote Manual~~	~~Transfer Open/ Transfer Closed~~	~~As Is~~	DCD_09.02.02-58
RCP motor CCW supply line isolation valves	NCS-MOV-446 A, B,C,D	3	Yes	Yes	Yes/Yes	Remote Manual	Transfer Closed	As Is	
RCP CCW supply line tie line isolation valves	NCS-MOV-232 A, B	3	Yes	Yes	Yes/No	Remote Manual	Transfer Open	As Is	
RCP CCW return line tie line isolation valves	NCS-MOV-233 A, B	3	Yes	Yes	Yes/No	Remote Manual	Transfer Open	As Is	
RCP CCW return line isolation valve	NCS-MOV-234 A, B	3	Yes	Yes	Yes/No	Remote Manual	Transfer Closed	As Is	
RCP CCW supply line isolation valves	NCS-MOV-401 A, B	3	Yes	Yes	Yes/No	~~Containment Isolation Phase B~~	~~Transfer Closed~~	As Is	DCD_09.02.02-58
						Remote Manual	Transfer Open/ Transfer Closed		
Letdown heat exchanger CCW supply line outside containment isolation valve	NCS-MOV-531	2	Yes	Yes	Yes/No	Containment Isolation Phase A	Transfer Closed	As Is	
Letdown heat exchanger CCW return line outside containment isolation valve	NCS-MOV-537	2	Yes	Yes	Yes/No	Containment Isolation Phase A	Transfer Closed	As Is	

As of 6/29/2012

Table 2.7.3.3-3 Component Cooling Water System Piping Characteristics (Sheet 1 of 2)

Pipe Line Name	ASME Code Section III Class	Seismic Category I	
Component cooling water supply, return lines piping and valves excluding the following; Component cooling water system containment isolation valves and piping between the valves Component cooling water supply, return lines piping and valves between and excluding the valves NCS-~~VLV-033~~AOV-058A and NCS-VLV-034A	3	Yes	DCD_09.02.02-49
Component cooling water supply, return lines piping and valves excluding the following; Component cooling water system containment isolation valves and piping between the valves Component cooling water supply, return lines piping and valves between and excluding the valves NCS-~~VLV-033~~AOV-058B and NCS-VLV-034B	3	Yes	DCD_09.02.02-49
Component cooling water supply, return lines piping and valves between and excluding the valves NCS-~~VLV-033~~AOV-058A and NCS-VLV-034A, excluding the following; Component cooling water system containment isolation valves and piping between the valves ~~Component cooling water system piping and valves between and including the valve NCS-AOV-661A and NCS-VLV-671A~~ ~~Component cooling water system piping and valves between and including the valve NCS-AOV-601 and NCS-VLV-653~~	-	No	DCD_09.02.02-49 DCD_09.02.02-49
Component cooling water supply, return lines piping and valves between and excluding the valves NCS-~~VLV-033~~AOV-058B and NCS-VLV-034B, excluding the following; Component cooling water system containment isolation valves and piping between the valves ~~Component cooling water system piping and valves between and including the valve NCS-AOV-661B and NCS-VLV-671B~~	-	No	DCD_09.02.02-49 DCD_09.02.02-49
Component cooling water system piping and valves related to the excess letdown heat exchanger inside containment between and including the valves NCS-MOV-511,517, SRV-513	2	Yes	
Component cooling water system piping and valves related to the letdown heat exchanger inside containment between and including the valves NCS-MOV-531,537, SRV-533	2	Yes	
Component cooling water system piping and valves between and including the containment isolation valves NCS-MOV-402A,436A,438A~~,445A,447A,448A~~ and NCS-VLV-403A,437A	2	Yes	DCD_09.02.02-58

Table 2.7.3.3-3 Component Cooling Water System Piping Characteristics (Sheet 2 of 2)

Pipe Line Name	ASME Code Section III Class	Seismic Category I	
Component cooling water piping and valves between and including the containment isolation valves NCS-MOV-402B,436B,438B~~,445B,447B,448B~~ and NCS-VLV-403B,437B	2	Yes	DCD_09.02.02-58
~~Component cooling water system piping and valves related to components installed in A/B from and excluding isolation valve NCS-AOV-602 up to and excluding stop valve NCS-VLV-651~~	-	~~No~~	DCD_09.02.02-49
~~Component cooling water system piping and valves related to components installed in T/B from and excluding isolation valves NCS-AOV-662A,B up to and excluding stop valves NCS-VLV-669A,B~~	-	~~No~~	DCD_09.02.02-49
Component cooling water system piping and valves related to reactor coolant pumps between the containment isolation valves NCS-MOV-436A,447A (excluding) and NCS-VLV-403A,437A (excluding) and the valves NCS-SRV-406A,B,435A (including)	3	Yes	
Component cooling water system piping and valves related to reactor coolant pumps between the containment isolation valves NCS-MOV-436B,447B (excluding) and NCS-VLV-403B,437B (excluding) and the valves NCS-SRV-406C,D,435B (including)	3	Yes	
~~Component cooling water system piping and valves between and including the valves NCS-AOV-601 and 602~~	~~3~~	~~Yes~~	DCD_09.02.02-49
~~Component cooling water system piping and valves between and including the valves NCS-VLV-651 and 653~~	~~3~~	~~Yes~~	DCD_09.02.02-49
~~Component cooling water system piping and valves between and including the valves NCS-AOV-661A,B and 662A,B~~	~~3~~	~~Yes~~	DCD_09.02.02-49
~~Component cooling water system piping and valves between and including the valves NCS-VLV-669A,B and 671A,B~~	~~3~~	~~Yes~~	DCD_09.02.02-49
Component cooling water surge tank surge line piping	3	Yes	

NOTE:
Dash (-) indicates not applicable

Table 2.7.3.3-4 Component Cooling Water System Equipment Alarms, Displays, and Control Functions (Sheet 1 of 3)

