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January 6, 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-12002

Subject: MHI's Response to US-APWR DCD RAI No. 866-6149 Revision 0 (SRP Section 06.02.06)

Reference: 1) "Request for Additional Information No. 866-6149 Revision 0, SRP Section: 06.02.06 – Containment Leakage Testing – Application Section: 6.2.6" dated November 14, 2011.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Response to Request for Additional Information No. 866-6149 Revision 0".

Enclosed are the responses to Question 06.02.06-34 that is contained within Enclosure 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,
Director - APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Response to Request for Additional Information No. 866-6149 Revision 0

A017
D081
NRO

CC: J. A. Ciocco
C. K. Paulson

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Enclosure 1

UAP-HF-12002
Docket No. 52-021

Response to Request for Additional Information No. 866-6149
Revision 0

January 2012

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

01/06/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 866-6149 REVISION 0**
SRP SECTION:	**06.02.06 – CONTAINMENT LEAKAGE TESTING**
APPLICATION SECTION:	**6.2.6**
DATE OF RAI ISSUE:	**11/14/2011**

QUESTION NO.: 06.02.06-34

In US-APWR DCD Revision 3 Tier 2 Section 6.2.6.5 you state the following in regards to special testing requirements for containment leakage testing: "The US-APWR does not have a secondary containment or as sub-atmospheric primary containment, therefore, there are no special testing requirements in addition to the requirements of Subsections 6.2.6.1 through 6.2.6.4 above" SRP Section 6.2.6, "Containment Leakage Testing", section III.3, states that special testing procedures for dual-type containments should be identified. In addition to dual containment plants SRP section 6.2.3, "Secondary Containment Functional Design", applies to those designs that utilize outer containment structures and systems that mitigate the radiological consequences of postulated accidents. In this SRP section, the secondary containment structure and systems is defined as those structures and systems that collect and process radioactive material that may leak from the primary containment following a design basis accident. Among other areas of review, SRP section 6.2.3 section 1 calls for a review of the design provisions for periodic leakage testing of secondary containment bypass leakage paths. 10 CFR Part 50, Appendix J part IV B. states that multiple barrier containments shall be subject to individual leakage rate tests in accordance with procedures specified in the Technical Specifications and Associated Bases. SRP section 6.2.3 states that primary containment bypass leakage paths are to be identified and associated bypass leakage rates are to be determined.

Based on a review of Tier 2 sections 6.2.6, 6.2.3, 6.5.3.2, and the chapter 15 accident analyses, the staff determined that some credit is taken for the action of the Annulus Emergency Exhaust System in concert with the annulus and containment penetration areas to capture and process fifty percent of the assumed DBA primary containment leakage through an ESF filter system prior to release to the environment. The remaining fifty percent of the assumed primary containment leakage (0.15% of containment volume per day) is assumed to be released directly to the environment. Therefore, the staff needs the following information in order to evaluate special testing requirements that may be needed to support assumptions used in the chapter 15 accident analyses on secondary containment performance:

1) Clarify US-APWR DCD Revision 3 Tier 2 Section 6.2.6.5, to be consistent with DCD sections 6.2.3, 6.5.3.2, and the chapter 15 accident analyses, as they apply to the SSCs outside of the primary containment structures that function to collect and process assumed primary containment leakage. Justify why special containment leakage testing requirements are or are not required for the annulus and the containment penetration areas, to justify the accident analysis assumptions.

2) Address SRP 6.2.3 Acceptance Criterion #4A and 4B: In meeting GDC 43 and 10 CFR Part 50, Appendix J, requirements for secondary containment system testing the following criteria apply:

   A. The fraction of primary containment leakage bypassing the secondary containment and escaping directly to the environment should be specified.

   BTP 6-3 provides guidance for detecting leakage paths to the environment which may bypass the secondary containment. The periodic leakage rate testing program for measuring the fraction of primary containment leakage that may directly bypass the secondary containment and other contiguous areas served by ventilation and filtration systems should be described. Individual tests should be according to procedures from technical specifications or their bases.

   With regard to the above criterion, please quantify the bypass leakage paths in the secondary containment design in section 6.2.3. Ensure this description is consistent with the description of the secondary containment in DCD section 6.5.3.2. In DCD section 6.2.6.5, describe the periodic leakage rate testing program for measuring the fraction of primary containment leakage that may directly bypass the containment penetration areas and annulus, served by the annulus emergency exhaust system. Describe how this portion of the containment leakage test program is described in DCD chapter 16, section 5.5.16.

   B. There should be provisions in the design of the secondary containment system for inspections and monitoring of the functional capability.

   Preoperational and periodic test programs determine the depressurization time, the secondary containment in-leakage rate, the uniformity of negative pressure throughout the secondary containment and other contiguous areas, and the potential for ex-filtration.

   With regard to the above criterion, please describe the provisions for secondary containment functional capability as they relate to the containment penetration areas and annulus, served by the annulus emergency exhaust system, in section 6.2.3 of the DCD; or describe where in the DCD these design provisions are described.

3) Revise DCD sections 6.2.3 and 6.2.6, and chapter 16 section 5.5.16 and associated bases, as necessary to document the response to #2 above in the DCD.

ANSWER:

The US-APWR containment vessel is a pre-stressed concrete containment vessel (PCCV) without a full secondary containment typical of operating PWRs. Inside the Reactor Building (RB) which surrounds the PCCV, certain areas are provided with emergency ventilation for containment and cleanup of potential leakage from the PCCV during an accident.

