2.2.2 In-Containment Refueling Water Storage Tank System

1.0 Description

The in-containment refueling water storage tank system (IRWSTS) is a safety-related system. The IRWSTS provides the following safety-related functions:

- Borated water supply for the emergency core cooling systems.
- Containment isolation.

The IRWSTS provides the following non-safety-related function:

- Borated water supply to the severe accident heat removal system (SAHRS) during a severe accident.

2.0 Arrangement

2.1 The functional arrangement of the IRWSTS is as shown in Figure 2.2.2-1—In-Containment Refueling Water Storage Tank System Functional Arrangement.

2.2 The location of the IRWSTS equipment is as listed in Table 2.2.2-1—IRWSTS Equipment Mechanical Design.

2.3 Physical separation exists between divisions of the IRWSTS.

3.0 Mechanical Design Features

3.1 Equipment listed in Table 2.2.2-1 as ASME Code Section III is designed and tested in accordance with ASME Code Section III.

3.2 Piping indicated in Figure 2.2.2-1 as ASME Code Section III is designed, welded, and tested in accordance with ASME Code Section III.

3.3 Equipment identified as Seismic Category I in Table 2.2.2-1 can withstand a design basis seismic load without loss of function as listed in Table 2.2.2-1.

3.4 Supports for piping shown as ASME Section III on Figure 2.2.2-1 will be designed in accordance with ASME Section III.

3.5 Specifications exist for components listed as ASME Section III in Table 2.2.2-1.

3.6 Specifications exist for piping shown as ASME Section III on Figure 2.2.2-1.

3.7 Specifications exist for supports for piping shown as ASME Section III on Figure 2.2.2-1

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

4.1 Displays listed in Table 2.2.2-2— IRWSTS Equipment I&C and Electrical Design are retrievable in the main control room (MCR) and the remote shutdown station (RSS) as listed in Table 2.2.2-2.

4.2 The IRWSTS equipment controls are provided in the MCR and the RSS as listed in Table 2.2.2-2.

4.3 Actuators listed as being controlled by a priority actuation and control system (PACS) module in Table 2.2.2-2 are controlled by a PACS module.

5.0 Electrical Power Design Features

5.1 The components designated as Class 1E in Table 2.2.2-2 are powered from the Class 1E division as listed in Table 2.2.2-2 in a normal or alternate feed condition.

5.2 Valves listed in Table 2.2.2-2 fail as-is on loss of power.

6.0 Environmental Qualifications

6.1 Equipment listed in Table 2.2.2 -2 for harsh environment can perform the function in Table 2.2.2-1 following exposure to the design basis environments for the time required.

7.0 Equipment and System Performance

7.1 Class 1E valves listed in Table 2.2.2-2 can perform the function listed in Table 2.2.2-1 under system design conditions.

7.2 Containment isolation valves listed in Table 2.2.2-1 close within the containment isolation response time following initiation of a containment isolation signal.

7.3 The IRWST provides a required water volume.

7.4 Post-LOCA pH control is provided for the IRWST with trisodium phosphate (TSP).

7.5 The IRWST suction inlet line for each safety injection system division has a debris screen.

7.6 The IRWST supplies water to the safety injection system (SIS) and to the SAHRS.

7.7 The IRWST provides water to flood the spreading area.

8.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.2.2-3—IRWSTS Inspections, Tests, Analyses, and Acceptance Criteria specifies the inspections, tests, analyses, and acceptance criteria for the IRWSTS.

Table 2.2.2-1—IRWSTS Equipment Mechanical Design (3 Sheets)

Equipment Description	Equipment Tag Number (1)	Equipment Location	ASME Code Section III	Function	Seismic Category
IRWST Three-way Isolation Valve for SIS Division 1	30JNK10 AA001	Safeguard Building 1	yes	open/close (Cont. Isol.)	I
IRWST Three-way Isolation Valve for SIS division 2	30JNK20 AA001	Safeguard Building 2	yes	open/close (Cont. Isol.)	I
IRWST Three-way Isolation valve for SIS Division 3	30JNK30 AA001	Safeguard Building 3	yes	open/close (Cont. Isol.)	I
IRWST Three-way Isolation Valve for SIS Division 4	30JNK40 AA001	Safeguard Building 4	yes	open/close (Cont. Isol.)	I
IRWST Isolation Valve for CVCS	30JNK10 AA009	Safeguard Building 1	yes	close (Cont. Isol.)	I
IRWST Isolation Valve for CVCS	30JNK10 AA013	Safeguard Building 1	yes	close (Cont. Isol.)	I
IRWST Isolation Valve for SAHRS	30JNK11 AA009	Safeguard Building 4	yes	open/close (Cont. Isol.)	I
SIS Division 1 Strainer Backflush Isolation Valve	30JNK10 AA006	Reactor Building	N/A	close	II
SIS Division 1 Strainer Backflush Isolation Valve	30JNK10 AA007	Reactor Building	N/A	close	II
SIS Division 2 Strainer Backflush Isolation Valve	30JNK10 AA004	Reactor Building	N/A	close	II
SIS Division 2 Strainer Backflush Isolation Valve	30JNK10 AA005	Reactor Building	N/A	close	II
SIS Division 3 Strainer Backflush Isolation Valve	30JNK11 AA004	Reactor Building	N/A	close	II
SIS Division 3 Strainer Backflush Isolation Valve	30JNK11 AA005	Reactor Building	N/A	close	II

