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TOKYO, JAPAN

October 31, 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-12234

Subject: MHI's Amended Response to US-APWR DCD RAI No. 735-5723 Revision 0 (SRP 09.01.03)

Reference: 1) "Request for Additional Information No. 735-5723 Revision 0, SRP Section 09.01.03 – Spent Fuel Pool Cooling and Cleanup System, Application Section : 9.1.3", dated April 20, 2011 (ML111110290).

2) Letter MHI Ref: UAP-HF-11187 from Y. Ogata to U.S. NRC, "MHI's Responses to US-APWR DCD RAI No. 735-5723 Revision 0 (SRP 09.01.03)", dated June 22, 2011 (ML111751348).

3) "SER US-APWR Chapter 9, Design Control Document", dated February 22, 2012 (ML120530340)

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Amended Response to Request for Additional Information No. 735-5723 Revision 0."

Enclosed is the amended response to a question contained within Reference 1. The original response was provided in Reference 2. MHI supersedes the previous letter (Reference 2) with this amended response letter. The response is being amended to address an Open Item in the Safety Evaluation Report ("SER") of US-APWR Design Control Document ("DCD") Chapter 9 (Reference 3).

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

Sincerely,

Y. Ogata

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

D081
NRO

Enclosure:

1. Amended Response to Request for Additional Information No. 735-5723 Revision 0

CC: J. A. Ciocco
J. Tapia

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Enclosure 1

UAP-HF-12234
Docket No. 52-021

Amended Response to Request for Additional Information No. 735-5723 Revision 0

October 2012

AMENDED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/31/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 735-5723 REVISION 1**

SRP SECTION: **09.01.03 – Spent Fuel Pool Cooling and Cleanup System**

APPLICATION SECTION: 9.1.3

DATE OF RAI ISSUE: **4/20/2011**

QUESTION NO.: 09.01.03-7

The spent fuel pit cooling and purification system (SFPCS) is required to be designed in accordance with General Design Criteria (GDC) 2, "Design Basis for Protection Against Natural Phenomena," and GDC 4, "Environmental and Dynamic Effects Design Bases."To comply with GDC 2 requirements, Standard Review Plan (SRP), Section 9.1.3, "Spent Fuel Pool Cooling and Cleanup System," specifies that Position C.1 and C.2 of Regulatory Guide 1.29, "Seismic Design Classification" must be satisfied. Position C.2 specifies that the design of non-safety-related SSCs would be acceptable if their failures do not adversely affect the control room occupants or safety-related SSCs to perform their safety-related functions. To meet GDC 4 requirements, SSCs important to safety must be designed to accommodate the dynamic effects resulting from pipe whip, missiles, and discharging fluids.

USAPWR Design Certification Document (DCD) Rev 3, Section 9.1.3.2.1.7, "Valves," states that manual valves are used to isolate the safety-related cooling portion of the SFPCS from the non-safety-related purifications portion, in case any leaks or failures occur on the non-safety portion. The DCD does not address how these valves would provide isolation of the safety-related portion of the SFPCS from the non-safety related portion to comply with GDC2 and GDC4 requirements upon a seismic event or an internally generated missile event. If such an event led to a failure of the non-safety related portion of the SFPCS while both loops of SFPCS are in operation, without automatic closure of the isolation valves, the SFPCS pumps could continue to feed the break and eventually lead to their tripping from loss of flow, resulting in the loss of SFPCS function.

Therefore, the applicant is requested to provide additional information in Tier 2, Section 9.1.3 of the DCD to address how presumed failures of non-safety-related portions of the SFPCS due to a seismic event or an internally generated missile event do not adversely affect the safety-related portion of the SFPCS, pursuant to the requirements of GDC 2 and GDC 4.

AMENDED ANSWER:

This response revises and replaces MHI's initial response to RAI 735-5723 Rev.0, Question 09.01.03-7 submitted in MHI Letter UAP-HF-11187 dated June 22, 2011.

In UAP-HF-11187, "MHI's Responses to US-APWR DCD RAI No. 735-5723 Revision 0 (SRP 09.01.03)", MHI stated that presumed failures of non-safety-related portions of the SFPCS would not affect the safety-related portions because:

- In the event of SFP drain down through non-safety related piping following a line break, permanent loss of SFPCS pump function due to air binding is prevented by automatic pump tripping on SFP low-low water level. The trip setpoint is above the pump suction piping.
- By closing manual valves locally to isolate the non-safety portion from the safety-related portion and then refilling the SFP from Seismic Category I sources, cooling could then be resumed by restarting SFP pumps from the MCR before the start of pool boiling (at least 2.5 hours after pump trip).

MHI evaluated that the interlock and operation stated above would maintain spent fuel integrity and that there would be no effect on the safety function. However, the NRC noted in a conference call on September 8, 2011 that local manual operation of the isolation valve for the non-safety portion could require operator action in a "harsh" environment (e.g., high temperature, radioactivity, humidity). Therefore, MHI proposes the following design improvement:

- The local manual isolation valve between the safety and non-safety portion (VLV-101A/B) of each train will be changed to double, automatic isolation MOVs which close on a low-low SFP water level signal. The MOVs will be powered by independent electrical divisions. There will be two SFP water level gauges (NOTE 1) with independent power supplies. By using independent valve closure signals, at least one isolation valve can be closed, considering the single-failure criterion.
- Each SFP pump also will be tripped on the low-low SFP water level signal. By using independent pump trip signals on low-low level, at least one SFP pump is assured to be available for restart, considering the single-failure criterion.
- As with the current design, before the start of SFP bulk boiling, the SFP can be refilled from a Seismic Category I source. Then, the SFP pump will be restarted to resume cooling.
- In order to preclude inadvertent draining of the SFP water that could cause uncovering of the spent fuel in the event of a pipe break in the purification system, the SFP suction will be changed to locate at approximately 5 feet below the normal water level of the SFP.