The US-APWR includes Penetration Areas within the RB, which enclose the containment penetrations. During a design-basis accident, the Penetration Areas are serviced by the Annulus Emergency Exhaust System (AEES), which functions to contain and filter any containment leakage to the Penetration Areas.

Therefore, the Penetration Areas of the RB function as a partial dual-containment and are served by the AEES to contain and filter any potential primary containment leakage to the Penetration Areas.

Item 1: Leakage Testing Requirements for Penetration Areas

This question is addressed in further detail in the responses to Items 2A and 2B below. Specifically, the responses below refer to existing test requirements and programs for the AEES and containment penetrations. In addition, the responses below clarify the DCD to provide consistency when discussing the partial dual-containment functions of the Penetration Areas and the AEES.

Item 2A-1: Bypass Leakage Path Identification

BTP 6-3 states that the following leakage barriers should be considered for potential bypass leakage around the leakage collection and filtration systems of the secondary containment:

A) Isolation valves in piping which penetrates both the primary and secondary containment barriers.
B) Seals and gaskets on penetrations which pass through both the primary and secondary containment barriers.
C) Welded joints on penetrations (e.g., guard pipes) which pass through both the primary and secondary containment barriers.

Containment penetrations (except main steam and feedwater penetrations) are enclosed by the Penetration Areas, and do not extend past the secondary containment barriers provided by these areas. Therefore, no leakage from seals, gaskets, or welded joints on containment penetrations will bypass the AEES. The Penetration Areas also enclose all containment isolation valves on containment piping penetrations that are potential bypass leakage paths, such that no stem or bonnet leakage from these valves will bypass the AEES. Furthermore, any piping which penetrates containment but does not extend outside the Penetration Areas will not result in any leakage which bypasses the AEES. Closed systems which meet the requirements of BTP 6-3, Section II.9 also provide a leakage boundary to preclude bypass leakage.

Therefore, the only leakage paths which may bypass the AEES are due to seat leakage for isolation valves on piping which extend beyond the Penetration Areas and do not consist of closed systems which meet the requirements below (from BTP 6-3, Section II.9):

A) Either (a) not directly communicate with the containment atmosphere or (b) not directly communicate with the environment following a LOCA.
B) Be designed in accordance with Quality Group B standards, as defined by RG 1.26. (Systems designed to Quality Group C or D standards that qualify as closed systems to

preclude bypass leakage will be considered case by case.)

C) Meet seismic Category I design requirements.
D) Be designed to at least the primary containment pressure and temperature design conditions.
E) Be designed for protection against pipe whip, missiles, and jet forces in a manner similar to that for engineered safety features.
F) Be tested for leakage unless it can be shown that during normal plant operations the system integrity is maintained.

Main steam and feedwater penetrations are not located in the penetration areas, and are located separately in the main steam and feedwater piping area as discussed in DCD Sections 10.3 and 10.4.7 (respectively) and shown in Figures 6.5-8 and 6.5-9. DCD Subsections 6.5.1 and 6.5.3.2 have been revised to clarify that these penetrations are not within the Penetration Areas. The main steam and feedwater piping inside containment meet the requirements of BTP 6-3, Section II.9, listed above. Therefore, the main steam and feedwater piping are closed systems inside containment which will preclude bypass leakage.

DCD Subsection 6.2.3 has been revised to discuss these leakage paths. Table 6.2.4-3 has been revised to identify which penetrations are potential bypass leakage paths.

Item 2A-2: Bypass Leakage Path Testing

All of the potential bypass leakage paths discussed above are tested periodically as part of the Containment Leakage Rate Testing (CLRT) program for containment isolation valves (i.e., Type C tests) discussed in DCD Subsection 6.2.6. Therefore, the Type C tests of the CLRT program provide means to quantify and track the amount of potential leakage bypassing the AEES to ensure that the assumptions in the safety analysis are met. DCD Subsection 6.2.6.5 has been revised to include this discussion.

As discussed in DCD Subsection 6.5.3.2, the total bypass leakage amount is expected to be much less than 10% of the total containment leakage, which provides significant margin to the 50% assumed in the Ch. 15 offsite dose analysis.

DCD Chapter 16, Section 5.5.16, and Subsection 6.2.6 state that the Containment Leakage Rate Testing (CLRT) program will follow the guidance of RG 1.163, which endorses NEI 94-01. NEI 94-01, Section 10.2 states that administrative limits for leakage rates should be established for individual components that are Type B or C tested as an indicator of potential valve or penetration degradation. Therefore, the test results for individual penetrations will be tracked and maintained as part of the CLRT program. Furthermore, the Type C test results will measure the total leakage from the valve including stem, bonnet, and disk leakage. Only disk leakage will result in potential bypass of the AEES. Therefore, the Type C test results provide a conservative measurement of the bypass leakage.

The Type C test results for individual valves as part of the CLRT program will be used to ensure that the total bypass leakage is maintained below the bypass leakage amount assumed in the offsite dose analysis for the potential bypass paths identified in Table 6.2.4-3. MHI considers the use of the Type C test results to monitor and control bypass leakage to be acceptable based on the amount of margin in the 50% bypass leakage assumed for the accident analyses and conservatism in representing bypass leakage through Type C test results.

Item 2B: Functional Capability of Annulus Emergency Exhaust Systems

The AEES is described further in DCD Subsections 6.5.1 and 9.4.5. DCD Ch. 14, Subsection 14.2.12.1.70, describes pre-operational testing of the AEES. DCD Ch. 16, SR 3.7.11.1 to 3.7.11.4, describe surveillance requirements for the AEES. DCD Tier 1, Subsection 2.7.5.2, includes ITAAC for the Engineered Safety Features Ventilation System, which includes the AEES..

