2.2.5 Fuel Pool Cooling and Purification System

1.0 Description

The fuel pool cooling and purification system (FPCPS) is made up of the following two separate subsystems:

- fuel pool cooling system (FPCS)
- fuel pool purification system (FPPS)

The FPCS is a safety-related system with two divisions. The FPCS provides the safety-related function of removing decay heat from the spent fuel pool.

The FPPS is a non-safety-related system that provides the following safety-related functions:

- Provides containment isolation.
- Provides SFP makeup water.

2.0 Arrangement

2.1 The functional arrangement of the FPCPS is as shown in Figure 2.2.5-1—Fuel Pool Cooling and Purification System Functional Arrangement.

2.2 The location of the FPCPS equipment is as listed in Table 2.2.5-1—FPCPS Equipment Mechanical Design.

2.3 Physical separation exists between divisions of the FPCPS.

3.0 Mechanical Design Features

3.1 Equipment listed in Table 2.2.5-1 as ASME Code Section III is designed and tested in accordance with ASME Code Section III.

3.2 Check valves listed in Table 2.2.5-1 will function as listed in Table 2.2.5-1.

3.3 Piping indicated in Figure 2.2.5-1 as ASME Code Section III is designed, welded, and tested in accordance with ASME Code Section III.

3.4 Equipment identified as Seismic Category I in Table 2.2.5-1 can withstand a design basis seismic load without loss of function as listed in Table 2.2.5-1.

3.5 Supports for piping shown as ASME Section III on Figure 2.2.5-1 will be designed in accordance with ASME Section III.

3.6 Specifications exist for components listed as ASME Section III in Table 2.2.5-1.

3.7 Specifications exist for piping shown as ASME Section III on Figure 2.2.5-1.

3.8 Specifications exist for supports for piping shown as ASME Section III on Figure 2.2.5-1.

4.0 Instrumentation and Controls (I&C) Design Features, Displays, and Controls

4.1 Displays listed in Table 2.2.5-2—FPCPS Equipment I&C and Electrical Design are retrievable in the main control room (MCR) and the remote shutdown station (RSS) as listed in Table 2.2.5-2.

4.2 The FPCPS equipment controls are provided in the MCR and the RSS as listed in Table 2.2.5-2.

4.3 Actuators listed as being controlled by a priority actuation and control system (PACS) module in Table 2.2.5-2 are controlled by a PACS module.

5.0 Electrical Power Design Features

5.1 The components designated as Class 1E in Table 2.2.5-2 are powered from the Class 1E division as listed in Table 2.2.5-2 in a normal or alternate feed condition.

5.2 Valves listed in Table 2.2.5-2 fail as-is on loss of power.

6.0 Environmental Qualifications

6.1 Equipment listed in Table 2.2.5-2 for harsh environment can perform the function in Table 2.2.5-1 following exposure to the design basis environments for the time required.

7.0 Equipment and System Performance

7.1 The fuel pool cooling system heat exchangers listed in Table 2.2.5-1 have the capacity to transfer the design heat load to the component cooling water system.

7.2 The pumps listed in Table 2.2.5-1 have sufficient net positive suction head available (NPSHA).

7.3 Class 1E valves listed in Table 2.2.5-2 can perform the function listed in Table 2.2.5-1 under system design conditions.

7.4 The FPCS provides for flow testing of the FPCS pumps during plant operation.

7.5 Containment isolation valves listed in Table 2.2.5-1 close within the containment isolation response time following initiation of a containment isolation signal.

7.6 The FPCS design provides for maintaining the spent fuel pool water level above the spent fuel.

8.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.2.5-3—FPCPS Inspections, Tests, Analyses, and Acceptance Criteria specifies the inspections, tests, analyses, and acceptance criteria for the FPCPS.