(Note1) The SFP water level gauge configuration was changed in UAP-HF-11255 "MHI's Response to US-APWR DCD RAI No. 756-5753 Revision 3 (SRP 09.01.03)":
- Two Class 1E level switches to provide low-low water level alarm.
- One non-safety related water level gauge to monitor the SFP water level during normal condition with continuous measurement within its range and with high resolution.

Impact on DCD

See attached marked-up DCD Revision 3 Tier 1 pages 2.7-247, 2.7-248, 2.7-249, 2.7-254, 2.7-255, Tier 2 Chapter 3 pages 3.2-44, 3.9-215, 3.9-216, 3.9-251, 3D-53, 3K-44 Tier 2 Chapter 9 pages 9.1-15, 9.1-16, 9.1-19, 9.1-25, 9.1-66 and 9.1-67.

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 Reports

There is no impact on the Technical / Topical Reports.

Table 2.7.6.3-1 Spent Fuel Pit Cooling and Purification System Equipment Characteristics

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	
Spent fuel pit pumps	SFS-MPP-001A,B	3	Yes	–	Yes/~~No~~Yes	Remote Manual	Start	–	DCD_14.03-13
						Low-low SFP water level	Stop	–	DCD_09.01.03-8
Spent fuel pit heat exchangers	SFS-MHX-001A,B	3	Yes	–	—/—	—/—	—	–	
Spent fuel pit	SFS-MPT-001	—	Yes	—	—/—	—	—	–	
Spent fuel pump discharge check valves	SFS-VLV-006A,B	3	Yes	—	—/—	—	Transfer Open/ Transfer Close	–	
Cooling-Purification lines isolation valves	SFS-MOV-001A,B; SFS-MOV-002A,B	3	Yes	Yes	Yes/No	Low-Low SFP water level	Transfer Close, Maintain Close	Fail as is	DCD_09.01.03-7 S01
Spend fuel pit level	SFS-LT-010, 020	–	Yes	–	Yes/Yes	–	–	–	DCD_09.01.03-8 DCD_14.03-13
Spend fuel pit temperature	SFS-TE-010, 020	–	Yes	–	Yes/Yes	–	–	–	DCD_09.01.03-8 DCD_14.03-13
Spend fuel pit pump discharge flow	SFS-FT-032, 042	–	Yes	–	Yes/Yes	–	–	–	DCD_09.01.03-8 DCD_14.03-13

Note: Dash (-) indicates not applicable

Markup- for RAI 735-5723

Table 2.7.6.3-2 Spent Fuel Pit Cooling and Purification System Piping Characteristics

Pipe Line Name	ASME Code Section III Class	Seismic Category I
SFP cooling piping up to and including the following valves: Purification line isolation valves: SFS-~~VLV~~MOV-~~101~~002A,B and SFS-VLV-133A,B	3	Yes
Safety-related SFP make up line from RWSP	3	Yes
Connection piping to and from RHRS	3	Yes
Water transfer line to transfer canal, cask pit, fuel inspection pit.	3	Yes

DCD_09.01.03-7 S01

Table 2.7.6.3-3 Spent Fuel Pit Cooling and Purification System Equipment Alarms, Displays and Control Functions

Equipment/Instrument Name	MCR/RSC Alarm	MCR Display(1)	MCR/RSC Control Function	RSC Display(1)
SFP pump SFS-MPP-001A, B	No	Yes	Yes	~~No~~Yes
SFP level (SFS-LIA-010, 020)	Yes	Yes(2)	No	Yes (2)
SFP temperature (SFS-TIA-010, 020)	Yes	Yes(2)	No	Yes(2)
SFP pump discharge flow (SFS-FIA-032, 042)	Yes	Yes(2)	No	Yes(2)

Note (1): on S-VDU except for "Yes(2)"

Note (2): on O-VDU

DCD_14.03-6, 8

DCD_09.01.03-8

DCD_14.03-6, 8

DCD_09.01.03-8

DCD_14.03-6, 8

DCD_09.01.03-8

DCD_14.03-6, 8

Table 2.7.6.3-4 Spent Fuel Pit Cooling and Purification System Location of Equipment and Piping

System and Components	Location
Spent fuel pit	Reactor Building
Spent fuel pit pumps	Reactor Building
Spent fuel pit heat exchangers	Reactor Building
SFP cooling piping up to and including the following valves : Purification line isolation valves: SFS-~~VLV~~MOV-~~101~~002A,B and SFS-VLV-133A,B	Reactor Building
Safety related SFP make up line from RWSP	Reactor Building
Connection piping to and from RHRS	Reactor Building
Water transfer line to transfer canal, cask pit, fuel inspection pit.	Reactor Building