DCD Subsection 6.2.3 has been revised to include a reference to the Subsections 6.5.1 and 9.4.5 for additional details.

Item 3: DCD Revisions

The DCD revisions are described in the responses above and indicated in the attached mark-ups.

Impact on DCD

See the attached mark-ups (Attachment-1) for DCD Subsections 6.2.3, 6.2.6.3, 6.2.6.5, 6.2.9, 6.5.1, 6.5.3.2, and Table 6.2.4-3.

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.

Impact on Technical/Topical Report

There is no impact on Technical/Topical Report.

6.2.2.5 Instrumentation Requirements

Four narrow-range pressure transmitters are provided. As described in Chapter 7, Section 7.3, the reactor protection system uses the narrow-range containment pressure transmitters to automatically actuate the following:

- CSS
- Containment isolation
- Main steam isolation
- Containment ventilation isolation
- ECCS

Narrow range containment pressure is indicated and alarmed in the MCR and RSC. A single, wide range containment pressure transmitter provides indication to the MCR and RSC.

Chapter 7, Subsection 7.3.1, describes instrumentation design details for actuating the CSS. Chapter 18, "Human Factors Engineering" identifies the CSS control panel locations and describes the instrumentation and alarm features of the human interface associated with the CSS information and control.

Chapter 5, Subsection 5.4.7, discusses other instrumentation associated with monitoring and controlling the RHR function of this system.

6.2.3 Secondary Containment Functional Design

The US-APWR design does not utilize a secondary containment. Rather than a secondary containment, portions of the primary containment are enclosed by containment penetration areas, which function to prevent the direct release of containment atmosphere to the environment through the containment penetrations. Containment penetration areas are served by the auxiliary building HVAC system during normal operation and by the annulus emergency exhaust system following a design basis accident. The annulus emergency exhaust system maintains the containment penetration areas at a negative pressure during accident conditions as described further in Subsection 6.5.1 and 9.4.5. Subsection 6.5.3.2 provides additional information on the function of the containment penetration areas. DCD_06.02.06-34

Leakage paths which may result in bypass of the annulus emergency exhaust system were identified using the selection criteria of BTP 6-3 (Ref. 6.2-51). These potential penetration area bypass paths are listed in Table 6.2.4-3. Potential bypass leakage paths are limited to containment isolation valve seat leakage for piping which extends beyond the penetration areas serviced by the annulus emergency exhaust system. Closed systems credited as leakage barriers meet the requirements of BTP 6-3 for precluding bypass leakage. DCD_06.02.06-34

Type C testing leakage rate results are used to determine the combined leakage rate for all Type B and C penetrations as discussed above.

6.2.6.4 Scheduling and Reporting of Periodic Tests

The proposed schedule and test report content requirements associated with performing pre-operational and periodic leakage rate testing are in accordance with the guidance provided in NEI 94-01 (Ref. 6.2-31), as modified and endorsed by the NRC in RG 1.163(Ref. 6.2-30). The results of preoperational and periodic Type A, Band C tests must be documented to show that the performance criteria for leakage have been met. The comparison to previous results of the performance of the overall containment system and of individual components within it must be documented to show that the test intervals established for the containment system and components within it are adequate.

6.2.6.5 Special Testing Requirements

~~The US-APWR does not have a secondary containment or a sub-atmospheric primary containment, therefore there are no special testing requirements in addition to the requirements of Subsections 6.2.6.1 through 6.2.6.4 above.~~Leakage paths that may bypass the penetration areas and the annulus emergency exhaust system are identified in Table 6.2.4-3 and will be Type C tested as part of the containment leakage rate test program with additional acceptance criteria to ensure that the assumptions of the safety analysis are met. DCD_06.02.06-34

6.2.7 Fracture Prevention of Containment Pressure Vessel

Ferritic containment pressure boundary materials include the ferritic portions of the containment vessel and all penetration assemblies or appurtenances attached to the containment vessel; all piping, pumps and valves attached to the containment vessel, or to penetration assemblies out to and including the pressure boundary materials of any valve required to isolate the system and provide a pressure boundary for the containment function.

Ferritic containment pressure boundary materials meet the fracture toughness criteria and requirements for testing identified in Article NE-2000 of Section III, Division 1 (Ref. 6.2-32) or Article CC-2000 of Section III, Division 2 of the ASME Code (Ref. 6.2-33).

6.2.8 Combined License Information

Any utility that references the US-APWR design for construction and Licensed operation is responsible for the following COL items:

COL 6.2(1) Deleted

COL 6.2(2) Deleted

COL 6.2(3) Deleted

COL 6.2(4) Deleted

LTR-NRC-06-46 regarding Pressurized Water Reactor (PWR) Containment Sump Downstream Effects. (ML062070451) DCD_06.02.02-55

6.2-49 US-APWR Sump Strainer Stress Report, MUAP-08012-NP (R1), March 2011.

