2.3.3 Severe Accident Heat Removal System

1.0 Description

The severe accident heat removal system (SAHRS) is a dedicated cooling water system for the primary containment to support mitigation of beyond design basis events (BDBEs). The system does not operate during normal plant operations or design basis accidents.

The SAHRS provides the following safety related functions:

- Containment isolation.

The SAHRS provides the following non-safety related functions:

- Passive cooling of the core melt stabilization system (CMSS).
- Active spray for environmental control of the containment atmosphere.
- Active recirculation cooling of the CMSS and containment.

2.0 Arrangement

2.1 The functional arrangement of the SAHRS is as shown in Figure 2.3.3-1—SAHRS Functional Arrangement.

2.2 The location of the SAHRS equipment is as listed in Table 2.3.3-1—SAHRS Equipment Mechanical Design.

3.0 Mechanical Design Features

3.1 Equipment listed in Table 2.3.3-1 as ASME Code Section III is designed, welded, and hydrostatically tested in accordance with ASME Code Section III.

3.2 Check valves listed in Table 2.3.3-1 will function as listed in Table 2.3.3-1.

3.3 Deleted.

3.4 Equipment identified as Seismic Category I in Table 2.3.3-1 can withstand seismic design basis loads without loss of safety function as listed in Table 2.3.3-1.

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3.9 Portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1 are designed in accordance with ASME Code Section III requirements.

3.10 Portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1 are installed in accordance with an ASME Code Section III Design Report.

3.11 Pressure boundary welds in portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1 are in accordance with ASME Code Section III.

3.12 Portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1 retain their pressure boundary integrity at their design pressure.

3.13 Portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1 are installed in accordance with ASME Code Section III requirements.

4.0 I&C Design Features, Displays and Controls

4.1 The SAHRS equipment controls are provided in the MCR as listed in Table 2.3.3-2—SAHRS Equipment I&C and Electrical Design.

4.2 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.3.3-2 responds to the state requested by a test signal.

5.0 Electrical Power Design Features

5.1 The components designated as Class 1E in Table 2.3.3-2 are powered from the Class 1E division as listed in Table 2.3.3-2 in a normal or alternate feed condition.

5.2 Valves listed in Table 2.3.3-2 fail as-is on loss of power.

6.0 Environmental Qualifications

6.1 Equipment listed in Table 2.3.3-2 for harsh environment can perform the function in Table 2.3.3-1 following exposure to the design basis environments for the time required.

7.0 Equipment and System Performance

7.1 The SAHRS heat exchanger as listed in Table 2.3.3-1 has the capacity to transfer the design heat load to the component cooling water system (CCWS).

7.2 Class 1E valves listed in Table 2.3.3-2 perform the functions listed in Table 2.3.3-1 under system design conditions.

7.3 Containment isolation valves listed in Table 2.3.3-1 close within the containment isolation response time following initiation of a containment isolation signal.

8.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.3.3-3 lists the SAHRS ITAAC.

Table 2.3.3-1—SAHRS Equipment Mechanical Design (2 Sheets)

Equipment Description	Equipment Tag Number (1)	Equipment Location	ASME Code Section III	Function	Seismic Category
SAHRS Suction Side Containment Isolation Valve	30JMQ40 AA001	Safeguard Building 4	Yes	Open-Close (Containment Isolation)	I
SAHRS Pump	30JMQ40 AP001	Safeguard Building 4	No	N/A	N/A
SAHRS Heat Exchanger	30JMQ40 AC001	Safeguard Building 4	No	N/A	N/A
Spray Function Outside Containment Isolation Valve	30JMQ41 AA001	Safeguard Building 4	Yes	Open-Close (Containment Isolation)	I
Active Cooling Function Outside Containment Isolation Valve	30JMQ42 AA001	Safeguard Building 4	Yes	Open-Close (Containment Isolation)	I
IRWST Backflush Function Outside Containment Isolation Valve	30JMQ43 AA001	Safeguard Building 4	Yes	Close (Containment Isolation)	I
Spray Function Inside Containment Isolation Check Valve	30JMQ41 AA002	Reactor Building	Yes	Open-Close	I
Active Cooling Function Inside Containment Isolation Check Valve	30JMQ42 AA002	Reactor Building	Yes	Open-Close	I
IRWST Backflush Function Inside Containment Isolation Check Valve	30JMQ43 AA002	Reactor Building	Yes	Close	I
Spray Header	30JMQ41 BR004	Reactor Building	No	N/A	II

Table 2.3.3-1—SAHRS Equipment Mechanical Design (2 Sheets)

