2.7.5 Fire Water Distribution System

1.0 Description

The fire water distribution system (FWDS) is non-safety related, except for the FWDS containment isolation valves and associated piping which are safety-related. The FWDS is comprised of the following fire water distribution subsystems:

- The FWDS conventional area, which consists of the fire water storage tanks, fire pumps, pump structure, and underground fire main loop.
- The FWDS inside Nuclear Island consists of supply headers and the standpipe and hose system.

The FWDS provides the following safety-related functions:

- The FWDS provides the safety-related function of providing containment isolation of the Reactor Building (RB).

The FWDS provides the following non-safety-related functions:

- The FWDS inside Nuclear Island is an alternate source of makeup water for the spent fuel spray system during a severe accident event.
- The FWDS inside Nuclear Island is an alternate source of makeup water for component cooling water system (CCWS) post seismic event.

2.0 Arrangement

2.1 The location of safety-related FWDS equipment is as listed in Table 2.7.5-1—Fire Water Distribution System Equipment Mechanical Design.

3.0 Mechanical Design Features

3.1 Valves listed in Table 2.7.5-1 will be functionally designed and qualified such that each valve is capable of performing its intended function for a full range of system differential pressure and flow, ambient temperatures, and available voltage (as applicable) under conditions ranging from normal operating to design-basis accident conditions.

3.2 Components identified as Seismic Category I in Table 2.7.5-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.7.5-1.

3.3 Components listed in Table 2.7.5-1 as ASME Code Section III are designed in accordance with ASME Code Section III requirements.

3.4 Components listed in Table 2.7.5-1 as ASME Code Section III are fabricated in accordance with ASME Code Section III requirements.

3.5 Pressure boundary welds on components listed in Table 2.7.5-1 as ASME Code Section III are in accordance with ASME Code Section III requirements.

3.6 Components listed in Table 2.7.5-1 as ASME Code Section III retain their pressure boundary integrity at their design pressure.

3.7 Components listed in Table 2.7.5-1 as ASME Code Section III are installed in accordance with ASME Code Section III requirements.

4.0 I&C Design Features, Displays and Controls

4.1 Displays listed in Table 2.7.5-2—Fire Water Distribution System Equipment I&C and Electrical Design are retrievable in the main control room (MCR) and the remote shutdown station (RSS) as listed in Table 2.7.5-2.

4.2 The FWDS equipment controls are provided in the MCR and the RSS as listed in Table 2.7.5-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.7.5-2 responds to the state requested by a test signal.

4.4 The as-built fire water distribution system is consistent with the post-fire safe shutdown analysis.

5.0 Electrical Power Design Features

5.1 The components designated as Class 1E in Table 2.7.5-2 are powered from the Class 1E division as listed in Table 2.7.5-2 in a normal or alternate feed condition.

5.2 Valves listed in Table 2.7.5-2 fail as-is on loss of power.

6.0 Environmental Qualifications

6.1 Components in Table 2.7.5-2, that are designated as harsh environment, will perform the function listed in Table 2.7.5-1 in the environments that exist during and following design basis events.

7.0 Equipment and System Performance

7.1 The FWDS includes two separate fresh water storage tanks.

7.2 The FWDS pumps consist of at least one electric motor-driven pump and one diesel engine-driven pump.

7.3 FWDS pumps have net positive suction head available (NPSHA) that is greater than net positive suction head required (NPSHR) at system run-out flow.

7.4 Class 1E valves listed in Table 2.7.5-2 can perform the function listed in Table 2.7.5-1 under system operating conditions.

7.5 The FWDS provides for flow testing of FWDS pumps during plant operation.

7.6 Containment isolation valves listed in Table 2.7.5-1 close within the containment isolation response time following initiation of a containment isolation signal.

7.7 The standpipe and hose systems in areas containing systems and components required for safe plant shutdown in the event of a safe shutdown earthquake (SSE), including the water supply to these standpipes, are capable of remaining functional and supplying two hose stations following an SSE.

8.0 Interface Requirements

8.1 The raw water supply system (RWSS) delivers makeup water to the FWDS fire water storage tanks.

9.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.7.5-3 lists the FWDS ITAAC.