Equipment/Instrument Name	MCR/RSC Alarm	MCR Display	MCR/RSC Control Function	RSC Display	
Component cooling water pumps (NCS-MPP-001 A,B,C,D)	No	Yes	Yes	Yes	
CCW supply header tie line isolation valves (NCS-MOV-020A,B)	No	Yes	Yes	Yes	
CCW return header tie line isolation valves (NCS-MOV-007A,B)	No	Yes	Yes	Yes	
CS/RHR heat exchanger CCW outlet valves (NCS-MOV-145A,B,C,D)	No	Yes	Yes	Yes	
RCP CCW supply line outside containment isolation valves (NCS-MOV-402A,B)	No	Yes	Yes	Yes	
~~RCP CCW supply line outside containment isolation valve bypass valves (NCS-MOV-445A,B)~~	~~No~~	~~Yes~~	~~Yes~~	~~Yes~~	DCD_09.02.02-58
RCP CCW return line inside containment isolation valves (NCS-MOV-436A,B)	No	Yes	Yes	Yes	
~~RCP CCW return line inside containment isolation valve bypass valves (NCS-MOV-447A,B)~~	~~No~~	~~Yes~~	~~Yes~~	~~Yes~~	DCD_09.02.02-58
RCP CCW return line outside containment isolation valves (NCS-MOV-438A,B)	No	Yes	Yes	Yes	
~~RCP CCW return line outside containment isolation valve bypass valves (NCS-MOV-448A,B)~~	~~No~~	~~Yes~~	~~Yes~~	~~Yes~~	DCD_09.02.02-58
RCP motor CCW supply line isolation valves (NCS-MOV-446A,B,C,D)	No	Yes	Yes	Yes	
RCP CCW supply line tie line isolation valves (NCS-MOV-232A,B)	No	Yes	Yes	Yes	
RCP CCW return line tie line isolation valves (NCS-MOV-233A,B)	No	Yes	Yes	Yes	
RCP CCW return line isolation valve (NCS-MOV-234A,B)	No	Yes	Yes	Yes	
RCP CCW supply line isolation valves (NCS-MOV-401A,B)	No	Yes	Yes	Yes	
Charging pump CCW return isolation valve (NCS-MOV-316A,B)	No	Yes	Yes	Yes	
Charging pump fire fighting water supply isolation valve (NCS-MOV-321A, B)	No	Yes	Yes	Yes	
Charging pump alternative cooling water supply isolation valve (NCS-MOV-322A,B)	No	Yes	Yes	Yes	
Charging pump non-essential chilled water supply isolation valve (NCS-MOV-323A,B)	No	Yes	Yes	Yes	
Charging pump alternative cooling water return isolation valve (NCS-MOV-324A,B)	No	Yes	Yes	Yes	

Table 2.11.2-1 Containment Isolation System Equipment Characteristics (Sheet 9 of 10)

System Name	Tag No.	ASME Code Section III Class	Seismic Category I	Remotely Operated Valve	Class 1E/ Qual. For Harsh Envir.	Safety-Related Display	PSMS Control	Active Safety Function	Loss of Motive Power Position	
CCWS	NCS-MOV-402 A, B	Refer to Tables 2.7.3.3-2 and 2.7.3.3-4								
CCWS	NCS-VLV-403 A, B									
~~CCWS~~	~~NCS-MOV-445 A, B~~									DCD_09.02.02-58
CCWS	NCS-MOV-436 A, B									
CCWS	NCS-VLV-437 A, B									
~~CCWS~~	~~NCS-MOV-447 A, B~~									DCD_09.02.02-58
CCWS	NCS-MOV-438 A, B									
~~CCWS~~	~~NCS-MOV-448 A, B~~									DCD_09.02.02-58
CCWS	NCS-MOV-531									
CCWS	NCS-MOV-537									
CCWS	NCS-MOV-511									
CCWS	NCS-MOV-517									

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Table 2.11.2-2 Containment Isolation System Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 10 of 10)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
15. Remotely operated CIVs located inside and outside the containment in series on the same penetration are powered from different Class 1E divisions.	15. Inspection of the remotely operated CIVs located inside and outside the containment in series on the same penetration will be performed.	15. The following CIVs located inside and outside the containment in series on the same penetration are powered from different Class 1E divisions.

Inside containment	Outside containment
RCS-AOV-147	RCS-AOV-148
CVS-AOV-005	CVS-AOV-006
CVS-MOV-203	CVS-MOV-204
NCS-MOV-436A ~~NCS-MOV-447A~~	NCS-MOV-438A ~~NCS-MOV-448A~~
NCS-MOV-436B ~~NCS-MOV-447B~~	NCS-MOV-438B ~~NCS-MOV-448B~~
LMS-AOV-052	LMS-AOV-053
LMS-AOV-055	LMS-AOV-056 LMS-AOV-060
LMS-LCV-010A	LMS-LCV-010B
LMS-AOV-104	LMS-AOV-105
PSS-AOV-003 PSS-MOV-006 PSS-MOV-013	PSS-MOV-031A
PSS-MOV-023	PSS-MOV-031B
PSS-AOV-062A PSS-AOV-062B PSS-AOV-062C PSS-AOV-062D	PSS-AOV-063
RWS-MOV-002	RWS-MOV-004
VCS-AOV-306	VCS-AOV-307
VCS-AOV-305	VCS-AOV-304
VCS-AOV-356	VCS-AOV-357
VCS-AOV-355	VCS-AOV-354
VWS-MOV-422	VWS-MOV-407
RMS-MOV-001	RMS-MOV-002
IGS-AOV-002	IGS-AOV-001

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Table 3.2-2 Classification of Mechanical and Fluid Systems, Components, and Equipment (Sheet 23 of 56)