Table 2.2.5-1—FPCPS Equipment Mechanical Design (2 Sheets)

Equipment Description	Equipment Tag Number(1)	Equipment Location	ASME Code Section III	Function	Seismic Category
FPC Division 1 Pump 1	30FAK11 AP001	Fuel Building (UFA)	yes	run	I
FPC Division 1 Pump 2	30FAK12 AP001	Fuel Building (UFA)	yes	run	I
FPC Division 2 Pump 3	30FAK21 AP001	Fuel Building (UFA)	yes	run	I
FPC Division 2 Pump 4	30FAK22 AP001	Fuel Building (UFA)	yes	run	I
FPC Division 1 Heat Exchanger	30FAK10 AC001	Fuel Building (UFA)	yes	heat transfer device	I
FPC Division 2 Heat Exchanger	30FAK20 AC001	Fuel Building (UFA)	yes	heat transfer device	I
FPC Division 1 Isolation Valve	30FAK10 AA001	Fuel Building (UFA)	yes	open	I
FPC Division 2 Isolation Valve	30FAK20 AA001	Fuel Building (UFA)	yes	open	I
FPC Division 1 to Sampling Isolation Valve	30FAK10 AA601	Fuel Building (UFA)	yes	close	I
FPC Division 2 to Sampling Isolation Valve	30FAK20 AA601	Fuel Building (UFA)	yes	close	I
RBP CI Valve (out)	30FAL12 AA002	Fuel Building (UFA)	yes	close (Containment Isolation)	I
RBP CI Valve (out)	30FAL15 AA002	Fuel Building (UFA)	yes	close (Containment Isolation)	I
RBP CI Valve (in)	30FAL12 AA001	Reactor Building (UJA)	yes	close (Containment Isolation)	I
RBP CI Valve (in),	30FAL15 AA003	Reactor Building	yes	close (Containment	I

Table 2.2.5-1—FPCPS Equipment Mechanical Design (2 Sheets)

Equipment Description	Equipment Tag Number(1)	Equipment Location	ASME Code Section III	Function	Seismic Category
(check valve)		(UJA)		Isolation)	
SFP Makeup Pump	30FAL02 AP001	Fuel Building (UFA)	yes	run	I
SFP Makeup Pump	30FAL02 AP002	Fuel Building (UFA)	yes	run	I

1) Equipment tag numbers are provided for information only and are not part of the certified design.

Table 2.2.5-2—FPCPS Equipment I&C and Electrical Design (2 Sheets)

Equipment Description	Equipment Tag Number (1)	Equipment Location	IEEE Class 1E Source (2)	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
FPC Division 1 Pump 1	30FAK11 AP001	Fuel Building (UFA)	Div. 1^N Div. 2^A	N/A	yes	On-Off / N/A	Start-Stop / N/A
FPC Division 1 Pump 2	30FAK12 AP001	Fuel Building (UFA)	Div. 1^N Div. 2^A	N/A	yes	On-Off / N/A	Start-Stop / N/A
FPC Division 2 Pump 3	30FAK21 AP001	Fuel Building (UFA)	Div. 4^N Div. 3^A	N/A	yes	On-Off / N/A	Start-Stop / N/A
FPC Division 2 Pump 4	30FAK22 AP001	Fuel Building (UFA)	Div. 4^N Div. 3^A	N/A	yes	On-Off / N/A	Start-Stop / N/A
FPC Division 1 Isolation Valve	30FAK10 AA001	Fuel Building (UFA)	Div. 1^N Div. 2^A	N/A	yes	Position / N/A	Open-Close/ N/A
FPC Division 2 Isolation Valve	30FAK20 AA001	Fuel Building (UFA)	Div. 4^N Div. 3^A	N/A	yes	Position / N/A	Open-Close/ N/A
FPC Division 1 to Sampling Isolation Valve	30FAK10 AA601	Fuel Building (UFA)	N/A	N/A	N/A	Position / N/A	Open-Close / N/A
FPC Division 2 to Sampling Isolation Valve	30FAK20 AA601	Fuel Building (UFA)	N/A	N/A	N/A	Position / N/A	Open-Close / N/A
RBP CI Valve (out)	30FAL12 AA002	Fuel Building (UFA)	Div. 1^N Div. 2^A	yes	yes	Position / Position	Open-Close / Open-Close
RBP CI Valve (out)	30FAL15 AA002	Fuel Building (UFA)	Div. 1^N Div. 2^A	yes	yes	Position / Position	Open-Close / Open-Close
RBP CI Valve (in)	30FAL12 AA001	Reactor Building (UJA)	Div. 4^N Div. 3^A	yes	yes	Position / Position	Open-Close / Open-Close