6.2-50 ASME Boiler & Pressure Vessel Code, Section III, Division 1, 2001 edition, up to and including 2003 Addenda

6.2-51 U.S. Nuclear Regulatory Commission, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, NUREG-0800, Branch Technical Position 6-3, Determination of Bypass Leakage Paths in Dual Containment Plants, Revision 4, 2007. DCD_06.02.06-34

Table 6.2.4-3 List of Containment Penetrations and System Isolation Positions (Sheet 1 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: Type	Valve: Operator	Actuation Mode: Primary	Actuation Mode: Secondary	Valve Position: Normal	Valve Position: Shutdown	Valve Position: Post-Accident	Power Failure	Actuation Signal	Valve Closure (seconds)	Power Source	Remark	DCD_03.09.06-61
P247	56	RCS	Nitrogen Gas	1	No	Sht. 2	RCS-VLV-133	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02.06-34
				1			RCS-AOV-132	Out			9.0 ft	Dia	Air	Auto	RM	O	C	C	FC	T	15	1E		
				3/4			RCS-VLV-167	In			-	Dia	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
P260	56	RCS	Demi. Water	3	No	Sht. 3	RCS-VLV-139	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02.06-34
				3			RCS-VLV-140	In			-	Dia	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
				3			RCS-AOV-138	Out			10.0 ft	Globe	Air	Auto	RM	O	C	C	FC	T	15	1E		
P276L	56	RCS	Nitrogen Gas	3/4	No	Sht. 4	RCS-AOV-147	In	C	Y	-	Globe	Air	Auto	RM	O	C	C	FC	T	15	1E	Note 9	DCD_06.02.06-34
				3/4			RCS-AOV-148	Out			10.0 ft	Globe	Air	Auto	RM	C	C	C	FC	T	15	1E		
P277	55	CVCS	Primary Coolant	4	No	Sht. 5	CVS-AOV-005	In	C	Y	-	Globe	Air	Auto	RM	O	O	C	FC	T	20	1E	Note 9	DCD_06.02.06-34
				4			CVS-AOV-006	Out			14.0 ft	Globe	Air	Auto	RM	O	O	C	FC	T	20	1E		
P278	55	CVCS	Primary Coolant	4	No	Sht. 6	CVS-VLV-153	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02.06-34
				4			CVS-MOV-152	Out			14.0 ft	Gate	Motor	Auto	RM	O	O	C	FAI	S	20	1E		
				3/4			CVS-VLV-653	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
P279	56	CVCS	Primary Coolant	1 1/2	No	Sht. 7	CVS-VLV-179B	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02.06-34
				1 1/2			CVS-MOV-178B	Out			14.0 ft	Globe	Motor	RM	Manual	O	O	O	FAI	RM	15	1E		
				3/4			CVS-VLV-667B	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
P280	56	CVCS	Primary Coolant	1 1/2	No	Sht. 7	CVS-VLV-179D	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02.06-34
				1 1/2			CVS-MOV-178D	Out			14.0 ft	Globe	Motor	RM	Manual	O	O	O	FAI	RM	15	1E		
				3/4			CVS-VLV-667D	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
P281	56	CVCS	Primary Coolant	1 1/2	No	Sht. 7	CVS-VLV-179A	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02.06-34
				1 1/2			CVS-MOV-178A	Out			14.0 ft	Globe	Motor	RM	Manual	O	O	O	FAI	RM	15	1E		
				3/4			CVS-VLV-667A	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
P282	56	CVCS	Primary Coolant	1 1/2	No	Sht. 7	CVS-VLV-179C	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02.06-34
				1 1/2			CVS-MOV-178C	Out			14.0 ft	Globe	Motor	RM	Manual	O	O	O	FAI	RM	15	1E		
				3/4			CVS-VLV-667C	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
P283	55	CVCS	Primary Coolant	3	No	Sht. 8	CVS-MOV-203	In	C	Y	-	Globe	Motor	Auto	RM	O	O	C	FAI	P,T+UV	15	1E	Note 9	DCD_06.02.06-34
				3			CVS-MOV-204	Out			9.0 ft	Globe	Motor	Auto	RM	O	O	C	FAI	P,T+UV	15	1E		
				3/4			CVS-VLV-202	In			-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA		
P236	56	SIS	Nitrogen Gas	1	No	Sht. 9	SIS-VLV-115	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02.06-34
				1			SIS-AOV-114	Out			9.0 ft	Globe	Air	Auto	RM	C	C	C	FC	T	15	1E		
				3/4			SIS-VLV-156	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		