System and Components	Equipment Class	Location	Quality Group	10 CFR 50 Appendix B (Reference 3.2-8)	Codes and Standards[3]	Seismic Category[4]	Notes	
Component cooling water supply/ return header C2 piping and valves between and excluding the valves NCS-~~VLV-033~~AOV-058B and NCS-VLV-034B (excluding the valves), excluding the following; Component cooling water system containment isolation valves and piping between these valves[8] Component cooling water system piping and valves between these valves NCS-~~AOV~~VLV-661B and NCS-VLV-~~671~~669B (~~including~~excluding the valves)[9]	4	R/B	D	N/A	4	II	8. Component cooling water system containment isolation valves and piping between these valves are Equipment Class 2, Quality Group B, Seismic Category I. 9. ~~Valves NCS-AOV-661B and NCS-VLV-671B are Equipment Class 3, Seismic Category I.~~	DCD_09.02.02-49 DCD_09.02.02-49
Component cooling water system piping and valves related to the excess letdown heat exchanger inside containment between and including the valves NCS-MOV-511,517, SRV-513	2	PCCV, R/B	B	YES	2	I		
Component cooling water system piping and valves related to the letdown heat exchanger inside containment between and including the valves NCS-MOV-531,537, SRV-533	2	PCCV R/B	B	YES	2	I		
Component cooling water system piping and valves between and including the containment isolation valves NCS-MOV-402A,436A,438A,~~446A,447A,448A~~ and NCS-VLV-403A,437A	2	PCCV R/B	B	YES	2	I		DCD_09.02.02-58
Component cooling water piping and valves between and including the containment isolation valves NCS-MOV-402B,436B,438B,~~446B,447B,448B~~ and NCS-VLV-403B,437B	2	PCCV R/B	B	YES	2	I		DCD_09.02.02-58

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Table 3.9-14 Valve Inservice Test Requirements (Sheet 71 of 120)

Valve Tag Number	Description	Valve/ Actuator Type	Safety-Related Missions	Safety Functions(2)	ASME IST Category	Inservice Testing Type and Frequency	IST Notes
NCS-MOV-446C	Reactor coolant pump motor component cooling water inlet side isolation	Remote MO Gate	Maintain Open Transfer Close	Active Remote Position	B	Remote Position Indication, Exercise/2 Years Exercise Full Stroke/ Cold Shutdown Operability Test	7
NCS-MOV-446D	Reactor coolant pump motor component cooling water inlet side isolation	Remote MO Gate	Maintain Open Transfer Close	Active Remote Position	B	Remote Position Indication, Exercise/2 Years Exercise Full Stroke/ Cold Shutdown Operability Test	7
~~NCS-MOV-447A~~	~~Reactor coolant pump component cooling water return containment isolation valve(In CV) bypass~~	~~Remote MO Globe~~	~~Maintain Close Transfer Close Transfer Open~~	~~Active Containment Isolation Safety Seat Leakage Remote Position~~	~~A~~	~~Remote Position Indication, Exercise/2 Years Containment Isolation Leak Test Exercise Full Stroke/ Cold Shutdown Operability Test~~	~~5~~ ~~7~~
~~NCS-MOV-447B~~	~~Reactor coolant pump component cooling water return containment isolation valve(In CV) bypass~~	~~Remote MO Globe~~	~~Maintain Close Transfer Close Transfer Open~~	~~Active Containment Isolation Safety Seat Leakage Remote Position~~	~~A~~	~~Remote Position Indication, Exercise/2 Years Containment Isolation Leak Test Exercise Full Stroke/ Cold Shutdown Operability Test~~	~~5~~ ~~7~~

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Table 3.9-14 Valve Inservice Test Requirements (Sheet 72 of 120)

Valve Tag Number	Description	Valve/ Actuator Type	Safety-Related Missions	Safety Functions(2)	ASME IST Category	Inservice Testing Type and Frequency	IST Notes	
~~NCS-MOV-448A~~	~~Reactor coolant pump component cooling water return containment isolation valve(In CV) bypass~~	~~Remote MO Gate~~	~~Maintain Close Transfer Close Transfer Open~~	~~Active Containment Isolation Safety Seat Leakage Remote Position~~	~~A~~	~~Remote Position Indication, Exercise/2 Years Containment Isolation Leak Test Exercise Full Stroke/ Cold Shutdown Operability Test~~	~~5 7~~	DCD_09.02.02-58
~~NCS-MOV-448B~~	~~Reactor coolant pump component cooling water Return Containment Isolation Valve(In RB) Bypass Valve~~	~~Remote MO Gate~~	~~Maintain Close Transfer Close Transfer Open~~	~~Active Containment Isolation Safety Seat Leakage Remote Position~~	~~A~~	~~Remote Position Indication, Exercise/2 Years Containment Isolation Leak Test Exercise Full Stroke/ Cold Shutdown Operability Test~~	~~5 7~~	DCD_09.02.02-58
NCS-SRV-003A	Component cooling water surge tank relief	Relief	Maintain Close Transfer Open Transfer Close	Active	BC	Class 2/3 Relief Valve Tests/10 Years and 20% in 4 Years		
NCS-SRV-003B	Component cooling water surge tank relief	Relief	Maintain Close Transfer Open Transfer Close	Active	BC	Class 2/3 Relief Valve Tests/10 Years and 20% in 4 Years		
NCS-VLV-016A	Component cooling water pump discharge check	Check	Maintain Open Transfer Open Transfer Close	Active	BC	Check Exercise/ Refueling Outage	3	
NCS-VLV-016B	Component cooling water pump discharge check	Check	Maintain Open Transfer Open Transfer Close	Active	BC	Check Exercise/ Refueling Outage	3	

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Table 3D-2 US-APWR Environmental Qualification Equipment List (Sheet 40 of 61)