Table 2.2.5-2—FPCPS Equipment I&C and Electrical Design (2 Sheets)

Equipment Description	Equipment Tag Number (1)	Equipment Location	IEEE Class 1E Source (2)	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
SFP Makeup Pump	30FAL02 AP001	Fuel Building (UFA)	Div. 1	N/A	yes	On-Off / N/A	Start-Stop / N/A
SFP Makeup Pump	30FAL02 AP002	Fuel Building (UFA)	Div. 4	N/A	yes	On-Off / N/A	Start-Stop / N/A

1) Equipment tag numbers are provided for information only and are not part of the certified design.
2) ^{N} denotes the division the component is normally powered from. ^{A} denotes the division the component is powered from when alternate feed is implemented.

Table 2.2.5-3—FPCPS Inspections, Tests, Analyses, and Acceptance Criteria (5 Sheets)

	Commitment Wording	Inspection, Test, or Analysis	Acceptance Criteria
2.1	The functional arrangement of the FPCPS is as shown on Figure 2.2.5-1.	Inspections of the as-built system as shown on Figure 2.2.5-1 will be conducted.	The as-built FPCPS conforms with the functional arrangement as shown in Figure 2.2.5-1.
2.2	The location of the FPCPS equipment is as listed in Table 2.2.5-1.	An inspection will be performed of the location of the equipment listed in Table 2.2.5-1.	The equipment listed in Table 2.2.5-1 is located as listed in Table 2.2.5-1.
2.3	Physical separation exists between divisions of the FPCPS.	An inspection will be performed to verify that the divisions of the FPCPS are provided adequate physical separation in the Fuel Building.	The divisions of the FPCPS are provided adequate separation in the Fuel Building.
3.1	The components designated as ASME Code Section III in Table 2.2.5-1 are designed to ASME Code Section III requirements.	Inspections will be conducted of ASME design, NDE and hydrostatic test reports for the components listed as ASME Code Section III in Table 2.2.5-1.	The components listed as ASME Code Section III in Table 2.2.5-1 have been designed and hydrostatically tested in accordance with ASME Code Section III requirements.
3.2	Check valves listed in Table 2.2.5-1 will function as listed in Table 2.2.5-1.	Tests will be performed for the operation of the check valves listed in Table 2.2.5-1.	The check valves listed in Table 2.2.5-1 perform the functions listed in Table 2.2.5-1.
3.3a	The piping identified as being within the ASME Code Section III boundary as indicated in Figure 2.2.5-1 has been designed in accordance with ASME Code Section III requirements including seismic loads.	Analysis of the as-designed piping will be performed in accordance with ASME Code Section III requirements for the piping indicated in Figure 2.2.5-1.	The as-designed piping identified as ASME Code Section III in Figure 2.2.5-1 meets ASME Code Section III design requirements.

