2.2.5 Fuel Pool Cooling and Purification System

Design Description

1.0 System 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 (SFP).

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

- Provides SFP makeup water.

2.0 Arrangement

2.1 The functional arrangement of the FPCPS is as described in the Design Description of Section 2.2.5, Tables 2.2.5-1— FPCPS Equipment Mechanical Design and 2.2.5-2— FPCPS Equipment I&C and Electrical Design, and as shown on Figure 2.2.5-1—Fuel Pool Cooling and Purification System Functional Arrangement.

2.2 Deleted.

2.3 Physical separation exists between divisions of the FPCS located in the Fuel Building as shown on Figure 2.2.5-1.

3.0 Mechanical Design Features

3.1 Pumps and valves listed in Table 2.2.5-1 will be functionally designed and qualified such that each pump and valve is capable of performing its intended function under the full range of fluid flow, differential pressure, electrical conditions, and temperature conditions up to and including design basis accident conditions.

3.2 Check valves listed in Table 2.2.5-1 will function to change position as listed in Table 2.2.5-1 under normal operating conditions.

3.3 Deleted.

3.4 Equipment identified as Seismic Category I in Table 2.2.5-1 can withstand seismic design basis loads without a loss of safety function(s).

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3.14 ASME Code Class 2 and 3 piping systems are designed in accordance with ASME Code Section III requirements.

3.15 As-built ASME Code Class 2 and 3 components listed in Table 2.2.5-1 are reconciled with the design requirements.

3.16 Pressure-boundary welds in ASME Code Class 2 and 3 components listed in Table 2.2.5-1 meet ASME Code Section III non-destructive examination requirements.

3.17 ASME Code Class 2 and 3 components listed in Table 2.2.5-1 retain their pressure-boundary integrity at their design pressure.

3.18 ASME Code Class 2 and 3 components listed in Table 2.2.5-1 are fabricated, installed, and inspected in accordance with ASME Code Section III requirements.

4.0 I&C Design Features, Displays, and Controls

4.1 Displays listed in Table 2.2.5-2 are indicated on the PICS operator workstations in the main control room (MCR) and the remote shutdown station (RSS).

4.2 Controls on the PICS operator workstations in the MCR and the RSS perform the function listed in Table 2.2.5-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.2.5-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.

5.0 Electrical Power Design Features

5.1 Equipment 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 Deleted.

6.0 Environmental Qualifications

6.1 Equipment designated as harsh environment in Table 2.2.5-2 can perform the function listed in Table 2.2.5-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.

7.0 Equipment and System Performance

7.1 Each FPCS heat exchanger listed in Table 2.2.5-1 has the capacity to transfer the design heat load to the component cooling water system (CCWS).

7.2 The pumps listed in Table 2.2.5-1 have net positive suction head available (NPSHA) that is greater than net positive suction head required (NPSHR) at system run-out flow.

7.3 Class 1E valves listed in Table 2.2.5-2 will function to change position as listed in Table 2.2.5-1 under normal operating conditions.

7.4 The pumps listed in Table 2.2.5-1 each have the capacity to provide flow to the FPCS heat exchangers.

7.5 Deleted.

7.6 Deleted.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.2.5-3 lists the FPCPS ITAAC.

Table 2.2.5-1—FPCPS Equipment Mechanical Design

Description	Tag Number(1)	Location	ASME Code Section III	Function	Seismic Category
FPC Division 1 Pump 1	30FAK11AP001	Fuel Building	Yes	Run	I
FPC Division 1 Pump 2	30FAK12AP001	Fuel Building	Yes	Run	I
FPC Division 2 Pump 3	30FAK21AP001	Fuel Building	Yes	Run	I
FPC Division 2 Pump 4	30FAK22AP001	Fuel Building	Yes	Run	I
FPC Division 1 Heat Exchanger	30FAK10AC001	Fuel Building	Yes	Heat Transfer Device	I
FPC Division 2 Heat Exchanger	30FAK20AC001	Fuel Building	Yes	Heat Transfer Device	I
FPC Division 1 Isolation Valve	30FAK10AA001	Fuel Building	Yes	Open-Close	I
FPC Division 2 Isolation Valve	30FAK20AA001	Fuel Building	Yes	Open-Close	I
FPC Division 1 to Sampling Isolation Valve	30FAK10AA601	Fuel Building	Yes	Close	I
FPC Division 2 to Sampling Isolation Valve	30FAK20AA601	Fuel Building	Yes	Close	I
RBP Containment Isolation Valve (outside)	30FAL12AA002	Fuel Building	Yes	Close	I
RBP Containment Isolation Valve (outside)	30FAL15AA002	Fuel Building	Yes	Close	I
RBP Containment Isolation Valve (inside)	30FAL12AA001	Reactor Building	Yes	Close	I
RBP Containment Isolation Check Valve (inside)	30FAL15AA003	Reactor Building	Yes	Close	I
SFP Makeup Pump	30FAL02AP001	Fuel Building	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
Sheet 1 of 2