Item Num	EquipmentTag	Description	Location		Purpose	Operational Durantion	Environmental Conditions	Radiation Condition	Influence of Submergence for Total Integrated Dose	Qualification Process	Seismic Category	Comments
			Building	Zone	RT, ESF, PAM, Pressure Boundary (PB), Other[1]		Harsh or Mild	Harsh or Mild	Yes/No	E=Electrical M=Mechanical	I, II, Non	
52	NCS-MOV-517	Motor Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
53	NCS-MOV-401A	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
54	NCS-MOV-402A	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
55	NCS-MOV-531	Motor Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
56	NCS-MOV-537	Motor Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
57	NCS-FCV-129A	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
58	NCS-FCV-129B	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
59	NCS-MOV-401B	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
60	NCS-MOV-402B	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
61	NCS-MOV-446A	Motor Operated Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
62	NCS-MOV-446B	Motor Operated Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
63	NCS-MOV-446C	Motor Operated Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
64	NCS-MOV-446D	Motor Operated Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
~~65~~	~~NCS-MOV-445A~~	~~Motor Operated Valve~~	~~R/B~~	~~6~~	~~ESF~~	~~1yr~~	~~Mild~~	~~Harsh~~	~~No (1)~~	~~M~~	~~I~~	DCD_09.02.02-58
~~66~~	~~NCS-MOV-445B~~	~~Motor Operated Valve~~	~~R/B~~	~~6~~	~~ESF~~	~~1yr~~	~~Mild~~	~~Harsh~~	~~No (1)~~	~~M~~	~~I~~	DCD_09.02.02-58
~~67~~	~~NCS-MOV-447A~~	~~Motor Operated Valve~~	~~PCCV~~	~~1-5~~	~~ESF~~	~~1yr~~	~~Harsh~~	~~Harsh~~	~~No (1)~~	~~M~~	~~I~~	DCD_09.02.02-58
~~68~~	~~NCS-MOV-447B~~	~~Motor Operated Valve~~	~~PCCV~~	~~1-5~~	~~ESF~~	~~1yr~~	~~Harsh~~	~~Harsh~~	~~No (1)~~	~~M~~	~~I~~	DCD_09.02.02-58
~~69~~	~~NCS-MOV-448A~~	~~Motor Operated Valve~~	~~R/B~~	~~6~~	~~ESF~~	~~1yr~~	~~Mild~~	~~Harsh~~	~~No (1)~~	~~M~~	~~I~~	DCD_09.02.02-58
~~70~~	~~NCS-MOV-448B~~	~~Motor Operated Valve~~	~~R/B~~	~~6~~	~~ESF~~	~~1yr~~	~~Mild~~	~~Harsh~~	~~No (1)~~	~~M~~	~~I~~	DCD_09.02.02-58
71	NCS-FCV-130A	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
72	NCS-FCV-130B	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
73	NCS-MOV-438B	Motor Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
74	NCS-FCV-132A	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
75	NCS-FCV-132B	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	

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- Emergency feedwater system
- Main steam system
- Seal water injection
- Component cooling water system DCD_09.02.02-58
- Post-accident sampling return line
- Fire protection water supply system

The condition in which containment isolation is needed in safety injection system, containment spray system and residual heat removal system is when leak occurs in these systems. These systems are located in safeguard component area. Leak detection system is installed in each system. Level instruments are installed in each pump compartment sump. In addition, if leak is occurred, operators can notice by pump suction/discharge pressure and pump flow rate. As for main steam system, NMS-MOV-507A, B, C, D, NMS-MOV-701A, B, C, D and EFS-MOV-101A, B, C, D are remote manual isolation valves. The condition in which containment isolation is needed is to prevent fission product from releasing such as in SGTR. In each main steam line, radiation monitors is installed. So operators can notice that these valves should be closed. As for seal water injection line, CVS-MOV-178 A, B, C, D are remote manual isolation valves. The condition in which containment isolation is needed is the case that seal injection flow is lost. In each injection line, flow rate instrument is installed. So operators can notice that these valves should be closed. The CCW supply and return line to the RCPs, NCS-MOV-402A/B, 436A/B, 438A/B, are remote manual isolation valves. Containment isolation would be considered if there were significant leakage from the CCWS, which could jeopardize the surge tank volume. Leakage can be recognized by operators as discussed in Subsection 9.2.2.3.2. As for post-accident sampling return line and fire protection water supply system, PSS-MOV-071 and FSS-MOV-004 are remote manual isolation valves. The reason why these valves does not receive containment isolation signal is that these are closed under administrative control, such as locked closed. Therefore, these valves are not needed to be closed if leak occur. DCD_09.02.02-58

Containment purge isolation valves (Containment Purge System) may be supplied with resilient seals and the subject containment penetrations and containment isolation valves will receive preoperational and periodic Type C leak rate testing in accordance with 10 CFR 50, Appendix J. The soft seated containment isolation butterfly valves in the containment purge system which may require resilient seal replacement following the leakage rate testing will be subject to seals replacement based on a valve manufacturer recommendation.

Table 6.2.4-1 presents the design information regarding provisions for isolating the containment penetrations, while Table 6.2.4-2 and Figure 6.2.4-1 presents associated containment isolation configurations. Table 6.2.4-3 presents the list of containment penetrations and system isolation positions, which includes the information related to the pipe length from containment to outermost isolation valve.

6.2.4.3.2 Evaluation of Conformance to General Design Criterion 56 of 10 CFR 50, Appendix A

Each line that connects directly to the containment atmosphere and penetrates the primary reactor containment is provided with containment isolation valves as follows, unless it can be demonstrated that the containment isolation provisions for a specific class of lines, such as instrument lines, are acceptable on some other defined basis. Isolation valves outside containment are located as close to containment as practical for those systems designed in conformance with GDC 56 or some other defined basis set forth in RG 1.141. The following systems penetrating the containment meet GDC 56 criteria:

- Fire protection water supply system (FSS) injection line to reactor cavity and station service air system (SSAS) service air line, using one automatic isolation valve inside containment and one locked closed isolation valve outside containment.

