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TOKYO, JAPAN

August 10, 2011

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffery A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-11255

Subject: MHI's Responses to US-APWR DCD RAI No. 756-5753 Revision 3 (SRP 09.01.03)

Reference: 1) "Request for Additional Information No. 756-5753 Revision 3, SRP Section: 09.01.03 - Spent Fuel Pool Cooling and Cleanup System, Application Section: 9.1.3" dated 5/11/2011.

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. 756-5753, Revision 0."

Enclosed are the responses to one RAI contained within Reference 1. This transmittal completes the response to this RAI.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, 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,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Response to Request for Additional Information No. 756-5753, Revision 3

D081
NRO

CC: J. A. Ciocco
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Contact Information

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Enclosure 1

UAP-HF-11255
Docket No. 52-021

Response to Request for Additional Information No. 756-5753, Revision 3

August, 2011

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

8/10/2011

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO. SPBA 756-5753 REVISION 3**
SRP SECTION:	**09.01.03 – Spent Fuel Pool Cooling and Cleanup System**
APPLICATION SECTION:	**8.3.1 AND 9.1.3**
DATE OF RAI ISSUE:	**5/11/2011**

QUESTION NO.: 09.01.03-8

DCD Tier 2 Section 8.3.1.1.3.6 "Load Shedding and Sequencing Circuits" states that when a loss of coolant accident (LOCA) occurs concurrent or following a loss of offsite power (LOOP):

- the emergency core cooling system (ECCS) actuation signal would initiate the ECCS load sequence;

- the load sequence would shed all loads not needed by the ECCS (Except the motor control center (MCC));

- the spent fuel pool (SFP) cooling system is not needed by the ECCS, therefore, this sequence will shutdown the SFPCS pumps.

This scenario is not consistent with system description presented in DCD Tier 2 Section 9.1.3, "Spent Fuel Pit Cooling and Purification System," which states that:

During a loss of offsite power (LOOP), the emergency power sources supply power to the SFP pumps so that the SFP cooling function is maintained.

The staff requests that the applicant clarify this apparent discrepancy. If the description in DCD Tier 2 Section 9.1.3 is not correct and the SFP cooling is stopped by the ECCS actuation signal, the applicant needs to modify DCD Tier 2 Section 9.1.3 to address this scenario and the following:

a) The applicant should describe the safety related instruments credited to monitor the SFP conditions (e.g., temperature and water level) while the SFP cooling system is shutdown;

b) The applicant should describe the minimum time available to re-establish SFP cooling;

c) The applicant should describe the operator actions required to re-establish SFP cooling in a timely manner.

ANSWER:

Section 9.1.3 of DCD Tier 2 does not provide an adequate description of the SFP pump operation should a LOOP occur or a LOCA concurrent with a LOOP. During a LOOP, the SFP pumps will trip on undervoltage and then will not be automatically re-actuated by the load sequencer as shown on Figure 8.3.1-2 in DCD Chapter 8; however, the pump may be manually started from the MCR to re-establish SFP cooling.

Refer to following answers to each item of RAI No.09.01.03-8

a) The safety-related classification is applied to instruments that are used for reactor trip, ESF actuation, safe shutdown and post accident monitoring in accordance with DCD Subsections 7.1.1 and 3.2. In present design, the temperature, flow rate to the heat exchanger and level instruments credited to monitor the SFP condition do not meet the criteria for a classification of safety-related. Because they will be augmented quality. This augmented quality applies to items not classified as safety-related, but whose design specifications are based on significant licensing requirements or commitments, such 10CFR50 Appendix A, GDC 61 for the handling, storage and cooling systems of spent fuel.. However, the instrumentations are quite important to identify the SFP condition during normal condition and at the SFP cooling function re-establishment, therefore, the instruments will be changed from non safety-related to safety-related as shown below;