Table 2.2.2-1—IRWSTS Equipment Mechanical Design (3 Sheets)

Equipment Description	Equipment Tag Number (1)	Equipment Location	ASME Code Section III	Function	Seismic Category
SIS Division 4 Strainer Backflush Isolation Valve	30JNK11 AA006	Reactor Building	N/A	close	II
SIS Division 4 Strainer Backflush Isolation Valve	30JNK11 AA007	Reactor Building	N/A	close	II
Trash Rack (IRWST Heavy Floor Opening)	30JNK10 AT014	Reactor Building	N/A	debris retaining device	I
Trash Rack (IRWST Heavy Floor Opening)	30JNK10 AT015	Reactor Building	N/A	debris retaining device	I
Trash Rack (IRWST Heavy Floor Opening)	30JNK11 AT014	Reactor Building	N/A	debris retaining device	I
Trash Rack (IRWST Heavy Floor Opening)	30JNK11 AT015	Reactor Building	N/A	debris retaining device	I
IRWST Retaining Basket	30JNK10 AT004	Reactor Building	N/A	debris retaining device	I
IRWST Retaining Basket	30JNK10 AT005	Reactor Building	N/A	debris retaining device	I
IRWST Retaining Basket	30JNK11 AT004	Reactor Building	N/A	debris retaining device	I
IRWST Retaining Basket	30JNK11 AT005	Reactor Building	N/A	debris retaining device	I
SIS Sump Strainer Division 1	30JNK10 AT001	Reactor Building	N/A	filtering device	I
SIS Sump Strainer Division 2	30JNK10 AT002	Reactor Building	N/A	filtering device	I
SIS Sump Strainer Division 3	30JNK11 AT002	Reactor Building	N/A	filtering device	I
SIS Sump Strainer Division 4	30JNK11 AT001	Reactor Building	N/A	filtering device	I
CVCS Sump Strainer	30JNK10 AT003	Reactor Building	N/A	filtering device	II

Table 2.2.2-1—IRWSTS Equipment Mechanical Design (3 Sheets)

Equipment Description	Equipment Tag Number (1)	Equipment Location	ASME Code Section III	Function	Seismic Category
SAHRS Sump Strainer	30JNK11 AT003	Reactor Building	N/A	filtering device	II
IRWST Tank	30JNK00 BB001	Reactor Building	N/A	storage volume	I

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

Table 2.2.2-2—IRWSTS Equipment I&C and Electrical Design

Equipment Description	Equipment Tag Number(1)	Equipment Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
IRWST Three-way Isolation Valve for SIS Division 1	30JNK10 AA001	Safeguard Building 1	1^N 2^A	yes	yes	Position/Position	Open-Close/Open-Close
IRWST Three-way Isolation Valve for SIS Division 2	30JNK20 AA001	Safeguard Building 2	2^N 1^A	yes	yes	Position/Position	Open-Close/Open-Close
IRWST Three-way Isolation valve for SIS Division 3	30JNK30 AA001	Safeguard Building 3	3^N 4^A	yes	yes	Position/Position	Open-Close/Open-Close
IRWST Three-way Isolation Valve for SIS Division 4	30JNK40 AA001	Safeguard Building 4	4^N 3^A	yes	yes	Position/Position	Open-Close/Open-Close
IRWST Isolation Valve for CVCS	30JNK10 AA009	Safeguard Building 1	1^N 2^A	yes	yes	Position/Position	Open-Close/Open-Close
IRWST Isolation Valve for CVCS	30JNK10 AA013	Safeguard Building 1	4^N 3^A	yes	yes	Position/Position	Open-Close/Open-Close
IRWST Isolation Valve for SAHRS	30JNK11 AA009	Safeguard Building 4	4^N 3^A	yes	yes	Position/Position	Open-Close/Open-Close