- CSS containment spray line, HVAC containment supply and exhaust line, plant radiation monitoring system (RMS) containment air sampling line, WMS containment sump pump discharge line, refueling water recirculation pump suction and discharge line, instrument air system (IAS) instrument air line, non-essential chilled water system containment fan cooler lines, and FSS water supply line to containment air purification unit, using one automatic isolation valve inside and one automatic isolation valve outside the containment.

- Leakage rate testing narrow range pressure detection line, using one locked closed isolation valve inside with a pipe cap and one locked closed isolation valve outside the containment.

- Component cooling water system (CCWS) supply line to the RCPs, using two ~~automatic~~ containment isolation valves of which the outboard valve is capable of remote manual operation. | DCD_09.02.02-58

- CCWS return line from RCPs, using two ~~automatic~~ containment isolation valves, one inside and one outside of the containment, each capable of remote manual operation. | DCD_09.02.02-58

Containment isolation provisions for lines in ESF or ESF-related systems normally consist of two isolation valves in series. A single isolation valve is acceptable if the system reliability can be shown to be greater, the system is closed outside the containment, and a single active failure can be accommodated with only one isolation valve in the line. In addition, penetrations exist that do not contain isolation valves, these lines are typically blank flanged. Table 6.2.4-2 lists GDC 56 systems with single valve isolation or blank flanges and justification, in accordance with the guidance in NUREG-0800, SRP 6.2.4 (Ref. 6.2-27).

Table 6.2.4-3 List of Containment Penetrations and System Isolation Positions (Sheet 6 of 15)

Pen NO.	GDC	System Name	Fluid	Line Size (in.)	ESF or Support System	Valve Arragmt Figure 6.2.4-1	Valve Number	Location of Valve	Type Tests	Type C Test	Length of Pipe (Note 1)	Valve		Actuation Mode		Valve Position			Power Failure	Actuation Signal	Valve Closure (seconds)	Power Source	Remark
												Type	Operator	Primary	Secondary	Normal	Shutdown	Post-Accident					
P417	56	CSS	Silicone Oil	3/4	Yes	Sht. 17	-	-	A	N	-	-	-	-	-	-	-	-	-	-	-	-	Note 8
P405L	56	CSS	Silicone Oil	3/4	No	Sht. 17	-	-	A	N	-	-	-	-	-	-	-	-	-	-	-	-	Note 8
P234	56	CCWS	Water with corrosion inhibitor	8	Yes	Sht. 19	NCS-VLV-403A	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9
				8			NCS-MOV-402A	Out			10.0 ft	Gate	Motor	~~Auto~~RM	~~RM~~Manual	O	O	~~C~~O	FAI	~~P~~NA	40	1E	
				~~4~~			~~NCS-MOV-445A~~	~~Out~~				~~Globe~~	~~Motor~~	~~Manual~~	~~None~~	~~C~~	~~C~~	~~O~~	~~FAI~~	~~NA~~	~~20~~	~~1E~~	
				3/4			NCS-VLV-452A	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA	
P249	56	CCWS	Water with corrosion inhibitor	8	Yes	Sht. 19	NCS-VLV-403B	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9
				8			NCS-MOV-402B	Out			10.0 ft	Gate	Motor	~~Auto~~RM	~~RM~~Manual	O	O	~~C~~O	FAI	~~P~~NA	40	1E	
				~~4~~			~~NCS-MOV-445B~~	~~Out~~				~~Globe~~	~~Motor~~	~~Manual~~	~~None~~	~~C~~	~~C~~	~~O~~	~~FAI~~	~~NAI~~	~~20~~	~~1E~~	
				3/4			NCS-VLV-452B	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA	
P232	56	CCWS	Water with corrosion inhibitor	8	Yes	Sht. 20	NCS-MOV-436A	In	C	Y	-	Gate	Motor	~~Auto~~RM	~~RM~~None	O	O	~~C~~O	FAI	~~P~~NA	40	1E	Note 9
				8			NCS-MOV-438A	Out			10.0 ft	Gate	Motor	~~Auto~~RM	~~RM~~Manual	O	O	~~C~~O	FAI	~~P~~NA	40	1E	
				~~4~~			~~NCS-MOV-447A~~	~~In~~				~~Globe~~	~~Motor~~	~~Manual~~	~~None~~	~~C~~	~~C~~	~~O~~	~~FAI~~	~~NA~~	~~20~~	~~1E~~	
				~~4~~			~~NCS-MOV-448A~~	~~Out~~				~~Globe~~	~~Motor~~	~~Manual~~	~~None~~	~~C~~	~~C~~	~~O~~	~~FAI~~	~~NA~~	~~20~~	~~1E~~	
				3/4			NCS-VLV-437A	In			-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	
P251	56	CCWS	Water with corrosion inhibitor	8	Yes	Sht. 20	NCS-MOV-436B	In	C	Y	-	Gate	Motor	~~Auto~~RM	~~RM~~None	O	O	~~C~~O	FAI	~~P~~NA	40	1E	Note 9
				8			NCS-MOV-438B	Out			10.0 ft	Gate	Motor	~~Auto~~RM	~~RM~~Manual	O	O	~~C~~O	FAI	~~P~~NA	40	1E	
				~~4~~			~~NCS-MOV-447B~~	~~In~~			–	~~Globe~~	~~Motor~~	~~Manual~~	~~None~~	~~C~~	~~C~~	~~O~~	~~FAI~~	~~NA~~	~~20~~	~~1E~~	
				~~4~~			~~NCS-MOV-448B~~	~~Out~~			–	~~Globe~~	~~Motor~~	~~Manual~~	~~None~~	~~C~~	~~C~~	~~O~~	~~FAI~~	~~NA~~	~~20~~	~~1E~~	
				3/4			NCS-VLV-437B	In			-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	
P233	57	CCWS	Water with corrosion inhibitor	4	No	Sht. 21	NCS-MOV-511	Out	A	N	9.0 ft	Gate	Motor	Auto	RM	O	O	C	FAI	T	20	1E	Note 5
P235	57	CCWS		4	No	Sht. 21	NCS-MOV-517	Out	A	N	9.0 ft	Gate	Motor	Auto	RM	C	C	C	FAI	T	20	1E	Note 5
P252	57	CCWS		8	No	Sht. 22	NCS-MOV-531	Out	A	N	9.0 ft	Gate	Motor	Auto	RM	O	O	C	FAI	T	40	1E	Note 5
P250	57	CCWS		8	No	Sht. 22	NCS-MOV-537	Out	A	N	9.0 ft	Gate	Motor	Auto	RM	O	O	C	FAI	T	40	1E	Note 5
P276R	56	WMS	Gas	3/4	No	Sht. 23	LMS-AOV-052	In	C	Y	-	Dia	Air	Auto	RM	O	O	C	FC	T	15	1E	Note 9
				3/4			LMS-AOV-053	Out			11.0 ft	Dia	Air	Auto	RM	C	C	C	FC	T	15	1E	
P284	56	WMS	Gas	2	No	Sht. 24	LMS-AOV-055	In	C	Y	-	Dia	Air	Auto	RM	O	O	C	FC	T	15	1E	Note 9
				2			LMS-AOV-056	Out			16.0 ft	Dia	Air	Auto	RM	O	O	C	FC	T	15	1E	
				2			LMS-AOV-060	Out			-	Dia	Air	Auto	RM	O	O	C	FC	T	15	1E	
P205	56	WMS	Borated Water	3	No	Sht. 25	LMS-LCV-010A	In	C	Y	-	Dia	Air	Auto	RM	C	C	C	FC	T	15	1E	Note 9
				3			LMS-LCV-010B	Out			9.0 ft	Dia	Air	Auto	RM	O	O	C	FC	T	15	1E	