- SFP water level
  Two water level gauges are installed in the SFP. These SFP water level instruments annunciate high, low and low-low water level of the SFP to the MCR and locally. Water level indication is available in the control room.
  The two level gauges will be changed to two Class 1E level switches to provide low-low water level alarm. If the water level is below the low-low setpoint, the pump shall not be re-started under LOOP condition. In addition, one non-safety related water level gauge will be installed to monitor the SFP water level during normal condition with continuous measurement within its range and with high resolution.
- Flow rate to the heat exchanger
  A flow meter is provided upstream of each SFP heat exchanger to monitor flow rates of SFP cooling water. 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 specific value. Two flow meter will be changed to two Class 1E flow meter for confirmation of SFP cooling re-establishment under LOOP condition.
- SFP temperature
  The cooling of the SFP water is confirmed by monitoring with temperature elements in the SPF that alarm in the MCR on a high SPF temperature. The one SFP temperature gauge will be changed to two Class 1E SFP temperature gauge to survey SFP temperature before and after the cooling recovery.

b) The minimum time available to re-establish SFP cooling is approximately 2.5 hours, which is the SFP time-to-boil shown in MUAP-09014P, Thermal-Hydraulic Analysis for

US-APWR Spent Fuel Racks. The time-to-boil stated is evaluated under critical condition, a total loss of cooling functions, a maximum SFP heat load during refueling, including a full core offload. The 2.5 hours is adequate to allow the operator to identify and rectify the situation.

c) At an occurrence of LOOP, the SFP pump will trip on undervoltage and then will not be automatically re-actuated by the sequencer, as shown on Figure 8.3.1-2 in DCD Chapter 8. However, the pump can be manually started from the MCR to re-establish the SFP cooling, if the GTG has available margin following the automatic load sequencer. Operators will monitor SFP temperature and water level and re-establish SFP cooling flow before the SFP temperature reaches the 200 degree F design temperature. Without SFP cooling the minimum time until the SFP temperature reaches 200 degrees F is approximately 2.5 hours, which is the SFP time-to-boil evaluated at the most critical condition. Before re-establishing SFP cooling, the operator should confirm that the SFP level is above the low-low level alarm setpoint. Since SFP cooling will be re-established before boiling, the water level in the SFP will not be significantly reduced due to evaporation. If the water level is below the low-low setpoint, the local operation to recover SFP water level will be necessary. The recovery operation will be done with the confirmation of SFP water temperature and water level locally. Indication of coolant flow to the heat exchanger will identify the cooling function re-establishment from MCR or local.
The SFPCS trains are powered by two safety-related, redundant Class 1E load centers, A1 and D1; each divided into two redundant load groups (i.e., load centers A and B for A1 and C and D for D1). The load centers, A, B, C, and D, are backed up by Class 1E gas turbine generators (GTG) A, B, C, and D, respectively. Either A1 or D1 power train is required to remain operable in order to maintain applicable safety functions during normal operating conditions, LOOP and other related transients, except station blackout. The load center buses, A1 and D1, are normally connected to the 480V Class 1E load centers, A and D, respectively. On-line maintenance of A-GTG and D-GTG that power A1 and D1, respectively, requires manual transfer of B-GTG to A1 and C-GTG to D1.

Impact on DCD

See Attachment 1 for the mark-up of DCD Section 9.1.3, Revision 3, changes to be incorporated.

- Revised Tier 1 Table 2.7.6.3-1 and Table 2.7.6.3-3 to add following instruments; Spent fuel pit level (SFS-LIA-010, 020), Spent fuel pit temperature (SFS-TIA-010, 020) and Spent fuel pit pump discharge flow (SFS-FIA-032, 042)

- Revised Tier 2 Table 3D-2 to add instruments shown above.

- Replace the second paragraph of the "Spent Fuel Pit Cooling" of DCD Section 9.1.3.3.1 with

  "During a loss of offsite power (LOOP), the SFP pump will trip on undervoltage and then will not be automatically re-actuated by the sequencer as shown on Figure 8.3.1-2 in DCD Chapter 8. However, the pump can be manually re-actuated from MCR to re-establish the SFP cooling. The operator will monitor SFP temperature and water level and re-establish SFP cooling flow before the SFP reaches the 200 degree F design temperature. Without SPF cooling, the SFP temperature reaches 200 degrees F in approximately 2.5 hours, which is the SFP time-to-boil evaluated at the most critical condition. Before re-establishing SFP cooling, the operator should confirm that the SFP level is above the low level alarm setpoint. Since SFP cooling will be re-established before boiling, the water level in the SFP will not be significantly reduced due to evaporation."

- Add the following paragraph after the first paragraph of the "Instrumentation Requirements" of DCD Section 9.1.3.5 as follows.