Description	Tag Number(1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
FPC Division 1 Pump 1	30FAK11AP001	Fuel Building	1^{N} / 2^{A}	N/A	Yes	On-Off / On-Off	Start-Stop / Start-Stop
FPC Division 1 Pump 2	30FAK12AP001	Fuel Building	1^{N} / 2^{A}	N/A	Yes	On-Off / On-Off	Start-Stop / Start-Stop
FPC Division 2 Pump 3	30FAK21AP001	Fuel Building	4^{N} / 3^{A}	N/A	Yes	On-Off / On-Off	Start-Stop / Start-Stop
FPC Division 2 Pump 4	30FAK22AP001	Fuel Building	4^{N} / 3^{A}	N/A	Yes	On-Off / On-Off	Start-Stop / Start-Stop
FPC Division 1 Isolation Valve	30FAK10AA001	Fuel Building	1^{N} / 2^{A}	N/A	Yes	Position / Position	Start-Stop / Start-Stop
FPC Division 2 Isolation Valve	30FAK20AA001	Fuel Building	4^{N} / 3^{A}	N/A	Yes	Position / Position	Start-Stop / Start-Stop
FPC Division 1 to Sampling Isolation Valve	30FAK10AA601	Fuel Building	N/A	N/A	N/A	Position / Position	Open-Close / Open-Close
FPC Division 2 to Sampling Isolation Valve	30FAK20AA601	Fuel Building	N/A	N/A	N/A	Position / Position	Open-Close / Open-Close
RBP CI Valve (outside)	30FAL12AA002	Fuel Building	1^{N} / 2^{A}	Yes	Yes	Position / Position	Open-Close / Open-Close
RBP CI Valve (outside)	30FAL15AA002	Fuel Building	1^{N} / 2^{A}	Yes	Yes	Position / Position	Open-Close / Open-Close
RBP CI Valve (inside)	30FAL12AA001	Reactor Building	4^{N} / 3^{A}	Yes	Yes	Position / Position	Open-Close / Open-Close
SFP Makeup Pump	30FAL02AP001	Fuel Building	1	N/A	Yes	On-Off / On-Off	Start-Stop / Start-Stop

Table 2.2.5-2—FPCPS Equipment I&C and Electrical Design
Sheet 2 of 2

Description	Tag Number(1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
SFP WR Level Sensor	30FAK31CL003	Fuel Building	1^{N} / 2^{A}	Note 3	N/A	Level / Level	NA / N/A
SFP WR Level Sensor	30FAK31CL004	Fuel Building	4^{N} / 3^{A}	Note 3	N/A	Level / Level	NA / N/A
SFP WR Level Sensor	30FAK31CL005	Fuel Building	1^{N} / 2^{A}	Note 3	N/A	Level / Level	N/A / N/A
SFP WR Level Sensor	30FAK31CL006	Fuel Building	4^{N} / 3^{A}	Note 3	N/A	Level / Level	N/A / 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 equipment is normally powered from; ^{A} denotes the division the equipment is powered from when alternate feed is implemented.

3. The SFP WR level sensors will be qualified to operate for a minimum of seven days under the following conditions:

   – Radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with the SFP water where fuel remains covered.

   – Temperature of 212 degrees F and 100% relative humidity.

   – Boiling water and/or steam environment.

   – Concentrated borated water environment.