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9.2.2.2.2.2 Normal Plant Shutdown

After approximately four hours of normal plant cool down, when the reactor coolant temperature and pressure are reduced to approximately 350 °F and 400 psig, the standby CCW HXs and pumps are placed in service resulting in four trains (i.e. four CCWPs and four CCW HXs) in operation. The CCWS isolation valve for each of the CS/RHR HXs is opened to supply cooling water to these HXs.

The failure of one cooling train (i.e. failure in one pump or one HX) increases the time for plant cool down, however, it does not affect the safe operation of the plant. The plant can be safely brought to the cold shutdown condition with a minimum of two trains.

During plant cool down by the residual heat removal system, the CCW supply temperature to the various components is permitted to increase to 110 °F.

9.2.2.2.2.3 Refueling

During refueling, the required number of CCW HXs and pumps is determined by the heat load. Normally, three trains operate in this mode. The remaining train may be taken out of service for maintenance. An operating CCWP in each subsystem supplies CCW to all loops in service in the particular subsystem with a maximum CCW supply water temperature not exceeding 100 °F.

9.2.2.2.2.4 Loss of Coolant Accident

All CCW~~P~~ pumps are automatically actuated by an ECCS actuation signal. The pump start signal ~~to the pumps is delayed~~has a 10-sec time delay for load sequencing. (Refer to Figure 8.3.1-2 Logic diagrams (Sheet 18 of 24)) The isolation valves for the CS/RHR HXs are automatically opened by the ECCS actuation signal and the same train CCWP start signal. The header tie line isolation valves ~~are closed by an ECCS actuation signal in coincidence with an undervoltage signal, and the CCWS is separated into four individual trains (A, B, C and D)~~are not automatically closed on an ECCS signal so that flow is not interrupted to the RCP thermal barriers coolers. The header tie line isolation valves must be closed by operator action to separate the CCWS into four trains (A, B, C and D). The COL Applicant is to develop a milestone schedule for implementation of the emergency operating procedures to assure that the necessary header tie line isolation valves are closed within 24 hours after an event to achieve train separation. See COL Item 13.5(6) . The header tie line isolation valves can be manually reopened from the MCR to restore RCP seal and SFP HX cooling, if required. The operator must manually open the CV atmosphere gas sample cooler outlet valve (NCS-VLV-224) during accident conditions for gas sampling.

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As a minimum, two trains are required to operate during a LOCA.

9.2.2.2.2.5 Loss of Offsite Power (LOOP)

In the case of a LOOP, all CCWPs are automatically loaded onto their respective Class 1E power sources. The CCWS continues to provide cooling of the required components.

- Section 3.7, Seismic Design;

Pipe rupture protection against other ruptured piping is addressed in Section 3.6, Protection against Dynamic Effects Associated with Postulated Rupture of Piping. Leakage cracks and other type of pipe rupture are not postulated in the safety-related CCWS piping because piping is designed to comply BTP 3-4 B(iii)(1)(c) and C as stated in Subsection 3.6.2.1.2.2 and 3.6.2.1.3. DCD_09.02.02-85

The CCWS continues to perform its safety function in the event of a fire. Subsection 9.5.1 addresses fire protection.

The R/B which contains safety-related portions of the CCWS is designed and constructed as a safety-related and seismic category I structure. The safety-related portions of the CCWS are designed and constructed as seismic category I.

Relief valves are provided on the components as necessary to prevent potential thermal overpressurization against over pressure of equipment and piping.

The CCWS is a closed system that is maintained in a water solid condition with a surge tank located at the highest point in the system thus preventing the potential for water hammer.

9.2.2.3.1 Leakage from Higher Pressure Components into CCWS

If leakage from a higher pressure component to the CCWS should occur, the water level of CCW surge tank increases and an alarm is transmitted to the MCR. If the in-leakage is radioactive, the radiation monitors of the CCWS also indicate in the MCR the increased radiation level and transmit an alarm when the radiation level reaches its set point. After the leak source is identified, the leak is isolated from the CCWS.