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: Type	Valve: Operator	Actuation Mode: Primary	Actuation Mode: Secondary	Valve Position: Normal	Valve Position: Shutdown	Valve Position: Post-Accident	Power Failure	Actuation Signal	Valve Closure (seconds)	Power Source	Remark
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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Table 6.2.4-3 List of Containment Penetrations and System Isolation Positions (Sheet 7 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 Type	Valve Operator	Actuation Mode Primary	Actuation Mode Secondary	Valve Position Normal	Valve Position Shutdown	Valve Position Post-Accident	Power Failure	Actuation Signal	Valve Closure (seconds)	Power Source	Remark	
																								DCD_03.09.06-61
P207	56	WMS	Primary Coolant	2	No	Sht. 26	LMS-AOV-104	In	C	Y	-	Dia	Air	Auto	RM	C	C	C	FC	T	15	1E	<u>Note 9</u>	DCD_06.02.06-34
				2			LMS-AOV-105	Out			9.0 ft	Dia	Air	Auto	RM	C	C	C	FC	T	15	1E		
P267L	55	PSS	Primary Coolant	3/4	No	Sht. 27	PSS-AOV-003	In	C	Y	-	Globe	Air	Auto	RM	C	C	C	FC	T	15	1E	<u>Note 9</u>	DCD_06.02.06-34
				3/4			PSS-MOV-006	In			-	Globe	Motor	Auto	RM	O	O	C	FAI	T	15	1E		
				3/4			PSS-MOV-013	In			-	Globe	Motor	Auto	RM	C	C	C	FAI	T	15	1E		
				3/4			PSS-MOV-031A	Out			14.0 ft	Globe	Motor	Auto	RM	O	O	C	FAI	T	15	1E		
P269R	55	PSS	Primary Coolant	3/4	No	Sht. 28	PSS-MOV-023	In	C	Y	-	Globe	Motor	Auto	RM	O	O	C	FAI	T	15	1E	<u>Note 9</u>	DCD_06.02.06-34
				3/4			PSS-MOV-031B	Out			14.0 ft	Globe	Motor	Auto	RM	O	O	C	FAI	T	15	1E		
P267R	56	PSS	Borated Water	3/4	No	Sht. 29	PSS-AOV-062A	In	C	Y	-	Globe	Air	Auto	RM	C	C	C	FC	T	15	1E	<u>Note 9</u>	DCD_06.02.06-34
				3/4			PSS-AOV-062B	In			-	Globe	Air	Auto	RM	C	C	C	FC	T	15	1E		
				3/4			PSS-AOV-062C	In			-	Globe	Air	Auto	RM	C	C	C	FC	T	15	1E		
				3/4			PSS-AOV-062D	In			-	Globe	Air	Auto	RM	C	C	C	FC	T	15	1E		
				3/4			PSS-AOV-063	Out			13.0 ft	Globe	Air	Auto	RM	O	O	C	FC	T	15	1E		
P270	56	PSS	Containment Atmosphere	3/4	No	Sht. 30	PSS-VLV-072	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	<u>Note 9</u>	DCD_06.02.06-34
				3/4			PSS-VLV-091	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
				3/4			PSS-MOV-071	Out			9.0 ft	Globe	Motor	RM	Manual	C	C	C	FAI	RM	15	1E		
P237R	57	SGBDS	Secondary	3/4	No	Sht. 31	SGS-AOV-031A	Out	A	N	11.0 ft	Globe	Air	Auto	RM	O	O	C	FC	T	15	1E	Note 5	
P237L	57	SGBDS	Coolant	3/4	No	Sht. 31	SGS-AOV-031B	Out	A	N	12.0 ft	Globe	Air	Auto	RM	O	O	C	FC	T	15	1E	Note 5	
P239R	57	SGBDS	Secondary	3/4	No	Sht. 31	SGS-AOV-031C	Out	A	N	11.0 ft	Globe	Air	Auto	RM	O	O	C	FC	T	15	1E	Note 5	
P239L	57	SGBDS	Coolant	3/4	No	Sht. 31	SGS-AOV-031D	Out	A	N	12.0 ft	Globe	Air	Auto	RM	O	O	C	FC	T	15	1E	Note 5	
P505	57	SGBDS	Secondary	4	No	Sht. 31	SGS-AOV-001A	Out	A	N	22.0 ft	Globe	Air	Auto	RM	O	O	C	FC	T	20	1E	Note 5	
P506	57	SGBDS	Coolant	4	No	Sht. 31	SGS-AOV-001B	Out	A	N	26.0 ft	Globe	Air	Auto	RM	O	O	C	FC	T	20	1E	Note 5	
P507	57	SGBDS		4	No	Sht. 31	SGS-AOV-001C	Out	A	N	26.0 ft	Globe	Air	Auto	RM	O	O	C	FC	T	20	1E	Note 5	
P508	57	SGBDS		4	No	Sht. 31	SGS-AOV-001D	Out	A	N	22.0 ft	Globe	Air	Auto	RM	O	O	C	FC	T	20	1E	Note 5	
P161	56	RWS	Borated Water	6	No	Sht. 32	RWS-MOV-002	In	C	Y	-	Gate	Motor	Auto	RM	O	O	C	FAI	T	30	1E	<u>Note 9</u>	DCD_06.02.06-34
				6			RWS-MOV-004	Out			19.0 ft	Gate	Motor	Auto	RM	O	O	C	FAI	T	30	1E		
				3/4			RWS-VLV-003	In			-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA		
P162	56	RWS	Borated Water	4	No	Sht. 33	RWS-VLV-023	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	<u>Note 9</u>	DCD_06.02.06-34
				4			RWS-AOV-022	Out			29.0 ft	Dia	Air	Auto	RM	O	O	C	FC	T	20	1E		
				3/4			RWS-VLV-073	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		