Table 2.2.5-3—FPCPS Inspections, Tests, Analyses, and Acceptance Criteria (5 Sheets)

	Commitment Wording	Inspection, Test, or Analysis	Acceptance Criteria
3.3b	The piping identified as being within the ASME Code Section III boundary as indicated in Figure 2.2.5-1 has been welded and hydrostatically tested in accordance with ASME Code Section III.	Inspections will be conducted of the as-built piping as indicated in Figure 2.2.5-1 for the following: 1) Welding has been performed per ASME Code Section III. 2) Hydrostatic testing per ASME Code Section III was performed.	1) The piping as indicated in Figure 2.2.5-1 as ASME Code Section III has been welded in accordance with ASME Code Section III welding requirements. 2) The piping as indicated in Figure 2.2.5-1 as ASME Code Section III has been hydrostatically tested in accordance with ASME Code Section III requirements.
3.4	Equipment identified as Seismic Category I in Table 2.2.5-1 can withstand a design basis seismic load without loss of function as listed in Table 2.2.5-1.	a. Inspection will be performed of the equipment identified as Seismic Category I in Table 2.2.5-1. b. Type tests, tests, analyses, or a combination of tests and analyses will be performed on the equipment designated as Seismic Category I in Table 2.2.5-1.	a. The equipment designated as Seismic Category I in Table 2.2.5-1 is installed as designed. b. The equipment designated as Seismic Category I in Table 2.2.5-1 can with stand a design basis seismic load without loss of function.
3.5	Supports for piping shown as ASME Section III on Figure 2.2.5-1 will be designed per ASME Section III.	An analysis will be performed.	a. Supports for piping shown as ASME Section III on Figure 2.2.5-1 are designed to ASME Section III. b. Snubbers have been identified, including those analyzed for fatigue for piping shown as ASME Section III on Figure 2.2.5-1. c. Support mass is less than ten percent of the adjacent pipe span for piping shown as ASME Section III on Figure 2.2.5-1.

Table 2.2.5-3—FPCPS Inspections, Tests, Analyses, and Acceptance Criteria (5 Sheets)

	Commitment Wording	Inspection, Test, or Analysis	Acceptance Criteria
3.6	Specifications exist for components listed as ASME Section III in Table 2.2.5-1.	An inspection will be performed.	Specifications exist for components listed as ASME Section III in Table 2.2.5-1.
3.7	Specifications exist for piping shown as ASME Section III on Figure 2.2.5-1.	An inspection will be performed.	Specifications exist for piping identified as ASME Section III on Figure 2.2.5-1.
3.8	Specifications exist for supports for piping shown as ASME Section III on Figure 2.2.5-1.	An inspection will be performed.	Specifications exist for supports for piping shown as ASME Section III on Figure 2.2.5-1.
4.1	Displays exist or can be retrieved in the MCR and the RSS as identified in Table 2.2.5-2.	Inspections will be performed for the existence or retrieveability of the displays in the MCR and the RSS as listed in Table 2.2.5-2.	a. The displays listed in Table 2.2.5-2 as being retrieved in the MCR can be retrieved in the MCR. b. The displays listed in Table 2.2.5-2 as being retrieved in the RSS can be retrieved in the RSS.
4.2	Controls exist in the MCR and the RSS as identified in Table 2.2.5-2.	Tests will be performed for the existence of control signals from the MCR and the RSS to the equipment listed in Table 2.2.5-2.	a. The controls listed in Table 2.2.5-2 as being in the MCR exist in the MCR. b. The controls listed in Table 2.2.5-2 as being in the RSS exist in the RSS.
4.3	Actuators listed as being controlled by a PACS module in Table 2.2.5-2 are controlled by a PACS module.	An operational test will be performed using test signals for the actuators being controlled by a PACS module as listed in Table 2.2.5-2. An inspection will be performed on the actuation of the actuator.	The actuators listed as being controlled by a PACS module in Table 2.2.5-2 actuate to the state requested by the signal.