In the event that the in-leakage is through the RCP thermal barrier HX, the isolation valves on the RCP thermal barrier HX CCW return line are automatically closed by the high flow rate signal, thereby preventing further CCWS contamination.

9.2.2.3.2 Leakage from the CCWS

A decrease to the setpoint in the CCW surge tank water level initiates automatic makeup water to the surge tank and an alarm is transmitted to the main control room indicating a system leak. After the leak source is identified by visual inspection or by a change in individual CCW flow rate, the leak is isolated.

If the water level of the surge tank further decreases, the surge tank low-low water level signal is transmitted to the MCR and the ~~header tie line isolation valves automatically close. Since~~operator may close the header tie line isolation valves from the MCR. Because the subsystem consists of two ~~individual~~ trains, the train with the leak can be isolated and the other train ~~can be operated~~remains operational. DCD_09.02.02-58

In the event of a loss of system integrity in the non-seismic portion of the system, the CCWS is designed to maintain functionality by closing ~~both header tie line isolation valves and~~ the isolation valves in the supply and return lines to the non-seismic category I buildings. Automatic closure is activated upon the surge tank low-low water level signal. DCD_09.02.02-58 DCD_09.02.02-49

~~Seismic Category I make up to the component cooling surge tank is available from the refueling water storage pit.~~The flow rate of make-up water to the surge tank is designed to be 75 gpm. This makeup capability is more than adequate to compensate for the worst case leakage through pump seals and valves if isolation of non-safety piping were required. In such a scenario, the total CCWS subsystem leak (two trains) rate is small; the potential total lost volume over a 7-day period is calculated to be less than 50 gallons per subsystem (including 25 gallons per 7 days associated with boundary isolation valving). This potential loss is also small in comparison to the available compartment water volume. Thus, the surge tank available water volume can compensate for potential leakage losses without makeup for at least 7 days. The makeup capability is also sufficient to compensate for failure of a CCWS pump seal. Such a leak could be terminated by isolation of the affected pump. DCD_09.02.02-49

As indicated above, the potential tank water loss due to leakage over 7 days is small in comparison to the available surge tank water volume. The volume of water in each surge tank compartment between the low-low level setpoint and the instrument "0" level exceeds 800 gallons. This volume allows each tank compartment to accommodate leakage of more than 3 gallons per hour continuously for 7 days without affecting CCWS function, in the event that makeup were not available.

To provide additional capability for makeup after 7 days, if needed, each CCWS subsystem has a connection for water supply from the Fire Protection Water Supply System (FSS). Because the CCWS is designed to be isolated from non-safety piping with only a small system leakage rate, makeup through the FSS would not be required for at least 7 days, even in the event of a SSE.

Component cooling water inleakage to the RCS could occur only when the RCS pressure falls below the CCWS pressure. The RCS pressure falls below the CCWS pressure only during plant shutdown, and a load which is so large as to cause damage to the thermal barrier is unlikely because the RCS side is at low temperature and low pressure. For these reasons, it is considered that there is a very low potential for inleakage of component cooling water into the RCS. DCD_09.02.02-58

9.2.2.3.3 Sharing of CCWS

The CCWS is not shared with multi-units.

9.2.2.3.4 Prevention of Corrosion

Water chemistry of CCWS is controlled and maintained by adding chemicals and covering the surge tank with nitrogen gas to prevent long term corrosion that may degrade system performance.

9.2.2.3.5 RCP seal protection

~~Even in the event that the CCW to RCP is isolated by a containment spray actuation signal and the seal water injection from the CVCS is also lost, the containment isolation valves on the CCW supply and return lines can be manually reopened from the MCR to restore RCP seal cooling. As shown in Table 9.2.2-3, the CCWS is designed to restore CCW supply to the RCP thermal barrier HX, assuming any single failure.~~ DCD_09.02.02-58

~~To re-supply water to the thermal barrier after the isolation of the containment vessel during an accident, the cooling water for the thermal barrier is ensured by opening NCS-MOV-445A/B, NCS-MOV-447A/B, and NCS-MOV-448A/B.~~The CCW provides cooling to the thermal barrier of the reactor coolant pump seals. Thermal barrier cooling provides a redundant method to CVCS seal injection for RCP seal protection. Thermal barrier cooling does not isolate on an accident signal. In the event that both CCWS flow to the RCP thermal barriers and CVCS seal injection were unavailable, the RCP seals would be expected to maintain their integrity for a short time, as indicated in Subsection 8.4.2.1.2. DCD_09.02.02-58

9.2.2.3.6 RCP seal protection during SBO conditions

RCP seal integrity during SBO conditions is discussed in Section 8.4.

9.2.2.4 Inspection and Testing Requirements

9.2.2.4.1 Preoperational Testing and Inspection

Preoperational testing of the CCWS is performed as described in Section 14.2 to verify that system is installed in accordance with plans and specifications. The system is hydrostatically tested and is functionally tested to verify that the proper sequence of valve positions and pump starting occur on the appropriate signals. The pumps are tested to verify performance. Proper orifice installation and/or valve position settings are verified and adjusted, as required, to maintain proper flow balance in the system.

9.2.2.4.2 In-Service Testing and Inspection

Periodic pressure and functional testing of components will be performed to assure the structural and leak tight integrity of system components. Pumps and valves are inspected in accordance with Section XI of the ASME code. DCD_09.02.02-65

During normal operation, the standby pump and CCW HX are periodically tested for operability or, alternatively, placed in service in place of the train which has been operating. Routinely during plant shutdown, automatically operated pumps and valves are tested in accordance with surveillance requirements SR 3.7.7.2 and SR 3.7.7.3. DCD_09.02.02-65
Additionally periodic flow testing is performed to verify correct flow balancing among indi~~b~~vidual heat loads. DCD_09.02.02-67

Descriptions of the testing and inspection programs for pumps and valves are provided in the following subsections and sections:

- Subsection 3.9.6, Functional design, qualification & in-service testing programs for pumps, valves & dynamic restraints;
- Subsection 6.2.4, Containment Isolation System (applicable to CCWS containment isolation valves);
- Section 6.6, In-service inspection & testing of class 2 & 3 components.