Table 6.2.4-3 List of Containment Penetrations and System Isolation Positions (Sheet 8 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						DCD_03.09. 06-61
P253	56	PMWS	Demineralized Water	2	No	Sht. 34	DWS-VLV-005	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02. 06-34
				2			DWS-VLV-004	Out			9.0 ft	Dia	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
				3/4			DWS-VLV-006	In			-	Dia	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
P245	56	IAS	Compressed Air	2	No	Sht. 35	IAS-VLV-003	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02. 06-34
				2			IAS-MOV-002	Out			9.0 ft	Globe	Motor	Auto	RM	O	O	C	FAI	T	15	1E		
				3/4			IAS-VLV-004	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
P248	56	FSS	Fire Water	3	No	Sht. 36	FSS-VLV-003	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02. 06-34
				3			FSS-AOV-001	Out			9.0 ft	Globe	Air	Auto	RM	C	C	C	FC	T	15	1E		
				3/4			FSS-VLV-002	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
P238	56	FSS	Fire Water	6	No	Sht. 37	FSS-VLV-006	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02. 06-34
				6			FSS-MOV-004	Out			10.0 ft	Gate	Motor	Auto	RM	C	C	C	FAI	RM	30	1E		
				3/4			FSS-VLV-005	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
P230	56	SSAS	Compressed Air	2	No	Sht. 38	SAS-VLV-103	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02. 06-34
				2			SAS-VLV-101	Out			9.0 ft	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
				3/4			SAS-VLV-102	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
P200	-	-	(Fuel Transfer Tube)	22	No	Sht. 39	-	-	B	N	-	Flange	NA	-	-	C	C	C	NA	NA	NA	NA		
P451	56	HVAC	Containment Atmosphere	36	No	Sht. 40	VCS-AOV-305	In	C	Y	-	B-fly	Air	Auto	RM	C	O	C	FC	V	5	1E	Note 9	DCD_06.02. 06-34
				36			VCS-AOV-304	Out			13.0 ft	B-fly	Air	Auto	RM	C	O	C	FC	V	5	1E		
P452	56	HVAC	Containment Atmosphere	36	No	Sht. 40	VCS-AOV-306	In	C	Y	-	B-fly	Air	Auto	RM	C	O	C	FC	V	5	1E	Note 9	DCD_06.02. 06-34
				36			VCS-AOV-307	Out			9.0 ft	B-fly	Air	Auto	RM	C	O	C	FC	V	5	1E		
P410	56	HVAC	Containment Atmosphere	8	No	Sht. 41	VCS-AOV-356	In	C	Y	-	B-fly	Air	Auto	RM	C	C	C	FC	V	5	1E	Note 9	DCD_06.02. 06-34
				8			VCS-AOV-357	Out			10.0 ft	B-fly	Air	Auto	RM	C	C	C	FC	V	5	1E		
P401	56	HVAC	Containment Atmosphere	8	No	Sht. 41	VCS-AOV-355	In	C	Y	-	B-fly	Air	Auto	RM	C	C	C	FC	V	5	1E	Note 9	DCD_06.02. 06-34
				8			VCS-AOV-354	Out			10.0 ft	B-fly	Air	Auto	RM	C	C	C	FC	V	5	1E		
P262R	56	HVAC	Silicone Oil	3/4	No	Sht. 42	-	-	A	N	-	-	-	-		-	-	-	-	-	-	-	Note 8	
P262L	56	HVAC	Silicone Oil	3/4	No	Sht. 42	-	-	A	N	-	-	-	-		-	-	-	-	-	-	-	Note 8	
P408	56	VWS	Chilled Water	10	No	Sht. 43	VWS-VLV-421	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9	DCD_06.02. 06-34
				10			VWS-MOV-403	Out			9.0 ft	Gate	Motor	Auto	RM	O	C	C	FAI	T	50	1E		
				3/4			VWS-VLV-426	In			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA		
P409	56	VWS	Chilled Water	10	No	Sht. 43	VWS-MOV-422	In	C	Y	-	Gate	Motor	Auto	RM	O	O	C	FAI	T	50	1E	Note 9	DCD_06.02. 06-34
				10			VWS-MOV-407	Out			9.0 ft	Gate	Motor	Auto	RM	O	C	C	FAI	T	50	1E		
				3/4			VWS-VLV-423	In			-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA		