DCD_09.01.03-7 S01

Table 2.7.6.3-5 Spent Fuel Pit Cooling and Purification System Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 5 of 5)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria	
11. Controls are provided in the MCR to start and stop the spent fuel pit pumps identified in Table 2.7.6.3-3.	11.i ~~Tests will be performed on the as-built spent fuel pit pumps identified in Table 2.7.6.3-3 using controls in the as-built MCR.~~ Tests will be performed for MCR control capability of equipment, identified in Table 2.7.6.3-3, on the as-built S-VDU.	11.i MCR controls for equipment, identified in Table 2.7.6.3-3, on the as-built S-VDU have a capability to operate the respective equipment.	DCD_14.03-5
	11.ii Tests will be performed on the as-built equipment, identified in Table 2.7.6.3-3, using controls on the as-built O-VDU in the MCR.	11.ii Controls on the as-built O-VDU in the ~~as-built~~ MCR start and stop the as-built spent fuel pit pumps identified in Table 2.7.6.3-3.	DCD_14.03-5
12.a The check valves, identified in Table 2.7.6.3-1 as having an active safety function, perform an active safety function to change position as indicated in the table.	12.a Tests of the as-built check valves identified in Table 2.7.6.3-1 as having an active safety function will be performed under preoperational test pressure, temperature, and fluid flow conditions.	12.a Each as-built check valve identified in Table 2.7.6.3-1 as having an active safety function changes position as indicated in Table 2.7.6.3-1 under preoperational test conditions.	DCD_09.01.03-7 S01
12.b The remote operated valves, identified in Table 2.7.6.3-1 as having an active safety function, perform an active safety function to change position as indicated in the table.	12.b Tests of the as-built remote operated valves identified in Table 2.7.6.3-1 as having an active safety function will be performed under preoperational test pressure, temperature, and fluid flow conditions.	12.b Each as-built remote operated valve identified in Table 2.7.6.3-1 as having an active safety function changes position as identified in Table 2.7.6.3-1 under preoperational test conditions.	DCD_09.01.03-7 S01
13. The pumps identified in Table 2.7.6.3-1 perform their safety functions under design conditions.	13. Type tests or a combination of type tests and analyses of each pump identified in Table 2.7.6.3-1 will be performed to demonstrate the ability of the pump to perform its safety function under design conditions.	13. An equipment qualification data summary report exists and concludes that the pumps identified in Table 2.7.6.3-1 perform their safety functions under design conditions.	DCD_03.09.06-69

DCD_09.01.
03-7 S01

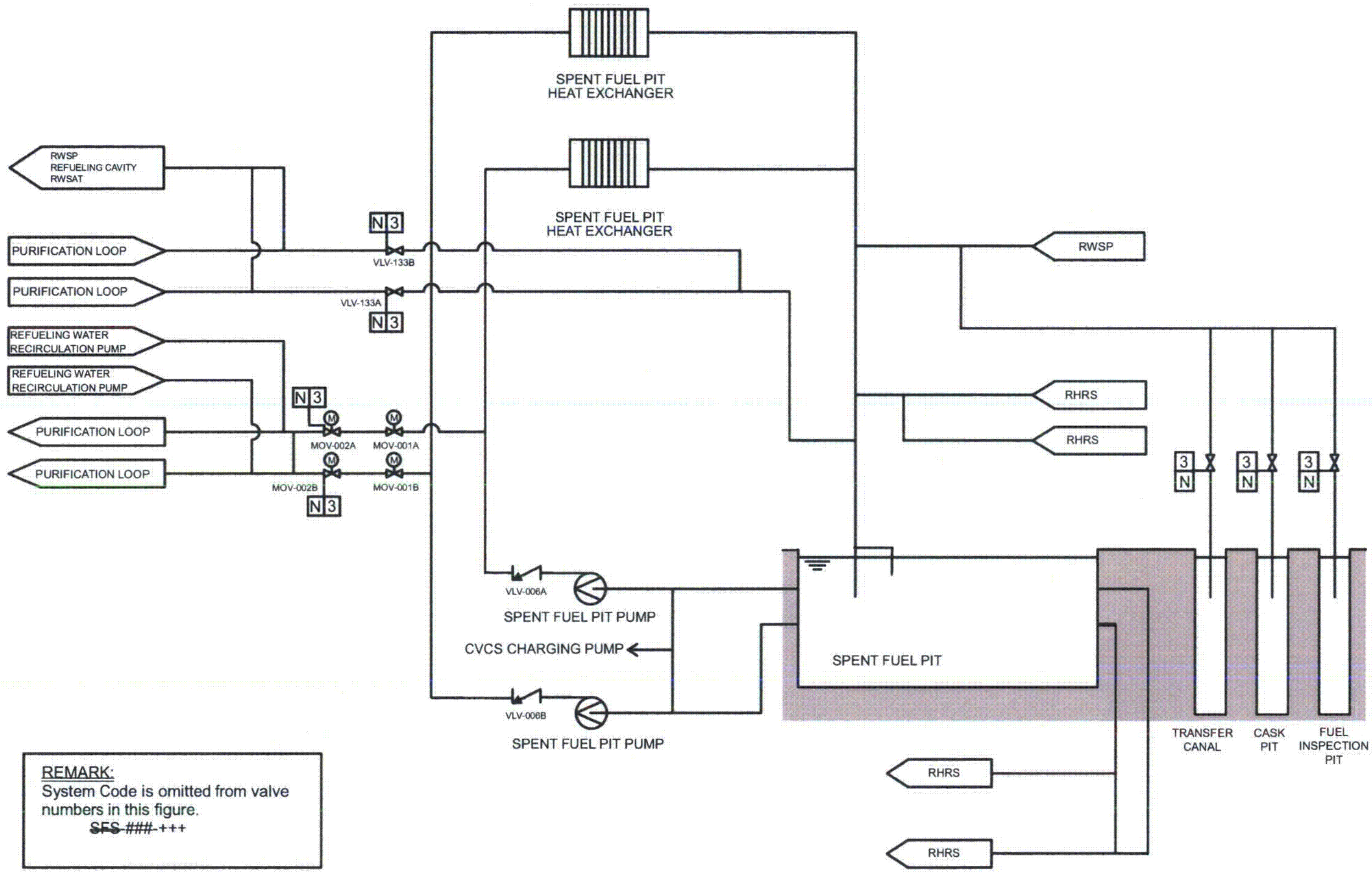

Figure 2.7.6.3-1 Spent Fuel Pit Cooling and Purification System

Table 3.2-2 Classification of Mechanical and Fluid Systems, Components, and Equipment (Sheet 27 of 58)