Table 2.2.5-3—Fuel Pool Cooling and Purification System ITAAC
Sheet 1 of 7

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The functional arrangement of the FPCPS is as described in the Design Description of Section 2.2.5, Tables 2.2.5-1 and 2.2.5-2, and as shown on Figure 2.2.5-1.	An inspection of the as-built FPCPS functional arrangement will be performed.	The FPCPS conforms to the functional arrangement as described in the Design Description of Section 2.2.5, Tables 2.2.5-1 and 2.2.5-2, and as shown on Figure 2.2.5-1.
2.2	Deleted.	Deleted.	Deleted.
2.3	Physical separation exists between divisions of the FPCS located in the Fuel Building as shown on Figure 2.2.5-1.	An inspection will be performed to verify that the as-built divisions of the FPCS are physically separated in the Fuel Building.	The divisions of the FPCS are physically separated by a wall in the Fuel Building as shown on Figure 2.2.5-1.
3.1	Pumps and valves listed in Table 2.2.5-1 will be functionally designed and qualified such that each pump and valve is capable of performing its intended function under the full range of fluid flow, differential pressure, electrical conditions, and temperature conditions up to and including design basis accident conditions.	Tests or type tests of pumps and valves will be performed to demonstrate that the pumps and valves function under the full range of fluid flow, differential pressure, electrical conditions, and temperature conditions up to and including design basis accident conditions.	A report concludes that the pumps and valves listed in Table 2.2.5-1 are capable of performing their intended function under the full range of fluid flow, differential pressure, electrical conditions, and temperature conditions up to and including design basis accident conditions.
3.2	Check valves listed in Table 2.2.5-1 will function to change position as listed in Table 2.2.5-1 under normal operating conditions.	Tests will be performed to verify the ability of check valves to change position under normal operating conditions.	The check valves change position as listed in Table 2.2.5-1 under normal operating conditions.
3.3	Deleted.	Deleted.	Deleted.

Table 2.2.5-3—Fuel Pool Cooling and Purification System ITAAC
Sheet 2 of 7

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.4	Equipment identified as Seismic Category I in Table 2.2.5-1 can withstand seismic design basis loads without a loss of safety function(s).	a. Type tests, analyses, or a combination of type tests and analyses will be performed on the equipment identified as Seismic Category I in Table 2.2.5-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements. b. An inspection will be performed of the as-built equipment identified as Seismic Category I in Table 2.2.5-1 to verify that the equipment, including in a condition bounded by the tested or analyzed condition.	a. Test/analysis reports conclude that the equipment identified as Seismic Category I in Table 2.2.5-1 can withstand seismic design basis loads without a loss of safety function(s). b. Inspection reports conclude that the equipment identified as Seismic Category I in Table 2.2.5-1, including anchorage, are installed in a condition bounded by the tested or analyzed condition.
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3.9	Deleted.	Deleted.	Deleted.
3.10	Deleted.	Deleted.	Deleted.
3.11	Deleted.	Deleted.	Deleted.
3.12	Deleted.	Deleted.	Deleted.
3.13	Deleted.	Deleted.	Deleted.
3.14	ASME Code Class 2 and 3 piping systems are designed in accordance with ASME Code Section III requirements.	An inspection of piping design and analysis documentation required by ASME Code Section III will be performed. {{DAC}}	ASME Code Section III Design Report(s) exist that meet the requirements of NCA-3550 and conclude that the design of ASME Code Class 2 and 3 piping systems complies with the requirements of ASME Code Section III. {{DAC}}

Table 2.2.5-3—Fuel Pool Cooling and Purification System ITAAC
Sheet 3 of 7

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.15	As-built ASME Code Class 2 and 3 components listed in Table 2.2.5-1 are reconciled with the design requirements.	A reconciliation analysis of ASME Code Class 2 and 3 components will be performed.	ASME Code Design Report(s) exist that meet the requirements of NCA-3550, conclude that the design reconciliation has been completed for as-built ASME Code Class 2 and 3 components listed in Table 2.2.5-1, and document that the results of the reconciliation analysis comply with the requirements of ASME Code Section III.
3.16	Pressure-boundary welds in ASME Code Class 2 and 3 components listed in Table 2.2.5-1 meet ASME Code Section III non-destructive examination requirements.	An inspection of the as-built pressure-boundary welds in ASME Code Class 2 and 3 components will be performed.	ASME Code reports(s) exist that conclude that ASME Code Section III requirements are met for non-destructive examination of pressure-boundary welds in ASME Code Class 2 and 3 components listed in Table 2.2.5-1.
3.17	ASME Code Class 2 and 3 components listed in Table 2.2.5-1 retain their pressure-boundary integrity at their design pressure.	A hydrostatic test will be conducted on ASME Code Class 2 and 3 components that are required to be hydrostatically tested by ASME Code Section III.	ASME Code Data Report(s) exist and conclude that the results of the hydrostatic test of ASME Code Class 2 and 3 components listed in Table 2.2.5-1 comply with the requirements of ASME Code Section III.
3.18	ASME Code Class 2 and 3 components listed in Table 2.2.5-1 are fabricated, installed, and inspected in accordance with ASME Code Section III requirements.	An inspection of the as-built construction activities and documentation for ASME Code Class 2 and 3 components will be conducted.	ASME Code Data Report(s) exist that conclude that ASME Code Class 2 and 3 components listed in Table 2.2.5-1 are fabricated, installed, and inspected in accordance with ASME Code Section III requirements.