  "The instrumentations are quite important to identify the SFP condition during normal condition and at the SFP cooling function re-establishment, therefore, the instruments such as SFP temperature, SFP water level and flow rate to the SFP heat exchanger are safety-related."

- Revise the first sentence of the "Temperature " of DCD Section9.1.3.5.1 to the followings.

  "Two safety-related temperature instruments in SFP water are installed. If the SFP water temperature would be high, the temperature instrument annunciates to MCR and local. Temperature transmitter is provided to monitor the temperature of the water in the SFP and to give an indication, as well as an alarm, in the MCR when normal temperatures are exceeded."

- Change the first paragraph of the "Flow" of DCD Section 9.1.3.5.3 to the following.

  "Two safety-related flow transmitter 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."

- Revise the description of the "Water Level" of DCD Section9.1.3.5.4 as follows.

  "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. The SFP water level switches annunciates 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."

- Revise the figure 9.1.3.1 to reflect the changes regarding instrumentation appropriately.

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.

Attachment 1
US-APWR DCD Section 9.1.3 Mark-up
Response to RAI No. 756-5753 Revision 3

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	~~Remote Manual~~	~~Start~~	–
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	–
Spent fuel pit level	SFS-LIA-010, 020	-	Yes	-	Yes/No	-	-	-
Spent fuel pit temperature	SFS-TIA-010, 020	-	Yes	-	Yes/No	-	-	-
Spent fuel pit pump discharge flow	SFS-FIA-032, 042	-	Yes	-	Yes/No	-	-	-

Note: Dash (-) indicates not applicable

Remote Manual	Start
Low-low SFP water level	Stop

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-101A,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

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

Table 3D-2 US-APWR Environmental Qualification Equipment List (Sheet 8 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	
138	NCS-FT-130B	B- Reactor Coolant Pump Thermal Barrier Component Cooling Water Flow	PCCV	1-5	Other	5min*	Harsh	Harsh	No (1)	E	I	*Not Required Post Accident
139	NCS-FT-131A	C- Reactor Coolant Pump Thermal Barrier Component Cooling Water Flow	PCCV	1-5	Other	5min*	Harsh	Harsh	No (1)	E	I	*Not Required Post Accident
140	NCS-FT-131B	C- Reactor Coolant Pump Thermal Barrier Component Cooling Water Flow	PCCV	1-5	Other	5min*	Harsh	Harsh	No (1)	E	I	*Not Required Post Accident
141	NCS-FT-132A	D- Reactor Coolant Pump Thermal Barrier Component Cooling Water Flow	PCCV	1-5	Other	5min*	Harsh	Harsh	No (1)	E	I	*Not Required Post Accident
142	NCS-FT-132B	D- Reactor Coolant Pump Thermal Barrier Component Cooling Water Flow	PCCV	1-5	Other	5min*	Harsh	Harsh	No (1)	E	I	*Not Required Post Accident
143	NCS-LT-010	A – Component Cooling Water Surge Tank Water Level	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
144	NCS-LT-011	A - Component Cooling Water Surge Tank Water Level	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
145	NCS-LT-020	B - Component Cooling Water Surge Tank Water Level	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
146	NCS-LT-021	B - Component Cooling Water Surge Tank Water Level	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
147	NCS-PT-030	A - Component Cooling Water Header Pressure	R/B	8	PAM, Other	4mos, 36hr	Mild	Harsh	No (1)	E	I	
148	NCS-PT-031	B - Component Cooling Water Header Pressure	R/B	8	PAM, Other	4mos, 36hr	Mild	Harsh	No (1)	E	I	
149	NCS-PT-032	C - Component Cooling Water Header Pressure	R/B	8	PAM, Other	4mos, 36hr	Mild	Harsh	No (1)	E	I	
150	NCS-PT-033	D - Component Cooling Water Header Pressure	R/B	8	PAM, Other	4mos, 36hr	Mild	Harsh	No (1)	E	I	
151	SFS-LT-010	SFP water level	R/B	12	Other	1 yr	Mild	Harsh	No (1)	E	1	
152	SFS-LT-020	SFP water level	R/B	12	Other	1 yr	Mild	Harsh	No (1)	E	1	
153	SFS-FT-032	A-SFP pump discharge flow	R/B	7	Other	1 yr	Mild	Harsh	No (1)	E	1	
154	SFS-FT-042	B-SFP pump discharge flow	R/B	7	Other	1 yr	Mild	Harsh	No (1)	E	1	
~~151~~ 155	EWS-FT-034	A - Component Cooling Water Heat Exchanger Essential Service Water Flow	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
~~152~~ 156	EWS-FT-035	B - Component Cooling Water Heat Exchanger Essential Service Water Flow	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
~~153~~ 157	EWS-FT-036	C - Component Cooling Water Heat Exchanger Essential Service Water Flow	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
~~154~~ 158	EWS-FT-037	D - Component Cooling Water Heat Exchanger Essential Service Water Flow	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
~~155~~ 159	EWS-PT-015	A - Essential Service Water Header Pressure	UHSRS	-	PAM, Other	2wks, 36hr	Mild	-	-	E	I	(1)