System and Components	Equipment Class	Location	Quality Group	~~10 CFR 50 Appendix B (Reference 3.2-8)~~Quality Assurance Classification(5)	Codes and Standards(3)	Seismic Category(4)	Notes	
Spent fuel pit cooling piping and valves up to and including the following valves: Primary makeup line isolation valve SFS-VLV-026,~~027~~028 and SFS-VLV-030,031,032 Purification line isolation valves SFS-~~VLV~~MOV-~~101~~002A,B	3	R/B	C	~~YES~~Q	3	I		DCD_03.02.02-17 DCD_03.02.02-17 DCD_09.01.03-7 S01
Spent fuel pit purification piping and valves from but excluding valve SFS-~~VLV~~MOV-~~101~~002A, B up to but excluding valve SFS-VLV-133A,B, A,B-Purification crosstie piping and valves	8	R/B A/B	D	~~N/A~~N	4	NS		DCD_03.02.02-17 DCD_09.01.03-7 S01
Spent fuel pit cooling piping and valves from but excluding RHS-VLV-032A,D (return line from containment spray/ residual heat removal system)	3	R/B	C	~~YES~~Q	3	I		DCD_03.02.02-17
Spent fuel pit cooling piping and valves up to but excluding RHS-VLV-033A,D (towards containment spray/ residual heat removal system)	3	R/B	C	~~YES~~Q	3	I		DCD_03.02.02-17
Water supply piping and valves from emergency feedwater pits from and including SFS-VLV-023 but excluding SFS-VLV-024	4	R/B	D	~~N/A~~A	4	~~NS~~II	Note 5.a	DCD_03.02.02-17
Water supply piping and valves from emergency feedwater pits to spent fuel pit from and including SFS-VLV-024	4	R/B	D	~~N/A~~A	4	~~NS~~II	Note 5.a	DCD_03.02.02-17
Water supply piping and valves from demineralized water storage tank ~~from and including SFS-VLV-025~~ up to ~~but~~and excluding SFS-VLV-026	10	R/B	N/A	~~N/A~~N	5	NS		DCD_03.02.02-17

Table 3.9-14 Valve Inservice Test Requirements (Sheet 83 of 121)

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-326B	Charging pump non-essential chilled water return line isolation	Remote MO Gate	Maintain Close	Safety Seat Leakage	A	Remote Position Indication, Exercise/2 Years Non-safety portion Isolation Leak Test Exercise Full Stroke/ Refueling Outage Operability Test	
NCS-MOV-241	Containment fan cooler alternative cooling water supply isolation	Remote MO Gate	Maintain Close	Safety Seat Leakage	A	Remote Position Indication, Exercise/2 Years Non-safety portion Isolation Leak Test Exercise Full Stroke/ Refueling Outage Operability Test	
NCS-MOV-242	Containment fan cooler alternative cooling water supply isolation	Remote MO Gate	Maintain Close	Safety Seat Leakage	A	Remote Position Indication, Exercise/2 Years Non-safety portion Isolation Leak Test Exercise Full Stroke/ Refueling Outage Operability Test	
SFS-MOV-001A,B	Cooling-purification lines isolation	Remote MO Gate	Transfer Close, Maintain Close	Active	BC	Remote Position Indication, Exercise/2 Years; Exercise Full Stroke/Quarterly Operability Test	

DCD_09.02.02-80

DCD_09.01.03-7 S01

Table 3.9-14 Valve Inservice Test Requirements (Sheet 84 of 121)

Valve Tag Number	Description	Valve/ Actuator Type	Safety-Related Missions	Safety Functions(2)	ASME IST Category	Inservice Testing Type and Frequency	IST Notes
SFS-MOV-002A,B	Cooling-purification lines isolation	Remote MO Globe	Transfer Close, Maintain Close	Active	BC	Remote Position Indication, Exercise/2 Years; Exercise Full Stroke/Quarterly Operability Test	
SFS-VLV-006A	Spent fuel pit pump discharge check	Check	Maintain Open Transfer Open Transfer Close	Active	BC	Check Exercise/ Refueling Outage	3
SFS-VLV-006B	Spent fuel pit pump discharge check	Check	Maintain Open Transfer Open Transfer Close	Active	BC	Check Exercise/ Refueling Outage	3
EWS-VLV-502A	Essential service water pump discharge check	Check	Maintain Open Transfer Open Maintain Close Transfer Close	Active	BC	Check Exercise/ Refueling Outage	3
EWS-VLV-502B	Essential service water pump discharge check	Check	Maintain Open Transfer Open Maintain Close Transfer Close	Active	BC	Check Exercise/ Refueling Outage	3
EWS-VLV-502C	Essential service water pump discharge check	Check	Maintain Open Transfer Open Maintain Close Transfer Close	Active	BC	Check Exercise/ Refueling Outage	3
EWS-VLV-502D	Essential service water pump discharge check	Check	Maintain Open Transfer Open Maintain Close Transfer Close	Active	BC	Check Exercise/ Refueling Outage	3

DCD_09.01.03-7 S01

Table 3.9-14 Valve Inservice Test Requirements (Sheet 119 of 121)