Table 6.2.4-3 List of Containment Penetrations and System Isolation Positions (Sheet 9 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 Type	Valve Operator	Actuation Mode Primary	Actuation Mode Secondary	Valve Position Normal	Valve Position Shutdown	Valve Position Post-Accident	Power Failure	Actuation Signal	Valve Closure (seconds)	Power Source	Remark
P265	56	RMS	Containment Atmosphere	1	No	Sht. 44	RMS-VLV-005	In	C	Y	-	Check	Self	Auto	None	-	-	-	NA	NA	NA	NA	Note 9
				1			RMS-MOV-003	Out			9.0 ft	Globe	Motor	Auto	RM	O	O	C	FAI	T	15	1E	
				3/4			RMS-VLV-004	in			-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA	
P266	56	RMS	Containment Atmosphere	1	No	Sht. 44	RMS-MOV-001	In	C	Y	-	Globe	Motor	Auto	RM	O	O	C	FAI	T	15	1E	Note 9
				1			RMS-MOV-002	Out			9.0 ft	Globe	Motor	Auto	RM	O	O	C	FAI	T	15	1E	
P231	56	ICIGS	Carbon Dioxide	3/4	No	Sht. 45	IGS-AOV-002	In	C	Y	-	Dia	Air	Auto	RM	C	C	C	FC	T	15	1E	Note 9
				3/4			IGS-AOV-001	Out			9.0 ft	Dia	Air	Auto	RM	C	C	C	FC	T	15	1E	
P405R	56	LTS	Containment Atmosphere	3/4	No	Sht. 47	LTS-VLV-002	In	C	Y	-	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA	Note 9
							LTS-VLV-001	Out			9.0 ft	Globe	Manual	Manual	None	C	C	C	NA	NA	NA	NA	
P223	56	LTS	Containment Atmosphere	3/4	No	Sht. 47	-	In	B	N	-	Flange	NA	Manual	None	C	C	C	NA	NA	NA	NA	
							-	Out			-	Flange	NA	Manual	None	C	C	C	NA	NA	NA	NA	
P216	56	LTS	Containment Atmosphere	3/4	No	Sht. 46	-	In	B	N	-	Flange	NA	Manual	None	C	C	C	NA	NA	NA	NA	
							-	Out			-	Flange	NA	Manual	None	C	C	C	NA	NA	NA	NA	
P218	56	LTS	Containment Atmosphere	3/4	No	Sht. 46	-	In	B	N	-	Flange	NA	Manual	None	C	C	C	NA	NA	NA	NA	
							-	Out			-	Flange	NA	Manual	None	C	C	C	NA	NA	NA	NA	
P418R	56	RLS	Containment Atmosphere	1 1/2	No	Sht. 48	-	In	B	N	-	Flange	NA	Manual	None	C	C	C	NA	NA	NA	NA	
							-	Out			-	Flange	NA	Manual	None	C	C	C	NA	NA	NA	NA	
P418L	56	RLS	Containment Atmosphere	1 1/2	No	Sht. 48	-	In	B	N	-	Flange	NA	Manual	None	C	C	C	NA	NA	NA	NA	
							-	Out			-	Flange	NA	Manual	None	C	C	C	NA	NA	NA	NA	
P520	56	-	-	-	-	Sht. 49	-	NA	B	N	-	None	None	Manual	Manual	C	C	C	NA	NA	NA	NA	
P530	56	-	-	-	-	Sht. 49	-	NA	B	N	-	None	None	Manual	Manual	C	C	C	NA	NA	NA	NA	
P540	56	-	-	-	-	Sht. 50	-	NA	B	N	-	None	None	Manual	Manual	C	C	C	NA	NA	NA	NA	
P208	-	(Spare)	-	-	-	Sht. 52	-	-	A	N	-	-	-	-	-	-	-	-	-	-	-	-	
P213	-	(Spare)	-	-	-	Sht. 52	-	-	A	N	-	-	-	-	-	-	-	-	-	-	-	-	
P215	-	(Spare)	-	-	-	Sht. 52	-	-	A	N	-	-	-	-	-	-	-	-	-	-	-	-	
P246	-	(Spare)	-	-	-	Sht. 52	-	-	A	N	-	-	-	-	-	-	-	-	-	-	-	-	
P254	-	(Spare)	-	-	-	Sht. 52	-	-	A	N	-	-	-	-	-	-	-	-	-	-	-	-	
P268	-	(Spare)	-	-	-	Sht. 52	-	-	A	N	-	-	-	-	-	-	-	-	-	-	-	-	
P269L	-	(Spare)	-	-	-	Sht. 52	-	-	A	N	-	-	-	-	-	-	-	-	-	-	-	-	
P275	-	(Spare)	-	-	-	Sht. 52	-	-	A	N	-	-	-	-	-	-	-	-	-	-	-	-	
P285	-	(Spare)	-	-	-	Sht. 52	-	-	A	N	-	-	-	-	-	-	-	-	-	-	-	-	
P301	-	(Spare)	-	-	-	Sht. 52	-	-	A	N	-	-	-	-	-	-	-	-	-	-	-	-	

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

Note 8 - These lines sense the pressure of containment atmosphere on the inside and are connected to pressure transmitters on the outside. Each of channels has a separate penetration and each pressure transmitter is located immediately adjacent to the outside of the containment wall. It is connected to a sealed bellows located immediately adjacent to the inside containment wall by means of a sealed fluid filled tube. This tubing along with the transmitter and bellows is conservatively designed and subject to strict quality control and to regular in-service inspections to assure its integrity. This arrangement provides a double barrier (one inside and one outside) between the containment and the outside containment. Should a leak occur outside containment, the sealed bellows inside containment, which is designed to withstand full containment design pressure, will prevent the escape of containment atmosphere. Should a leak occur inside containment the diaphragm in the transmitter, which is designed to withstand full containment design pressure, will prevent any escape of containment atmosphere. This arrangement provides automatic double barrier isolation without operator action and without sacrificing any reliability with regard to its safeguards functions. Both the bellows and the tubing inside containment and the transmitter and tubing outside containment are enclosed by protective shielding. The shielding (box, channel, etc.) prevents mechanical damage to the components from missiles, water jets, dropping tools, etc. Because of this sealed fluid filled system, a postulated severance of the line during either normal operation or accident conditions will not result in any release from the containment. If the fluid in the tubing is heated during the accident, the flexible bellows will allow expansion of the fluid without overpressurizing the system and without significant detriment to the accuracy of the transmitter. This arrangement is intended to provide guidance in satisfying Criterion 56 on the other defined basis in that it meets NRC Regulatory Guide 1.11 and consists of a missile protected closed system inside and outside containment. Therefore, in accordance with ANS 56.8-1994, Section 3.3.1, these valves are not required to be Type C tested. (Ref. 6.2-35)

Note 9 - Seat leakage for the isolation valves on these penetrations are potential leakage paths which may result in bypass of the annulus emergency exhaust system. See Subsection 6.2.3 for details. DCD_06.02.06-34

6.5 Fission Product Removal and Control Systems

The fission product removal systems are ESFs that remove fission products that are released from the reactor core as a result of postulated accidents and become airborne. The containment controls the leakage of fission products from the containment to ensure that the leakage fraction that may reach the environment is below limits. The US-APWR fission product removal (three systems) and control (containment) systems are as follows:

- MCR HVAC system (includes the MCR emergency filtration system)
- Annulus emergency exhaust system
- Containment spray system
- Containment

The fission product removal effects under accident conditions are shown in Table 6.5-1.

The annulus emergency exhaust system is separate and distinct from the MCR HVAC system, which is described in Section 6.4 above. The containment spray system for containment cooling is described in Subsection 6.2.2.