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 2.2.2-3—IRWSTS Inspections, Tests, Analyses, and Acceptance Criteria (5 Sheets)

	Commitment Wording	Inspection, Test, or Analysis	Acceptance Criteria
2.1	The functional arrangement of the IRWSTS is as shown on Figure 2.2.2-1.	Inspections of the as-built system as shown on Figure 2.2.2-1 will be conducted.	The as-built IRWSTS conforms with the functional arrangement as shown in Figure 2.2.2-1.
2.2	The location of the IRWSTS equipment is as listed in Table 2.2.2-1.	An inspection will be performed of the location of the equipment listed in Table 2.2.2-1.	The equipment listed in Table 2.2.2-1 is located as listed in Table 2.2.2-1.
2.3	Physical separation exists between divisions of the IRWSTS.	An inspection will be performed to verify that the divisions of the IRWSTS are located in separate Safeguard Buildings.	The divisions of the IRWSTS are located in separate Safeguard Buildings.
3.1	The components designated as ASME Code Section III in Table 2.2.2-1 are designed in accordance with 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 2.2.2-1.	The components listed as ASME Code Section III in Table 2.2.2-1 have been designed and hydrostatically tested in accordance with ASME Code Section III requirements.
3.2a	The piping identified as being within the ASME Code Section III boundary as indicated in Figure 2.2.2-1 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 2.2.2-1.	The as-designed piping identified as ASME Code Section III in Figure 2.2.2-1 meets ASME Code Section III design requirements.
3.2b	The piping identified as being within the ASME Code Section III boundary as indicated in Figure 2.2.2-1 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 2.2.2-1 for the following: Welding has been performed per ASME Code Section III. Hydrostatic testing per ASME Code Section III was performed.	The piping indicated in Figure 2.2.2-1 as ASME Code Section III has been welded in accordance with ASME Code Section III welding requirements. The piping indicated in Figure 2.2.2-1 as ASME Code Section III has been hydrostatically tested in accordance with ASME Code Section III requirements.

Table 2.2.2-3—IRWSTS Inspections, Tests, Analyses, and Acceptance Criteria (5 Sheets)

	Commitment Wording	Inspection, Test, or Analysis	Acceptance Criteria
3.3	Equipment identified as Seismic Category I in Table 2.2.2-1 can withstand a design basis seismic load without loss of function as listed in Table 2.2.2-1.	a. Inspection will be performed of the equipment identified as Seismic Category I in Table 2.2.2-1. 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 2.2.2-1.	a. The equipment designated as Seismic Category I in Table 2.2.2-1 is installed as designed. b. The equipment designated as Seismic Category I in Table 2.2.2-1 can withstand a design basis seismic load without loss of function.
3.4	Supports for piping shown as ASME Section III on Figure 2.2.2-1 will be designed in accordance with ASME Section III.	An analysis will be performed.	a. Supports for piping shown as ASME Section III on Figure 2.2.2-1 are designed in accordance with ASME Section III. b. Snubbers have been identified, including those analyzed for fatigue for piping shown as ASME Section III on Figure 2.2.2-1. c. Support mass is less than ten percent of the adjacent pipe span for piping shown as ASME Section III on Figure 2.2.2-1.
3.5	Specifications exist for components listed as ASME Section III in Table 2.2.2-1.	An inspection will be performed.	Specifications exist for components listed as ASME Section III in Table 2.2.2-1.
3.6	Specifications exist for piping shown as ASME Section III on Figure 2.2.2-1.	An inspection will be performed.	Specifications exist for piping identified as ASME Section III on Figure 2.2.2-1.
3.7	Specifications exist for supports for piping shown as ASME Section III on Figure 2.2.2-1.	An inspection will be performed.	Specifications exist for supports for piping shown as ASME Section III on Figure 2.2.2-1.