Valve Tag Number	Description	Valve/ Actuator Type	Safety-Related Missions	Safety Functions(2)	ASME IST Category	Inservice Testing Type and Frequency	IST Notes
GTS-VLV-103A,B,C,D	Air start valve	Remote AO Globe	Transfer Open	Active	B	Exercise Full Stroke/ Quarterly	14
GTS-VLV-104A,B,C,D	Air start valve	Remote AO Globe	Transfer Open	Active	B	Exercise Full Stroke/ Quarterly	14
GTS-SOV-109A,B,C,D	Air start pilot valve	Remote SO 3way	Transfer Open	Active	B	Exercise Full Stroke/ Quarterly	
GTS-SOV-110A,B,C,D	Air start pilot valve	Remote SO 3way	Transfer Open	Active	B	Exercise Full Stroke/ Quarterly	
GTS-VLV-117A,B,C,D	Air receiver inlet check	Check	Transfer Close	Active	BC	Check Exercise/ Quarterly	
GTS-VLV-118A,B,C,D	Air receiver inlet check	Check	Transfer Close	Active	BC	Check Exercise/ Quarterly	
GTS-VLV-123A,B,C,D	Air receiver relief valve	Relief	Maintain Close Transfer Open Transfer Close	Active	BC	Class 2/3 Relief Valve Tests/10 Years and 20% in 4 Years	
GTS-VLV-124A,B,C,D	Air receiver relief valve	Relief	Maintain Close Transfer Open Transfer Close	Active	BC	Class 2/3 Relief Valve Tests/10 Years and 20% in 4 Years	
~~SFS-VLV-101A~~	~~Spent fuel pit purification subsystem inlet isolation~~	~~Manual~~	~~Transfer Close~~	~~Active~~	~~B~~	~~Exercise Full Stroke/ 5 Years~~	
~~SFS-VLV-101B~~	~~Spent fuel pit purification subsystem inlet isolation~~	~~Manual~~	~~Transfer Close~~	~~Active~~	~~B~~	~~Exercise Full Stroke/ 5 Years~~	

DCD_09.01.03-7 S01

Table 3D-2 US-APWR Environmental Qualification Equipment List (Sheet 47 of 67)

Item Num	EquipmentTag	Description	Location		Purpose	Operational Duration	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	
107	NCS-MOV-146B	Motor Operated Valve	R/B	13-3	ESF	1yr	Mild	Mild	No (1)	M	I	
108	NCS-MOV-146C	Motor Operated Valve	R/B	13-3	ESF	1yr	Mild	Mild	No (1)	M	I	
109	NCS-MOV-146D	Motor Operated Valve	R/B	13-3	ESF	1yr	Mild	Mild	No (1)	M	I	
Equipment (Spent Fuel Pit Cooling and Purification System)												
1	SFP-MPP-001A	A-Spent Fuel Pit Pump	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
2	SFP-MPP-001B	B-Spent Fuel Pit Pump	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
3	~~SFP-MHX-001A~~Deleted	~~A-Spent Fuel Pit Heat Exchanger~~	~~R/B~~	~~6~~	~~ESF~~	~~1yr~~	~~Mild~~	~~Harsh~~	~~No (1)~~	~~M~~	~~I~~	
4	~~SFP-MHX-001B~~Deleted	~~B-Spent Fuel Pit Heat Exchanger~~	~~R/B~~	~~6~~	~~ESF~~	~~1yr~~	~~Mild~~	~~Harsh~~	~~No (1)~~	~~M~~	~~I~~	
5	SFS-MOV-001A	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
6	SFS-MOV-001B	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
7	SFS-MOV-002A	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
8	SFS-MOV-002B	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
Equipment (Essential Service Water System)												
1	EWS-MPP-001A	A-Essential Service Water Pump	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
2	EWS-MPP-001B	B-Essential Service Water Pump	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
3	EWS-MPP-001C	C-Essential Service Water Pump	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
4	EWS-MPP-001D	D-Essential Service Water Pump	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
5	EWS-SST-001A	A-Essential Service Water Pump Outlet Strainer	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
6	EWS-SST-002A	A-Essential Service Water Pump Outlet Strainer	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
7	EWS-SST-001B	B-Essential Service Water Pump Outlet Strainer	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
8	EWS-SST-002B	B-Essential Service Water Pump Outlet Strainer	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
9	EWS-SST-001C	C-Essential Service Water Pump Outlet Strainer	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
10	EWS-SST-002C	C-Essential Service Water Pump Outlet Strainer	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
11	EWS-SST-001D	D-Essential Service Water Pump Outlet Strainer	UHSRS	-	ESF	1yr	Mild	-	-	M	I	

DCD_09.02.02-86

DCD_03.11-41

DCD_09.01.03-7 S01

Table 3K-2 R/B RCA Components Protected From Internal Flooding (Sheet 22 of 22)

Item No.	Equipment Tag	Description	Location					Flood Elevation above Floor [ft]	Notes
			Building	Side	Floor Elevation	Fire Zone No.	Location Elevation above Floor		
273	NCS-MOV-146D	Motor Operated Valve	R/B RCA	W	3'-7"	FA2-128-02	above flood elevation	0.88	
274	SFS-MOV-001A	Motor Operated Valve	R/B RCA	E	3'-7"	FA2-209-01	above flood elevation	0.69	
275	SFS-MOV-002A	Motor Operated Valve	R/B RCA	E	3'-7"	FA2-209-01	above flood elevation	0.69	
276	SFS-MOV-001B	Motor Operated Valve	R/B RCA	W	3'-7"	FA2-128-04	above flood elevation	0.88	
277	SFS-MOV-002B	Motor Operated Valve	R/B RCA	W	3'-7"	FA2-128-04	above flood elevation	0.88	

DCD_09.02.02-86

DCD_09.01.03-7 S01

Note:

1. These components are protected by water-tight door and floor drain isolation valve against in-flow of flooding occurring outside of compartment. In addition, these components are not required to be protected against flooding occurring inside the compartment due to redundancy of other trains/components.

- The system piping is arranged such that the failure of any line cannot drain the SFP water level below a point 11 ft 1 in above the top of the stored fuel assemblies, which is the minimum SFP water level that provides adequate shielding.

- The SFPCS is designed to collect system leakage. A liner collection system to the R/B sump is provided to collect possible leakage from the SFP liner plate welds on the pit walls and floor. Leakage from the system piping is collected to the R/B sump. A leakage alarm will be installed upstream of the R/B sump for immediate detection of significant leakage levels. Details are described in DCD Subsection 9.1.2.2.

- Instrumentation is provided to indicate SFP water level and temperature.

- The SFP cooling portion is designed to limit the radiation dose at the surface of the SFP through the shielding provided by the SFP water.