Table 3D-2 US-APWR Environmental Qualification Equipment List (Sheet 9 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	
~~156~~ 160	EWS-PT-016	B - Essential Service Water Header Pressure	UHSRS	-	PAM, Other	2wks, 36hr	Mild	-	-	E	I	(1)
~~157~~ 161	EWS-PT-017	C - Essential Service Water Header Pressure	UHSRS	-	PAM, Other	2wks, 36hr	Mild	-	-	E	I	(1)
~~158~~ 162	EWS-PT-018	D - Essential Service Water Header Pressure	UHSRS	-	PAM, Other	2wks, 36hr	Mild	-	-	E	I	(1)
~~159~~ 163	RWS-LT-010	Refueling Water Storage Pit Water Level (Narrow Range)	PCCV	1-5	PAM	4mos	Harsh	Harsh	No (1)	E	I	
~~160~~ 164	RWS-LT-011	Refueling Water Storage Pit Water Level (Wide Range)	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
~~161~~ 165	RWS-LT-012	Refueling Water Storage Pit Water Level (Narrow Range)	PCCV	1-5	PAM	4mos	Harsh	Harsh	No (1)	E	I	
~~162~~ 166	RWS-LT-013	Refueling Water Storage Pit Water Level (Wide Range)	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
~~163~~ 167	LMS-LT-093A	Containment Sump Water Level A	PCCV	1-5	Other	36hr*	Harsh	Harsh	No (2)	E	I	*Not Required Post Accident
~~164~~ 168	LMS-LT-093B	Containment Sump Water Level B	PCCV	1-5	Other	36hr*	Harsh	Harsh	No (2)	E	I	*Not Required Post Accident
Instruments (Resistance Temperature Detectors)												
1	RCS-TE-020	Loop A - Reactor Coolant Hot Leg Temperature (Wide Range)	PCCV	1-3	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
2	RCS-TE-021A	Loop A - Reactor Coolant Hot Leg Temperature (Narrow Range)	PCCV	1-3	RT	5min	Harsh	Harsh	No (1)	E	I	
3	RCS-TE-021B	Loop A - Reactor Coolant Hot Leg Temperature (Narrow Range)	PCCV	1-3	RT	5min	Harsh	Harsh	No (1)	E	I	
4	RCS-TE-021C	Loop A - Reactor Coolant Hot Leg Temperature (Narrow Range)	PCCV	1-3	RT	5min	Harsh	Harsh	No (1)	E	I	
5	RCS-TE-021D	Loop A - Reactor Coolant Cold Leg Temperature (Narrow Range)	PCCV	1-3	RT	5min	Harsh	Harsh	No (1)	E	I	
6	RCS-TE-023A	Loop A - Reactor Coolant Hot Leg Temperature (Narrow Range) (spare)	PCCV	1-3	RT	5min	Harsh	Harsh	No (1)	E	I	
7	RCS-TE-023B	Loop A - Reactor Coolant Hot Leg Temperature (Narrow Range) (spare)	PCCV	1-3	RT	5min	Harsh	Harsh	No (1)	E	I	
8	RCS-TE-023C	Loop A - Reactor Coolant Hot Leg Temperature (Narrow Range) (spare)	PCCV	1-3	RT	5min	Harsh	Harsh	No (1)	E	I	