Table 2.2.2-3—IRWSTS Inspections, Tests, Analyses, and Acceptance Criteria (5 Sheets)

	Commitment Wording	Inspection, Test, or Analysis	Acceptance Criteria
4.1	Displays exist or can be retrieved in the MCR and the RSS as identified in Table 2.2.2-2.	Inspections will be performed for the existence or retrieveability of the displays in the MCR or the RSS as listed in Table 2.2.2-2.	The displays listed in Table 2.2.2-2 as being retrieved in the MCR can be retrieved in the MCR. The displays listed in Table 2.2.2-2 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 2.2.2-2.	Tests will be performed for the existence of control signals from the MCR and the RSS to the equipment listed in Table 2.2.2-2.	The controls listed in Table 2.2.2-2 as being in the MCR exist in the MCR. The controls listed in Table 2.2.2-2 as being in the RSS exist in the RSS.
4.3	Actuators listed as being controlled by a PACS module in Table 2.2.2-2 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 2.2.2-2. An inspection will be performed on the actuation of the actuator.	The actuators listed as being controlled by a PACS module in Table 2.2.2-2 actuate to the state requested by the signal.
5.1	The components designated as Class 1E in Table 2.2.2-2 are powered from the Class 1E division as listed in Table 2.2.2-2 in a normal or alternate feed condition.	Testing will be performed for components designated as Class 1E in Table 2.2.2-2 by providing a test signal in each normally aligned division. Testing will be performed for components designated as Class 1E in Table 2.2.2-2 by providing a test signal in each division with the alternate feed aligned to the divisional pair.	The test signal provided in the normally aligned division is present at the respective Class 1E component identified in Table 2.2.2-2. 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 2.2.2-2.
5.2	Valves listed in Table 2.2.2-2 fail as-is on loss of power.	Testing will be performed for the valves listed in Table 2.2.2-2 to fail as-is on loss of power.	Following loss of power, the valves listed in Table 2.2.2-2 fail as-is.

Table 2.2.2-3—IRWSTS Inspections, Tests, Analyses, and Acceptance Criteria (5 Sheets)

	Commitment Wording	Inspection, Test, or Analysis	Acceptance Criteria
6.1	Components listed as Class 1E in Table 2.2.2-2 that are designated as harsh environment will perform the function listed in Table 2.2.2-1 in the environments that exist before and during the time required to perform their function.	6.1a 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 2.2.2-2 to perform the function listed in Table 2.2.2-1 for the environmental conditions that could occur before and during a design basis accident. 6.1b For equipment listed for harsh environment in Table 2.2.2-2, an inspection will be performed of the as-installed Class 1E equipment and the associated wiring, cables and terminations.	6.1a The Class 1E equipment listed for harsh environment in Table 2.2.2-2 can perform the function listed in Table 2.2.2-1 before and during design basis accidents for the time required to perform the listed function. 6.1b Inspection concludes the as-installed Class 1E equipment and associated wiring, cables, and terminations as listed in Table 2.2.2-2 for harsh environment conform with the design.
7.1	Class 1E valves listed in Table 2.2.2-2 perform the function listed in Table 2.2.2-1 under system conditions.	Tests and analyses or a combination of tests and analyses will be performed to demonstrate the ability of the valves listed in Table 2.2.2-2 to change position as listed in Table 2.2.2-1 under system design conditions.	The as-installed valve changes position as listed Table 2.2.2-1 under system design conditions.
7.2	Containment isolation valves listed in Table 2.2.2-1 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 2.2.2-1 to close within the containment isolation response time following initiation of a containment isolation signal.	The containment isolation valves listed in Table 2.2.2-1 close within the required times following initiation of a containment isolation signal: 30JNK10 AA009 $\leq$ 30 seconds 30JNK10 AA013 $\leq$ 30 seconds 30JNK11 AA009 $\leq$ 60 seconds

Table 2.2.2-3—IRWSTS Inspections, Tests, Analyses, and Acceptance Criteria (5 Sheets)

	Commitment Wording	Inspection, Test, or Analysis	Acceptance Criteria
7.3	The IRWST provides a required water volume.	An inspection will be performed of the IRWST required water volume.	The IRWST provides the following required minimum water volume: 66,886 ft^3.
7.4	Post-LOCA pH control is provided for the IRWST with TSP.	An inspection and analysis will be performed of the post LOCA pH control for the IRWST with TSP.	The following quantity of TSP exists for the IRWST to provide a post-LOCA pH control > 7: ≥ 12,200 lbm TSP.
7.5	The IRWST suction inlet line for each safety injection system division has a debris screen.	An inspection will be performed for the existence of a debris screen in the IRWST suction inlet line for each safety injection system division.	A debris screen exists in the IRWST suction inlet line for each safety injection system division.
7.6	The IRWST supplies water to the safety injection system and to the severe accident heat removal system.	An inspection will be performed of the IRWST to supply water to the safety injection system and severe accident heat removal system.	The IRWST supplies water to the safety injection system and the severe accident heat removal system.
7.7	The IRWST provides water to flood the spreading area.	An inspection will be performed of the IRWST to provide water to flood the spreading area.	The IRWST provides water to flood the spreading area.