- To continuously indicate the radiation levels inside the fuel handling area, an alarm signal warns the occupants of the fuel handling area of a deteriorated radiological condition. A description is presented in DCD Subsection 12.3.4.1.

9.1.3.2 System Description

A schematic of the SFPCS, which consists of two 100% cooling capacity trains, is shown in Figure 9.1.3-1. Each train includes one SFP pump, one SFP heat exchanger, one SFP filter, and one SFP demineralizer. In addition, each train of equipment has its own suction and discharge headers and includes the piping, valves, and instrumentation necessary for system operation.

Each SFPCS train contains a cooling portion for cooling of the SFP and a purification portion for purification of the boric acid water in the SFP, RWSP, RWSAT, and the refueling cavity. The SFPCS is designed such that either train can be operated to perform all the functions required of the system independently of the other train. Normally, one train is continuously cooling and purifying the SFP while the other train is available for water transfers, refueling water purification, or aligned as a backup to the operating train.

The suction line, which is protected by a strainer, is connected to the SFP at an elevation approximately 54 ft below the normal SFP water level. The return line contains a siphon breaker located near the surface of the water. These features are provided so that the pit cannot be gravity drained below a point 11 ft 1 in above the top of the spent fuel assemblies. DCD_09.01.03-7 S01

The SFPCS consists of one 100% capacity RWSAT (29,410 cu. ft), pumps, associated valves, piping, and instrumentation. The piping to and from the RWSAT is single-walled stainless steel that runs above ground and penetrates the building wall directly into the tank. For piping between buildings, penetration sleeves are provided to collect and direct any leakage back into the building drain for further processing. The RWSAT employs leak-tight valves to minimize leakage to the environment. This design is supplemented by operational programs, which include periodic visual inspections for piping integrity. DCD_12.03-12.04-38

Testing the piping segments will be included as a part of the plant routine inspections and maintenance program. DCD_12.03-12.04-38

Cooling is performed for the SFP water by circulating the SFP water with the SFP pump and removing decay heat through the SFP heat exchanger. The heat removal is accomplished by taking high temperature water from the SFP, pumping it through a heat exchanger, transferring heat from the SFP water to the CCWS (discussed in Subsection 9.2.2), and returning the cooled water to the SFP.

Purification is performed for the SFP water by bypassing approximately 265 gpm from the cooling portion into the purification portion's demineralizer and filter, and removing solid materials and dissolved impurities. Two motor operated isolation valves are~~An isolation valve is~~ provided to permit isolation from the cooling portion and allow purification of the SFP water in the refueling cavity, the RWSAT, or the RWSP in parallel to the SFP cooling operation. DCD_09.01.03-7 S01

When the heat load of the SFP is high (for full core offload), two RHRS trains (A and D), each comprising of one CS/RHRS pump and one CS/RHRS heat exchanger, perform SFP cooling in conjunction with the two SFP cooling trains.

The SFP is initially filled with water that has a boron concentration of approximately 4000 ppm; refer to Table 9.1.3-2 for the SFP design parameters. The boric acid water is supplied from the RWSP to the SFP through the refueling water recirculation pump, or directly supplied by connecting a temporary pipe to the boric acid water supply end connection located at the outlet of the boric acid blender in the chemical and volume control system.

The SFP condition resulting from the unlikely failure of the spent fuel cooling portion would be a rise in the SFP water temperature followed by an increase in evaporative losses. Minor leakage from SFPCS piping, components, or SFP liner will also decrease the SFP water level. A liner leakage collection system directs any possible leakage from SFP liner plate welds and floor to the R/B sump. A leakage level alarm for early detection is installed upstream of the R/B sump. Makeup to the SFP is manually started upon receipt of a low-level alarm signal from the SFP to the MCR. These losses could be made up from the following water sources.

The safety-related boric acid water makeup line is provided from the RWSP to the SFP. This tank contains 4000 ppm boric acid, thereby maintaining the initial boric acid water concentration in the SFP. The same concentration will be maintained during normal operations. The RWSP, as a primary water source of water to the SFP, is seismic category I. The makeup line from the RWSP to the SFP is seismic category I, ASME Code section III Class 3. The RWSP has a leak detection system which consists of leak detection channels that interface with the RWSP liner and are routed through the RWSP floor into standpipes between the RWSP and the PCCV. These standpipes are visually inspected during refueling outages as part of the leak monitoring operational program, in accordance with RG 4.21. DCD_12.03-12.04-37

As a backup of the safety-related makeup line, another makeup line is also provided from the emergency feedwater (EFW) pit to the SFP. The EFW pit, as a backup water source

9.1.3.2.1.6 Spent Fuel Pit Strainers

Spent fuel pit strainers are provided at the intake of the SFP to remove relatively large size solid materials for SFP and CS/RHR pump protection. The strainer is made of stainless steel.

9.1.3.2.1.7 Valves

Two automatic isolation MOVs which close on a low-low SFP water level signal are installed in series on each of two connection lines from cooling system to purification system. In the event of SFP drain down following non-safety-related purification system line break (e.g., due to a seismic event or internally-generated missile), these isolation MOVs are automatically closed on receipt of low-low SFP water level signal to terminate the SFP drain down. DCD_09.01.03-7 S01

Stroke limiters are attached to the downstream side isolation MOVs, which restrict the maximum flow rate through the valve below the SFP pump capacity to prevent the pump run-out and to reduce discharge flow rate until the isolation valve closes in case of a purification system pipe breakManual valves are Equipment Class 3 and Seismic Category I. Therefore they are capable of isolating the cooling and purification portions of the system under accident conditions. Manual valves are used to isolate the cooling portion of the SFPCS from the purification portion.In the event that the manual valves leaked or were not closed following a piping failure in the purification portion (e.g., due to a seismic event or internally generated missile), potential drain down of the SFP is prevented by the SFP pump suction and discharge piping configuration so that adequate water remains over the fuel assemblies, as discussed in Subsection 9.1.3.1. Manual valves are used to isolate components that could develop leaks or failures. Manual throttle valves are provided for flow control. Valves in contact with SFP water are made of stainless steel. DCD_09.01.03-7

9.1.3.2.1.8 Piping

All piping in contact with SFP water is made of stainless steel. The piping is welded, except for flanged connections for the pumps and heat exchangers.