Table 2.7.5-1—Fire Water Distribution System Equipment Mechanical Design

Description	Tag Number (1)	Location	ASME Code Section III	Function	Seismic Category
Fire Water Distribution System CI Valve	30SGB30AA031	Fuel Building	Yes	Close	I
Fire Water Distribution System CI Valve	30SGB30AA032	Reactor Building	Yes	Close	I

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

Table 2.7.5-2—Fire Water Distribution System Equipment I&C and Electrical Design

Description	Tag Number (1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
Fire Water Distribution System CI Valve	30SGB30AA031	FB	Division 4^{N} Division 3^{A}	No	Yes	Pos/N/A	Open-Close/ N/A
Fire Water Distribution System CI Valve	30SGB30AA032	RB	Division 1^{N} Division 2^{A}	Yes	Yes	Pos/N/A	Open-Close/ 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 2.7.5-3—Fire Water Distribution System ITAAC
(5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The location of the safety-related FWDS equipment is as listed in Table 2.7.5-1.	An inspection will be performed of the location of the equipment listed in Table 2.7.5-1.	The equipment listed in Table 2.7.5-1 is located as listed in Table 2.7.5-1.
3.1	Valves listed in Table 2.7.5-1 will be functionally designed and qualified such that each valve is capable of performing its intended function for a full range of system differential pressure and flow, ambient temperatures, and available voltage (as applicable) under conditions ranging from normal operating to design-basis accident conditions.	Tests or type tests of the valves listed in Table 2.7.5-1 will be conducted to demonstrate that the pumps and valves function under conditions ranging from normal operating to design-basis accident conditions.	A test report exists and concludes that the valves listed in Table 2.7.5-1 function under conditions ranging from normal operating to design-basis accident conditions.
3.2	Components identified as Seismic Category I in Table 2.7.5-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.7.5-1.	a. Type tests, analyses, or a combination of type tests and analyses will be performed on the components identified as Seismic Category I in Table 2.7.5-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements. b. Inspections will be performed of the Seismic Category I components identified in Table 2.7.5-1 to verify that the components, including anchorage, are installed as specified on the construction drawings and deviations have been reconciled to the seismic qualification reports (SQDP, EQDP, or analyses).	a. Seismic qualification reports (SQDP, EQDP, or analyses) exist and conclude that the Seismic Category I components identified in Table 2.7.5-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.7.5-1 including the time required to perform the listed function. b. Inspection reports exist and conclude that the Seismic Category I components identified in Table 2.7.5-1, including anchorage, are installed as specified on the construction drawings and deviations have been reconciled to the seismic qualification reports (SQDP, EQDP, or analyses).

Table 2.7.5-3—Fire Water Distribution System ITAAC
(5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.3	Components listed in Table 2.7.5-1 as ASME Code Section III are designed in accordance with ASME Code Section III requirements.	Inspections of ASME Code Section III Design Reports and associated reference documents will be performed.	ASME Code Section III Design Reports (NCA-3550) exist and conclude that components listed as ASME Code Section III in Table 2.7.5-1 comply with ASME Code Section III requirements.
3.4	Components listed in Table 2.7.5-1 as ASME Code Section III are fabricated in accordance with ASME Code Section III requirements.	An analysis will be performed to verify that deviations to the component design reports (NCA-3550) have been reconciled.	ASME Code Section III Design Reports (NCA-3550) exist and conclude that components listed as ASME Code Section III in Table 2.7.5-1 comply with ASME Code Section III requirements and any deviations to the design report have been reconciled.
3.5	Pressure boundary welds on components listed in Table 2.7.5-1 as ASME Code Section III are in accordance with ASME Code Section III requirements.	Inspections of pressure boundary welds will be performed to verify that welding is performed in accordance with ASME Code Section III requirements.	For components listed as ASME Code Section III in Table 2.7.5-1, ASME Code Section III Data Reports (NCA-8000) exist and conclude that pressure boundary welding has been performed in accordance with ASME Code Section III.
3.6	Components listed in Table 2.7.5-1 as ASME Code Section III retain their pressure boundary integrity at their design pressure.	Hydrostatic tests will be performed on the components.	For components listed as ASME Code Section III in Table 2.7.5-1, ASME Code Section III Data Reports exist and conclude that hydrostatic test results comply with ASME Code Section III requirements.
3.7	Components listed in Table 2.7.5-1 as ASME Code Section III are installed in accordance with ASME Code Section III requirements.	An inspection of ASME Code Data Reports will be performed.	ASME Code Section III N-5 Data Reports exist and conclude that components listed as ASME Code Section III in Table 2.7.5-1 have been installed in accordance with ASME Code Section III requirements.