6.5.1 ESF Filter Systems

The annulus emergency exhaust system is one of the ESF filter systems and is designed for fission product removal and retention by filtering the air it exhausts from the following areas following accidents:

- Penetration areas
- Safeguard component areas

The penetration areas are located adjacent to the containment and include all piping and electrical penetration areas (except main steam and feedwater penetrations). The safeguard component areas are located adjacent to the containment and include ECCS components and CSS components that are installed outside of containment. The penetration areas and the safeguard component areas are shown in Figure 6.5-2 through 6.5-9. Main steam and feedwater penetrations are not located in the penetration areas, and are located separately in the main steam and feedwater piping area as discussed in DCD Sections 10.3 and 10.4.7 and shown in Figures 6.5-8 and 6.5-9. DCD_06.02.06-34 DCD_06.02.06-34

The annulus emergency exhaust system is automatically initiated by the ECCS actuation signal and is initiated manually during non-ECCS actuation events (e.g., rod ejection accident or containment radiation level in excess of the normal operating range). This system establishes and maintains a negative pressure in the penetration areas and safeguard component areas relative to adjacent areas. Any airborne radioactive material in the penetration areas and safeguard component areas is directed to the annulus emergency exhaust system, avoiding an uncontrolled release to the environment.

practical to perform the required inservice examinations specified by the ASME Code Section XI. Additional accessibility requirements are specified in Subsection 6.6.2.

Inservice testing of pumps, valves, and other components, including spray nozzle, is performed in accordance with Chapter 16, "Technical Specifications."

6.5.2.5 Instrumentation Requirements

CSS instrumentation requirements are discussed in Subsection 6.2.2.5.

6.5.2.6 Materials

Spray additives such as sodium hydroxide are not used in the US-APWR. NaTB is added to the RWSP via NaTB baskets. NaTB compatibility with ESF systems is described in Subsection 6.1.1.2. Technical Specification 3.5.5 provides the minimum amount of NaTB and surveillances to verify the amount, solubility, and buffering capacity of NaTB.

6.5.3 Fission Product Control Systems

The US-APWR does not require a containment purge system. The removal of iodine and particulates by containment spray reduces fission product leakage to the environment below the guidelines. The analysis presented in Chapter 15 details the radiological consequences of the US-APWR design following a design basis accident that releases radioactive material into the containment. The inservice leakage rate test program detailed in Subsection 6.2.6 monitors and protects the assumed containment leakage rate.

6.5.3.1 Primary Containment

The US-APWR containment consists of a prestressed, post-tensioned concrete structure described in Chapter 3, Subsection 3.8.1. The US-APWR design does not include an ESF hydrogen purge system. The containment operations following a design basis accident that releases radioactive material into the containment are presented in Table 6.5-5.

6.5.3.2 Secondary Containments

The US-APWR primary containment is not completely surrounded by a secondary containment structure. However, all mechanical and electrical containment penetrations (except main steam and feedwater penetrations), including the equipment hatch and airlock, are surrounded by containment penetration areas to prevent direct release of containment atmosphere to the environment through these containment penetrations. Main steam and feedwater penetrations are not located in the penetration areas, and are located separately in the main steam and feedwater piping area as discussed in DCD Sections 10.3 and 10.4.7 and shown in Figures 6.5-8 and 6.5-9.

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Each penetration area is served by auxiliary building HVAC system during normal operation. Following a design basis accident, the penetration area is isolated by auxiliary building HVAC system isolation dampers that change position to closed position, and kept at a slightly negative pressure to control the release of radioactive materials to environment by the annulus emergency exhaust system. The annulus emergency exhaust system exhausts penetration area air through HEPA filters, as described in Subsection 6.5.1, Figure 6.5-1 and Chapter 9, Subsection 9.4.5. The auxiliary building HVAC system is described in Chapter 9, Subsection 9.4.3.

The leakage fraction of the primary containment leakage to the environment is presented in Table 6.5-5. This leakage fraction is based on the total potential containment bypass leakage rate. The potential containment bypass leakage rate is assumed to be due to leakage from containment isolation valves installed in piping, which penetrate both the primary containment and penetration areas and is determined based on valve design limitations. As a result, the potential containment bypass leakage is considered to be much less than 10%. However, the leakage fraction to the penetration areas in dose evaluations that are discussed in Chapter 15 is credited as 50%, that is, including a conservative margin assumed for the evaluation. The penetrations that are potential bypass paths are identified in Table 6.2.4-3 and are Type C tested as part of the containment leakage rate testing program. The total leakage for these valves will be tracked and controlled as part of the containment leakage rate testing program to remain below the leakage fraction assumed for the dose evaluations. DCD_06.02.06-34

These systems limit the maximum radiation dose to less than the criteria of RG 1.183 (Ref. 6.5-3). The radiological consequences following a design basis accident are presented in Chapter 15, Subsection 15.4.8 and 15.6.5.

6.5.4 Ice Condenser as a Fission Product Cleanup System

The US-APWR containment is a prestressed, post-tensioned concrete structure described in Subsection 3.8.1. The US-APWR design does not include an ice condenser-type containment design.

6.5.5 Pressure Suppression Pool as a Fission Product Cleanup System

The US-APWR containment is a prestressed, post-tensioned concrete structure described in Subsection 3.8.1. The US-APWR design is not a pressure suppression pool-type containment design.

6.5.6 Combined License Information

Any utility that references the US-APWR certified design for construction and operation is specifically responsible for the following:

COL 6.5(1) Deleted

COL 6.5(2) Deleted

COL 6.5(3) Deleted

COL 6.5(4) Deleted