Table 3D-2 US-APWR Environmental Qualification Equipment List (Sheet 12 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	
41	RHS-TE-014	A - Containment Spray / Residual Heat Removal Heat Exchanger Outlet Temperature	R/B	6	Other	36hr	Mild	Harsh	No (1)	E	I	
42	RHS-TE-024	B - Containment Spray / Residual Heat Removal Heat Exchanger Outlet Temperature	R/B	6	Other	36hr	Mild	Harsh	No (1)	E	I	
43	RHS-TE-034	C - Containment Spray / Residual Heat Removal Heat Exchanger Outlet Temperature	R/B	6	Other	36hr	Mild	Harsh	No (1)	E	I	
44	RHS-TE-044	D - Containment Spray / Residual Heat Removal Heat Exchanger Outlet Temperature	R/B	6	Other	36hr	Mild	Harsh	No (1)	E	I	
45	CSS-TE-020	Containment Temperature	PCCV	1-6	PAM	4mos	Harsh	Harsh	No (1)	E	I	
46	NCS-TE-025	A - Component Cooling Water Supply Temperature	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
47	NCS-TE-026	B - Component Cooling Water Supply Temperature	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
48	NCS-TE-027	C - Component Cooling Water Supply Temperature	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
49	NCS-TE-028	D - Component Cooling Water Supply Temperature	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
Instruments (Speed Sensors)												
1	RCS-SE-028A	A - Reactor Coolant Pump Speed	PCCV	1-4	RT	5min*	Harsh	Harsh	No (1)	E	I	*Not required post accident
2	RCS-SE-028B	A - Reactor Coolant Pump Speed (spare)	PCCV	1-4	RT	5min*	Harsh	Harsh	No (1)	E	I	*Not required post accident
3	RCS-SE-038A	B - Reactor Coolant Pump Speed	PCCV	1-4	RT	5min*	Harsh	Harsh	No (1)	E	I	*Not required post accident
4	RCS-SE-038B	B - Reactor Coolant Pump Speed (spare)	PCCV	1-4	RT	5min*	Harsh	Harsh	No (1)	E	I	*Not required post accident
5	RCS-SE-048A	C - Reactor Coolant Pump Speed	PCCV	1-4	RT	5min*	Harsh	Harsh	No (1)	E	I	*Not required post accident
6	RCS-SE-048B	C - Reactor Coolant Pump Speed (spare)	PCCV	1-4	RT	5min*	Harsh	Harsh	No (1)	E	I	*Not required post accident
7	RCS-SE-058A	D - Reactor Coolant Pump Speed	PCCV	1-4	RT	5min*	Harsh	Harsh	No (1)	E	I	*Not required post accident
8	RCS-SE-058B	D - Reactor Coolant Pump Speed (spare)	PCCV	1-4	RT	5min*	Harsh	Harsh	No (1)	E	I	*Not required post accident
50	SFS-TE-010	SFP temperature	R/B	12	Other	1 yr	Mild	Harsh	No (1)	E	I	
51	SFS-TE-020	SFP temperature	R/B	12	Other	1 yr	Mild	Harsh	No (1)	E	I	

loss of cooling capability of a SFP heat exchanger, the second cooling train provides a backup capability that ensures continued cooling of the SFP.

~~During a loss of offsite power (LOOP), the emergency power sources supply power to the SFP pumps so that the SFP cooling function is maintained.~~

In the case of a SFPCS single failure, one SFP pump and one heat exchanger in service will maintain a SFP temperature below 140°F for a 1/2 core offload.

For a full core offload with a single active failure, the pit temperature is maintained below 140°F with one train of SFP cooling and two RHRS trains in operation, or two trains of SFP cooling and one RHRS train in operation.

9.1.3.3.2 Spent Fuel Pit Water Supply

Borated water is initially pumped from the CVCS to the SFP. Approximately 400,000 gallons of borated water is injected to the SFP.

During a loss of offsite power (LOOP), the SFP pump will trip on undervoltage and then will not be automatically re-actuated by the sequencer as shown on Figure 8.3.1-2 in DCD Chapter 8. However, the pump can be manually re-actuated from MCR to re-establish the SFP cooling. The operator will monitor SFP temperature and water level and re-establish SFP cooling flow before the SFP reaches the 200 degree F design temperature. Without SPF cooling, the SFP temperature reaches 200 degrees F in approximately 2.5 hours, which is the SFP time-to-boil evaluated at the most critical condition. Before re-establishing SFP cooling, the operator should confirm that the SFP level is above the low level alarm setpoint. Since SFP cooling will be re-established before boiling, the water level in the SFP will not be significantly reduced due to evaporation.