As indicated in Subsection 9.1.3.1, system piping is arranged so that dynamic effects on the purification portion, such as an internally generated missile event, could not cause the SFP water level to drain below the minimum level required to provide adequate shielding, consistent with the requirements of GDC 2 and GDC 4. DCD_09.01.03-7

9.1.3.2.2 System Operation

9.1.3.2.2.1 Plant Startup, Normal Operation, and Shutdown

During plant startup, normal plant operation, and shutdown, one SFPCS train is normally operating. The operating train is aligned to provide SFP cooling and purification. The other train is available to perform the other system functions, such as RWSP or RWSAT purification and water transfers. Upon loss of the operating SFPCS train, operation is to be restored on or before actuation of the pit water high temperature alarm. Prior to

9.1.3.5.2 Pressure

Instrumentation is provided to measure and give local indication of the pressure in the SFP pump suction and discharge lines. These instruments are utilized to assess pump performance.

A local differential pressure indicator is installed at each SFP filter to measure the pressure differential between filter outlet and inlet. If the filter differential pressure exceeds the set value, a high differential pressure is alarmed in the MCR.

A local differential pressure indicator is installed at each SFP demineralizer to measure the differential pressure between outlet and inlet of the demineralizer. If the demineralizer differential pressure exceeds the set value, a high differential pressure is alarmed in the MCR.

9.1.3.5.3 Flow

~~Instrumentation is provided to measure and give local indication of the SFP cooling portion flow upstream of the SFP heat exchangers. This instrument is utilized to check if the flow rate of the cooling water returning to the SFP through the SFP heat exchanger is maintained at the specified value. Alarms to indicate low flow rates and eventual loss of flow that indicates a loss of cooling function are also integrated to inhibit abnormal temperature increases and eventual increases in radiation levels.~~ Two safety-related flow transmitters and a local indicator are provided to monitor and display the SFP cooling portion flow, upstream of the SFP heat exchangers. These instruments are utilized to verify that the flow rate of the cooling water, through the SFP heat exchanger and returning to the SFP is maintained at the specified value. Alarms to indicate low flow rates and eventual loss of cooling flow, annunciate in the MCR and locally, which indicate a loss of cooling function and are integral to preventing abnormal temperature increases and eventual increases in radiation levels.

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A local flow indicator is installed at the outlet of each purification line to measure the purification flow.

9.1.3.5.4 Water Level

~~A liquid level transmitter is installed in the SFP to monitor water level. The water level indication, high water level alarm, and low water level alarm are relayed to the MCR. A local alarm is also installed for detection by personnel present in the vicinity of the SFP.~~ Two safety-related SFP water level switches are installed in the SFP. Each transmitter is interlocked with the SFP pump of that same train to avoid SFP pump cavitation and failure due to decreased SFP water level below the SFP pump suction line. Each transmitter is also interlocked with the motor operated purification line isolation valves to close on a low-low SFP water level signal. The SFP water level switches annunciate low-low water level of the SFP to the MCR and locally.

Also, one non-safety related SFP water level transmitter is installed to monitor the SFP water level during normal condition with continuous measurement within its range and with high resolution.

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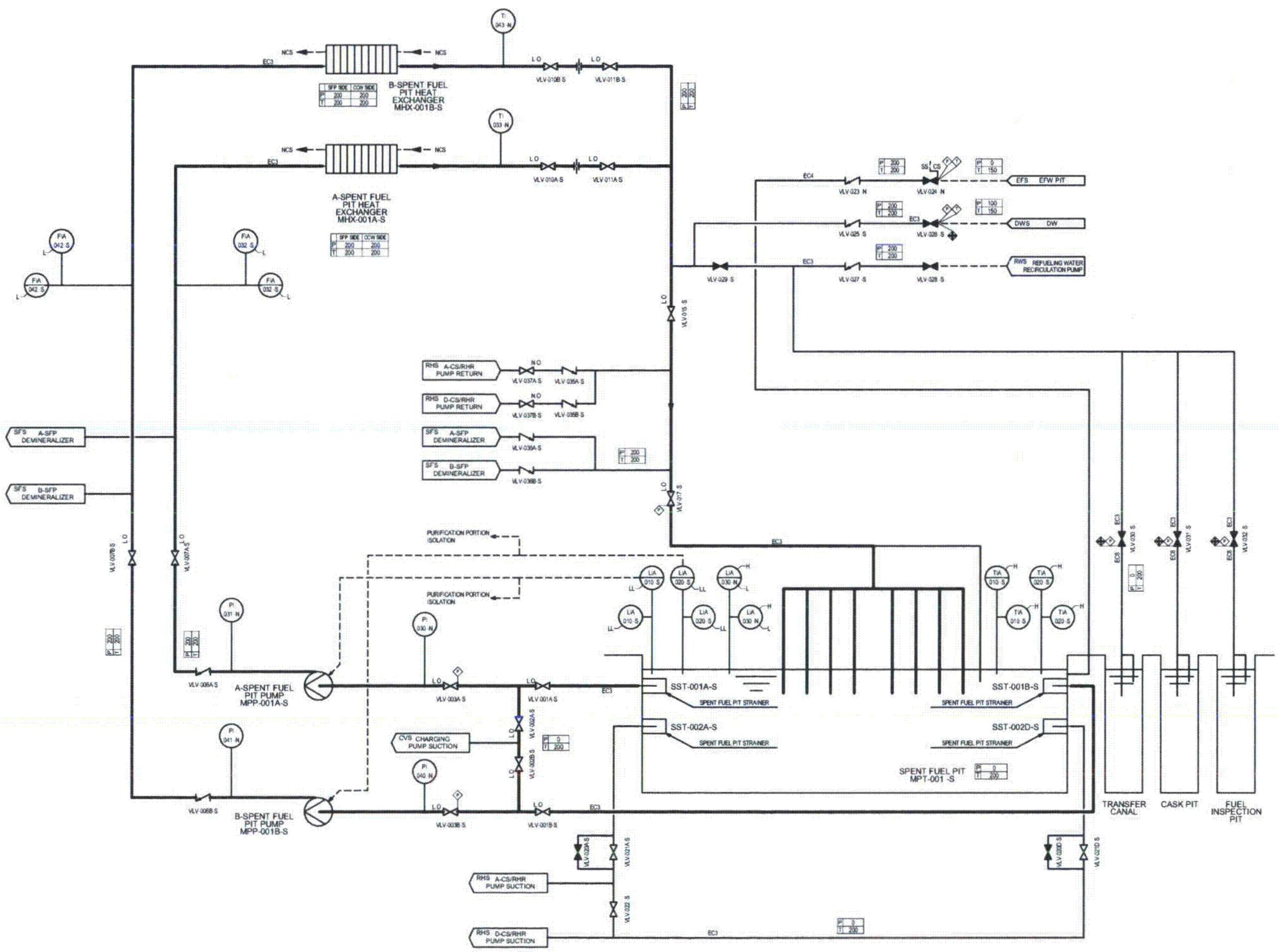