Table 2.7.5-3—Fire Water Distribution System ITAAC
(5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.1	Displays listed in Table 2.7.5-2 are retrievable in the MCR and the RSS as listed in Table 2.7.5-2.	Tests will be performed for the retrievability of the displays in the MCR or the RSS as listed in Table 2.7.5-2.	a. The displays listed in Table 2.7.5-2 as being retrieved in the MCR can be retrieved in the MCR. b. The displays listed in Table 2.7.5-2 as being retrieved in the RSS can be retrieved in the RSS.
4.2	The FWDS equipment controls are provided in the MCR and the RSS as listed in Table 2.7.5-2.	Tests will be performed on control signals from the MCR and the RSS to the equipment listed in Table 2.7.5-2.	a. The controls listed in Table 2.7.5-2 as being in the MCR exist in the MCR. b. The controls listed in Table 2.7.5-2 as being in the RSS exist in the RSS.
4.3	Equipment listed as being controlled by a PACS module in Table 2.7.5-2 responds to the state requested by a test signal.	A test will be performed using test signals.	Equipment listed as being controlled by a PACS module in Table 2.7.5-2 responds to the state requested by the test signal.
4.4	The as-built fire water distribution system is consistent with the post-fire safe shutdown analyses.	An inspection will be performed.	An inspection report documents that the as-built fire water distribution system is consistent with the post-fire safe shutdown analysis.
5.1	The components designated as Class 1E in Table 2.7.5-2 are powered from the Class 1E division as listed in Table 2.7.5-2 in a normal or alternate feed condition.	a. Testing will be performed for components designated as Class 1E in Table 2.7.5-2 by providing a test signal in each normally aligned division. b. Testing will be performed for components designated as Class 1E in Table 2.7.5-2 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 2.7.5-2. 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 2.7.5-2.
5.2	Valves listed in Table 2.7.5-2 fail as-is on loss of power.	Testing will be performed for the valves listed in Table 2.7.5-2 to fail as-is on loss of power.	Following loss of power, the valves listed in Table 2.7.5-2 fail as-is.

Table 2.7.5-3—Fire Water Distribution System ITAAC
(5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
6.1	Components in Table 2.7.5-2, that are designated as harsh environment, will perform the function listed in Table 2.7.5-1 in the environments that exist during and following design basis events.	a. Type tests or type tests and analysis will be performed to demonstrate the ability of the components listed as harsh environment in Table 2.7.5-2 to perform the function listed in Table 2.7.5-1 for the environmental conditions that could occur during and following design basis events.	a. Environmental Qualification Data Packages (EQDP) exist and conclude that the components listed as harsh environment in Table 2.7.5-2 can perform the function listed in Table 2.7.5-1 during and following design basis events including the time required to perform the listed function.
		b. Components listed as harsh environment in Table 2.7.5-2 will be inspected to verify installation in accordance with the construction drawings including the associated wiring, cables and terminations. Deviations to the construction drawings will be reconciled to the EQDP.	b. Inspection reports exists and conclude that the components listed in Table 2.7.5-2 as harsh environment has been installed per the construction drawings and any deviations have been reconciled to the EQDP.
7.1	The FWDS includes two separate fresh water storage tanks.	An inspection of the as-built capacity of the fire water storage tanks will be performed.	Each of the two fire water storage tank is of greater than or equal to 300,000 gallons capacity.
7.2	The FWDS pumps consist of at least one electric motor-driven pump and one diesel engine-driven pump.	a. An inspection will be performed to verify that at least one electric motor-driven pump and one diesel engine-driven pump exists.	a. At least one electric motor-driven pump and one diesel engine-driven pump exists.
		b. An analysis will be performed.	b. Analysis reports exist and conclude one diesel and one electric pump provide 100% capacity assuming failure of the largest pump or loss of offsite power.

Table 2.7.5-3—Fire Water Distribution System ITAAC
(5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
7.3	FWDS pumps have NPSHA that is greater than NPSHR at system run-out flow.	Testing will be performed to verify NPSHA for FWDS pumps.	The FWDS pumps have NPSHA that is greater than NPSHR at system run-out flow.
7.4	Class 1E valves listed in Table 2.7.5-2 perform the function listed in Table 2.7.5-1 under system operating conditions.	Tests and analyses or a combination of tests and analyses will be performed to demonstrate the ability of the valves listed in Table 2.7.5-2 to change position as listed in Table 2.7.5-1 under system operating conditions.	The valve changes position as listed Table 2.7.5-1 under system operating conditions.
7.5	The FWDS provides for flow testing of FWDS pumps during plant operation.	A test will be performed.	A flow test line allows testing of each FWDS pump during plant operation.
7.6	Containment isolation valves listed in Table 2.7.5-1 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 2.7.5-1 to close within the containment isolation response time following initiation of a containment isolation signal.	Containment isolation valves listed in Table 2.7.5-1 close within 60 seconds following initiation of a containment isolation signal.
7.7	The standpipe and hose systems in areas containing systems and components required for safe plant shutdown in the event of a safe shutdown earthquake (SSE), including the water supply to these standpipes, are capable of remaining functional and supplying two hose stations following an SSE.	An analysis will be performed to demonstrate the ability of the standpipe and hose systems in areas containing systems and components required for safe plant shutdown in the event of a SSE to remain functional and supply two hose stations following a SSE.	Analyses demonstrate the FWDS will remain functional following a SSE and is capable of supplying the two hydraulically most remote hose stations with at least 75 gpm per hose stream.

Next File