Table 2.2.5-3—Fuel Pool Cooling and Purification System ITAAC
Sheet 4 of 7

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.1	Displays listed in Table 2.2.5-2 are indicated on the PICS operator workstations in the MCR and the RSS.	a. Tests will be performed to verify that the displays listed in Table 2.2.5-2 are indicated on the PICS operator workstations in the MCR. b. Tests will be performed to verify that the displays listed in Table 2.2.5-2 are indicated on the PICS operator workstations in the RSS.	a. Displays listed in Table 2.2.5-2 are indicated on the PICS operator workstations in the MCR. b. Displays listed in Table 2.2.5-2 are indicated on the PICS operator workstations in the RSS.
4.2	Controls on the PICS operator workstations in the MCR and the RSS perform the function listed in Table 2.2.5-2.	a. Tests will be performed using controls on the PICS operator workstations in the MCR. b. Tests will be performed using controls on the PICS operator workstations in the RSS.	a. Controls on the PICS operator workstations in the MCR perform the function listed in Table 2.2.5-2. b. Controls on the PICS operator workstations in the RSS perform the function listed in Table 2.2.5-2.
4.3	Equipment listed as being controlled by a PACS module in Table 2.2.5-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.	A test will be performed using test input signals to verify equipment controlled by a PACS module responds to the state requested and provides drive monitoring signals back to the PACS module.	Equipment listed as being controlled by a PACS module in Table 2.2.5-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.

Table 2.2.5-3—Fuel Pool Cooling and Purification System ITAAC
Sheet 5 of 7

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
5.1	Equipment 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 by providing a test input signal in each normally aligned division.	a. The test input signal provided in the normally aligned division is present at the respective Class 1E equipment identified in Table 2.2.5-2.
		b. Testing will be performed by providing a test input signal in each division with the alternate feed aligned to the divisional pair.	b. The test input signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E equipment identified in Table 2.2.5-2.
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Table 2.2.5-3—Fuel Pool Cooling and Purification System ITAAC
Sheet 6 of 7

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
6.1	Equipment designated as harsh environment in Table 2.2.5-2 can perform the function listed in Table 2.2.5-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.	a. Type tests or type tests and analysis will be performed to demonstrate the ability of the equipment designated as harsh environment in Table 2.2.5-2 to perform the function listed in Table 2.2.5-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. b. An inspection will be performed of the as-built equipment designated as harsh environment in Table 2.2.5-2 to verify that the equipment, including the associated cables, wiring, and terminations located in a harsh environment, are bounded by the type test or combination of type tests and analyses.	a. EQDPs conclude that the equipment designated as harsh environment in Table 2.2.5-2 can perform the function listed in Table 2.2.5-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions, including the time required to perform the listed function. b. A report exists and concludes that the equipment designated as harsh environment in Table 2.2.5-2, including the associated cables, wiring, and terminations located in a harsh environment, are bounded by the type test or combination of type tests and analyses.
7.1	Each FPCS heat exchanger listed in Table 2.2.5-1 has the capacity to transfer the design heat load to the CCWS.	Tests and analyses will be performed to verify the capability of the FPCS heat exchangers to transfer the design heat load to the CCWS.	Each FPCS heat exchanger listed in Table 2.2.5-1 has the capacity to transfer a heat load of greater than or equal to 19.8 MW to the CCWS and maintain the SFP temperature below 140°F via one heat exchanger.
7.2	The pumps listed in Table 2.2.5-1 have NPSHA that is greater than NPSHR at system run-out flow.	Tests and analyses will be performed to verify pump NPSHA is greater than NPSHR at system run-out flow.	The pumps listed in Table 2.2.5-1 have NPSHA that is greater than NPSHR at system run-out flow.

Table 2.2.5-3—Fuel Pool Cooling and Purification System ITAAC
Sheet 7 of 7

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
7.3	Class 1E valves listed in Table 2.2.5-2 will function to change position as listed in Table 2.2.5-1 under normal operating conditions.	Tests will be performed to verify the ability of Class 1E valves to change position under normal operating conditions.	Class 1E valves listed in Table 2.2.5-2 change position as listed in Table 2.2.5-1 under normal operating conditions.
7.4	The pumps listed in Table 2.2.5-1 each have the capacity to provide flow to the FPCS heat exchangers.	Tests will be performed to verify the FPCS flowrate to the FPCS heat exchangers.	Each train of the FPCS delivers a minimum flow of 3576 gpm to the FPCS heat exchanger with one pump in operation.
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7.6	Deleted.	Deleted.	Deleted.

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