poration losses that accompany
pperating modes are expected to
c category I structure, is designed to
ly and effects of design basis events
cur. Consequently, makeup water
water lost based on the assumed

ife of the plant are not given credit in
ng or dropping accidents between or
se from these accidents that
subsequently cause SFP temperature to rise and finally boiling due to increased spent fuel heat generation rates are precluded from the high boron concentration of the SFP water maintained at 4000 ppm. The most critical condition that could challenge SFP integrity is an SBO event (where there is total loss of cooling functions) during a full core offload and the SFP fully loaded with previously discharged spent fuel. One alternate AC (AAC) power source is promptly activated within 60 minutes from the onset of SBO where one train of SFPCS equipment is reactivated to resume SFP cooling, thus precluding boiling. Furthermore, the SFP water volume allows an approximate 2.5-hour margin prior to an unlikely boiling of SFP water during a total loss of cooling condition or SBO at full core offloads. A thermal-hydralulic analysis (9.1.3.-26) of the SFP has been performed to evaluate the integrity of the SFPCS cooling function

The need for SFP water makeup, therefore, is ultimately based on natural evaporation losses. Since the quantity of water lost from this event is very small compared to the evaporation rate necessary to remove decay heat equivalent to 0.3% of rated thermal power; makeup rates from the different sources discussed hitherto are based on the latter. The calculated rate is approximately 100 gpm and is assumed to be the most limiting.

Redundant seismic category I sources are provided for SFP water makeup. The RWSP, as a primary water source of the SFP, is a seismic category I structure. The RWSP is able

9.1.3.3.5 Natural Phenomena and Missiles

The SFPCS provides protection of essential components against natural phenomena and internal and external missiles.

9.1.3.4 Inspection and Testing Requirements

The SFPCS is hydrostatically tested prior to initial startup. Preoperational testing is described in Chapter 14, Section 14.2. System performance during normal operation is ... peratures, levels, and flows.

The instrumentations are quite important to identify the SFP condition during normal condition and at the SFP cooling function re-establishment, therefore, the instruments such as SFP temperature, SFP water level and flow rate to the SFP heat exchanger are safety-related.

... ping is performed in accordance with the ... sed in Chapter 6, Section 6.6.

Inservice testing of active pumps and valves is performed to assure ... as described in Chapter 3, Subsection 3.9.6.

Sampling of the fuel pit water for gross activity and particulate matt... conducted periodically.

9.1.3.5 Instrumentation Requirements

The instrumentation provided for the SFPCS is discussed in the foll... Alarms and indications are provided as noted.

Two safety-related temperature instruments in SFP water are installed. If the SFP water temperature would be high, the temperature instrument annunciates to MCR and local. Temperature transmitter is provided to monitor the temperature of the water in the SFP and to give an indication, as well as an alarm, in the MCR when normal temperatures are exceeded.

9.1.3.5.1 Temperature

~~Local instrumentation is provided to measure the temperature of the water in the SFP and to give an indication, as well as an alarm, in the MCR when normal temperatures are exceeded.~~ A local alarm is also provided to warn personnel in the fuel handling building of abnormal temperature conditions.

Local instrumentation is provided at the outlet of the SFP heat exchangers to give an indication of the temperature of the SFP water as it leaves the heat exchanger and to monitor the SFP heat exchanger performance.

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.

Two safety-related flow transmitter 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.

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.~~

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. The SFP water level switches annunciates 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.

9.1.4 Light Load Handling System (Related to Refueling)

...chanical and electrical equipment ...rations. This encompasses the fuel ...g of spent fuel into the spent fuel

...R 50, Appendix A, specifically, General Design Criterion: GDC 2, 5, 61, and 62. The GDC are satisfied as follows:

- The LLHS is designed to meet the seismic category and equipment class quality requirements of the US-APWR as specified in Section 3.2.
- The LLHS in the US-APWR is not shared between multiple units.
- This system is designed with the following features:
  - Ability to perform periodic inspections and testing of components important to safety through appropriate configuration of the LLHS and, where necessary, the ability to isolate the equipment from shield waters (i.e. designed to be removed from the water following decontamination for as necessary inspections and testing);
  - Radiation shielding is provided either by the structural features such as concrete walls, floors, and/or barriers of the refueling area of the R/B or by maintaining a minimum coverage of irradiated fuel with water which has an appropriate concentration of boric acid.
- In accordance with ANSI/ANS57.1-1992, Design Requirements For Light Water Reactor Fuel Handling Systems, (Ref. 9.1.7-13) specifically:

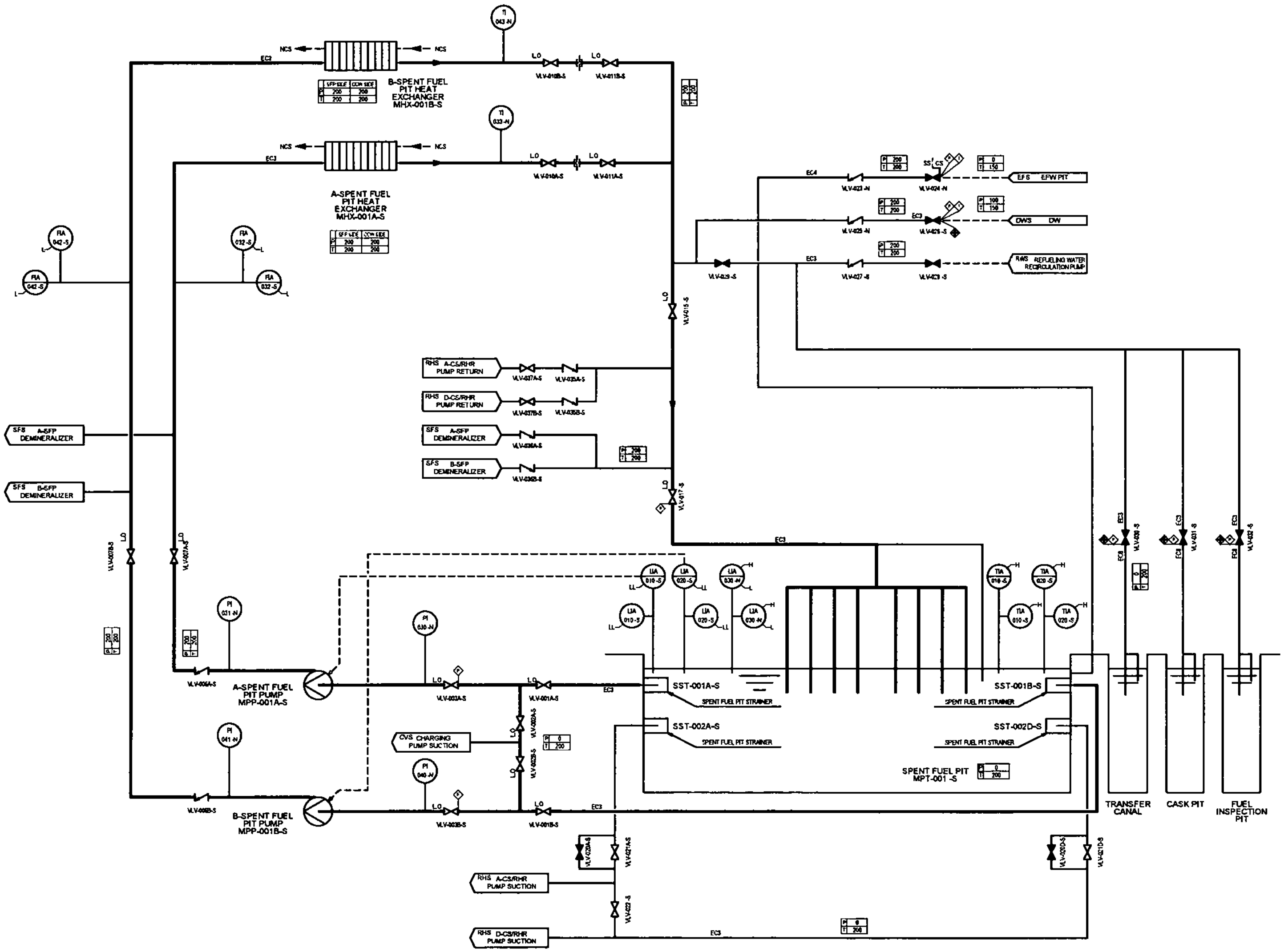

Figure 9.1.3-1 Schematic of Spent Fuel Pit Purification and Cooling System (Cooling Portion)