Table 9.2.2-3 Component Cooling Water System Failure Modes and Effects Analysis (Sheet 1 of 4)

Item	Component	Safety Function	Failure Mode	Effect on System Safety Function	Failure Detection Method	
1	CCW pumps	Pumps CCW to safety-related components	Fails to start upon the demand signal Trip for any reason	None Remaining three 50% capacity pumps are available. Minimum two pumps are required. (Opening the RCP Cross Tie Isolation Valves provides a flow path for RCP cooling if there should be a failure of the operating train in the same subsystem that has another train in a maintenance outage.)	Pump status lights indication in MCR Low pressure alarm of header pressure	DCD_09.02.02-58
2	header tie line isolation valve (MOV-007A,B, MOV-020A,B)	Separates to independent two trains	Fails to close upon the ~~demand~~remote manual signal	None Each train have own isolation valve. Either train could be isolated from the other train. (Note 1)	Valve position indication in MCR	DCD_09.02.02-58
		~~Opens to provide flow path to A1 loop after close of header tie line isolation valve~~	~~Fails to open upon the remote manual signal~~	~~None Each train have own isolation valve. Either train's valve could be opened.~~	~~Valve position indication in MCR~~	DCD_09.02.02-58 DCD_09.02.02-58
3	header tie line isolation valve (MOV-007C,D, MOV-020C,D)	Separates to independent two trains	Fails to close upon the ~~demand~~remote manual signal	None Each train have own isolation valve. Either train could be isolated from the other train.	Valve position indication in MCR	DCD_09.02.02-58
		~~Opens to provide flow path to C1 loop after close of header tie line isolation valve~~	~~Fails to open upon the remote manual signal~~	~~None Each train have own isolation valve. Either train's valve could be opened.~~	~~Valve position indication in MCR~~	DCD_09.02.02-58

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Table 9.2.2-3 Component Cooling Water System Failure Modes and Effects Analysis (Sheet 3 of 4)

Item	Component	Safety Function	Failure Mode	Effect on System Safety Function	Failure Detection Method	
8	Containment isolation valve for return line from letdown heat exchanger (MOV-537)	Closes to provide containment pressure boundary	Fails to close on the demand signal	None System inside containment is used as one of the isolation barriers. And system is designed to satisfy the requirements for closed system.	Valve position indication in MCR	
9	Containment isolation valve for supply to excess letdown heat exchanger (MOV-511)	Closes to provide containment pressure boundary	Fail to close on the demand signal	None System inside containment is used as one of the isolation barriers. And system is designed to satisfy the requirements for closed system.	Valve position indication in MCR	
10	Containment isolation valve for return line from excess letdown heat exchanger (MOV-517)	Closes to provide containment pressure boundary	Fail to close on the demand signal	None System inside containment is used as one of the isolation barriers. And system is designed to satisfy the requirements for closed system.	Valve position indication in MCR	
11	Containment isolation valve for supply to RCP (MOV-402A,B)	Closes to provide containment pressure boundary	Fail to close on the ~~demand~~remote manual signal	None A check valve (VLV-403A,B) is provided in series to provide containment pressure boundary.	Valve (motor operated valve) position indication in MCR	DCD_09.02.02-58
		~~Opens to provide flow path to RCP~~	~~Fail to open up on the remote manual signal~~	~~None~~ ~~A motor operated valve (MOV-445A,B) is provided in parallel to provide flow path to RCP.~~	~~Valve (motor operated valve) position indication in MCR~~	DCD_09.02.02-58

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Table 9.2.2-3 Component Cooling Water System Failure Modes and Effects Analysis (Sheet 4 of 4)

Item	Component	Safety Function	Failure Mode	Effect on System Safety Function	Failure Detection Method	
12	Containment isolation valve (inside CV) for return line from RCP (MOV-436A,B)	Closes to provide containment pressure boundary	Fail to close on the ~~demand~~remote manual signal	None A motor operated valve (MOV-438A,B) is provided in series to provide containment pressure boundary.	Valve position indication in MCR	DCD_09.02.02-58
		~~Opens to provide flow path to RCP~~	~~Fail to open up on the remote manual signal~~	~~None~~ ~~A motor operated valve (MOV-447A,B) is provided in parallel to provide flow path to RCP.~~	~~Valve position indication in MCR~~	DCD_09.02.02-58
13	Containment isolation valve (outside CV) for return line from RCP (MOV-438A,B)	Closes to provide containment pressure boundary	Fail to close on the ~~demand~~remote manual signal	None A motor operated valve (MOV-436A,B) is provided in series to provide containment pressure boundary.	Valve position indication in MCR	DCD_09.02.02-58
		~~Opens to provide flow path to RCP~~	~~Fail to open up on the remote manual signal~~	~~None~~ ~~A motor operated valve (MOV-448A,B) is provided in parallel to provide flow path to RCP.~~	~~Valve position indication in MCR~~	DCD_09.02.02-58

Note 1: As discussed in Subsection 9.2.2.2.2.4, header tie line isolation valve closure is assumed within 24 hours, by manual operation from the MCR, after an ECCS signal to establish separation of the two trains within a subsystem. Prior to closure of the header tie line isolation valves, there is the potential for additional loading on one train of a subsystem if a single failure is postulated in the other train (e.g., Given a ECCS automatic initiation signal and a single failure of one CCWS pump to auto start, one CCWS may supply ECCS loads to two trains). The additional heat load on the available heat exchanger is small in comparison to the heat exchanger margins discussed in Subsection 9.2.2.2.1.1. DCD_09.02.02-58