Table 2.2.5-3—FPCPS Inspections, Tests, Analyses, and Acceptance Criteria (5 Sheets)

	Commitment Wording	Inspection, Test, or Analysis	Acceptance Criteria
5.1	The components designated as Class 1E in Table 2.2.5-2 are powered from the Class 1E division as listed in Table 2.2.5-2 in a normal or alternate feed condition.	a. Testing will be performed for components designated as Class 1E in Table 2.2.5-2 by providing a test signal in each normally aligned division. b. Testing will be performed for components designated as Class 1E in Table 2.2.5-2 by providing a test signal in each division with the alternate feed aligned to the divisional pair.	a. The test signal provided in the normally aligned division is present at the respective Class 1E component identified in Table 2.2.5-2. b. The test signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E component identified in Table 2.2.5-2.
5.2	Valves listed in Table 2.2.5-2 fail as-is on loss of power.	Testing will be performed for the valves listed in Table 2.2.5-2 to fail as-is on loss of power.	Following loss of power, the valves listed in Table 2.2.5-2 fail as-is.
6.1	Components listed as Class 1E in Table 2.2.5-2 that are designated as harsh environment will perform the function listed in Table 2.2.5-1 in the environments that exist before and during the time required to perform their function.	a. Type tests, tests, analyses, or a combination of tests and analyses will be performed to demonstrate the ability of the equipment listed for harsh environment in Table 2.2.5-2 to perform the function listed in Table 2.2.5-1 for the environmental conditions that could occur before and during a design basis accident. b. For equipment listed for harsh environment in Table 2.2.5-2, an inspection will be performed of the as-installed Class 1E equipment and the associated wiring, cables and terminations.	a. The Class 1E equipment listed for harsh environment in Table 2.2.5-2 can perform the function listed in Table 2.2.5-1 before and during design basis accidents for the time required to perform the listed function. b. Inspection concludes the as-installed Class 1E equipment and associated wiring, cables, and terminations as listed in Table 2.2.5-2 for harsh environment conform with the design.
7.1	The fuel pool cooling system heat exchangers listed in Table 2.2.5-1 have the capacity to transfer the design heat load to the component cooling water system.	Tests and analyses will be performed to demonstrate the capability of the fuel pool cooling system heat exchangers as listed in Table 2.2.5-1 to transfer the heat load to the component cooling water system.	One fuel pool cooling system train has the capacity to remove the design heat load of 14 MW and maintain the SFP temperature below 140°F via the heat exchangers listed in Table 2.2.5-1.

Table 2.2.5-3—FPCPS Inspections, Tests, Analyses, and Acceptance Criteria (5 Sheets)

	Commitment Wording	Inspection, Test, or Analysis	Acceptance Criteria
7.2	The pumps listed in Table 2.2 5-1 have sufficient NPSHA.	Testing and analyses will be performed to verify adequate NPSHA for pumps listed in Table 2.2.5-1.	The pumps listed in Table 2.2.5-1 have sufficient NPSHA.
7.3	Class 1E valves listed in Table 2.2.5-2 perform the function listed in Table 2.2.5-1 under system design conditions.	Tests and analyses or a combination of tests and analyses will be performed to demonstrate the ability of the valves listed in Table 2.2.5-2 to change position as listed in Table 2.2.5-1 under system design conditions.	The as-installed valves change position as listed in Table 2.2.5-1 under system design conditions.
7.4	The fuel pool cooling system has provisions to allow flow testing of the fuel pool cooling system pumps during plant operation.	Testing for flow of the fuel pool cooling system pumps to the spent fuel pool will be performed.	The normal flow return line allows fuel pool cooling system pump flow to the spent fuel pool.
7.5	Containment isolation valves listed in Table 2.2.5-1 close within the containment isolation response time following initiation of a containment isolation signal.	Tests will be performed to demonstrate the ability of the containment isolation valves listed in Table 2.2.5-1 to close within the containment isolation response time following initiation of a containment isolation signal.	The containment isolation valves listed in Table 2.2.5-1 close within the required times following initiation of a containment isolation signal: 30 FAL12 AA001, 30FAL12 AA002, and 30FAL15 AA002 - a maximum 30 second closure time.
7.6	The fuel pool cooling system design provides for maintaining the spent fuel pool water level above the spent fuel.	Inspection and testing will be performed to demonstrate the spent fuel pool water level is maintained above the spent fuel.	The spent fuel pool water level is maintained greater than or equal to 23 feet above the spent fuel.