Figure 9.1.3-1 Schematic of Spent Fuel Pit Purification and Cooling System (Cooling Portion)

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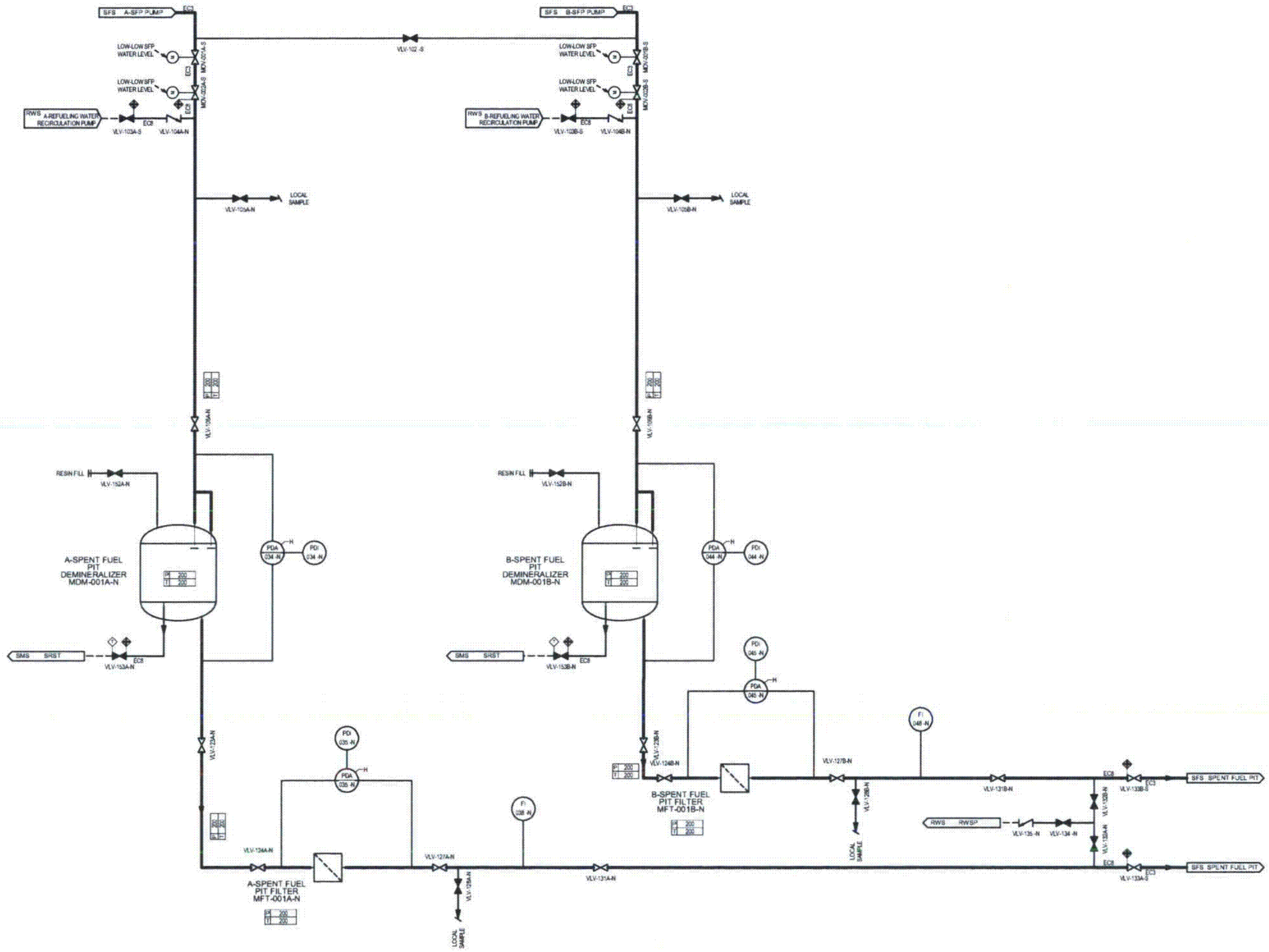

Figure 9.1.3-2 Schematic of Spent Fuel Pit Purification and Cooling System (Purification Portion)