Equipment Description	Equipment Tag Number (1)	Equipment Location	ASME Code Section III	Function	Seismic Category
Passive Cooling Function Flow Reducer	30JMQ42 BP001	Reactor Building	Yes	N/A	I
Passive Cooling Function Flow Reducer	30JMQ42 BP003	Reactor Building	Yes	N/A	I
Passive Flooding Line Isolation Valve	30JMQ42 AA003	Reactor Building	No	Open (Corium Cooling)	II
Passive Flooding Line Isolation Valve	30JMQ42 AA005	Reactor Building	No	Open (Corium Cooling)	II

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

Table 2.3.3-2—SAHRS Equipment I&C and Electrical Design

Equipment Description	Equipment Tag Number (1)	Equipment Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR Displays	MCR Controls
SAHRS Suction Side Containment Isolation Valve	30 JMQ 40 AA001	Safeguard Building 4	1^{N},2^{A}	Yes	Yes	Yes	Open-Close
SAHRS Pump	30 JMQ 40 AP001	Safeguard Building 4	4^{N}	No	Yes	N/A	Start-Stop
Spray Function Outside Containment Isolation Valve	30 JMQ 41 AA001	Safeguard Building 4	4^{N},3^{A}	Yes	Yes	Yes	Open-Close
Active Cooling Function Outside Containment Isolation Valve	30 JMQ 42 AA001	Safeguard Building 4	4^{N},3^{A}	Yes	Yes	Yes	Open-Close
IRWST Backflush Function Outside Containment Isolation Valve	30 JMQ 43 AA001	Safeguard Building 4	4^{N},3^{A}	Yes	Yes	Yes	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, while ^{A} denotes the division the component is powered from when alternate feed is implemented.

Table 2.3.3-3—SAHRS ITAAC (5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The functional arrangement of the SAHRS is as shown on Figure 2.3.3-1.	Inspections of the as-built system as shown on Figure 2.3.3-1 will be conducted.	The as-built SAHRS conforms with the functional arrangement as shown in Figure 2.3.3-1.
2.2	The location of the SAHRS equipment is as listed in Table 2.3.3-1.	An inspection will be performed of the location of the equipment listed in Table 2.3.3-1.	The equipment listed in Table 2.3.3-1 is located as listed in Table 2.3.3-1.
3.1	Equipment listed in Table 2.3.3-1 as ASME Code Section III is designed, welded, and hydrostatically tested in accordance with ASME Code Section III.	a. Analysis of the equipment identified in Table 2.3.3-1 as ASME Code Section III will be performed per ASME Code Section III design requirements. b. Inspections will be conducted on the equipment identified in Table 2.3.3-1 as ASME Code Section III to verify welding has been performed per ASME Code Section III welding requirements. c. Hydrostatic testing of the equipment identified in Table 2.3.3-1 as ASME Code Section III will be performed per ASME Code Section III hydrostatic testing requirements.	a. ASME Code Section III Design Reports (NCA-3550) exist and conclude that the equipment identified in Table 2.3.3-1 as ASME Code Section III meets ASME Code Section III design requirements. b. Equipment identified in Table 2.3.3-1 as ASME Code Section III has been welded per ASME Code Section III welding requirements. c. Equipment identified in Table 2.3.3-1 as ASME Code Section III has been hydrostatically tested per ASME Code Section III hydrostatic testing requirements.
3.2	Check valves listed in Table 2.3.3-1 will function as listed in Table 2.3.3-1.	Tests will be performed for the operation of the check valves listed in Table 2.3.3-1.	The check valves listed in Table 2.3.3-1 perform the functions listed in Table 2.3.3-1.
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Table 2.3.3-3—SAHRS ITAAC (5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.4	Equipment identified as Seismic Category I in Table 2.3.3-1 can withstand seismic design basis loads without loss of safety function as listed in Table 2.3.3-1.	a. Type tests, analyses or a combination of type tests and analyses will be performed on the equipment designated as Seismic Category I in Table 2.3.3-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements. b. Inspections will be performed of the as-installed Seismic Category I equipment listed in Table 2.3.3-1 to verify that the equipment including anchorage is installed as specified on the construction drawings.	a. Tests/analysis reports exist and conclude that the Seismic Category I equipment listed in Table 2.3.3-1 can withstand seismic design basis loads without loss of safety function. b. Inspection reports exist and conclude that the as-installed Seismic Category I equipment listed in Table 2.3.3-1 including anchorage is installed as specified on the construction drawings.
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3.6	Deleted.	Deleted.	Deleted.
3.7	Deleted.	Deleted.	Deleted.
3.8	Deleted.	Deleted.	Deleted.
3.9	Portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1 are designed in accordance with ASME Code Section III requirements.	Inspections will be performed for the existence of ASME Code Section III Design Reports.	ASME Code section III Design Reports (NCA-3550) exist for portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1.
3.10	Portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1 are installed in accordance with an ASME Code Section III Design Report.	Inspections will be performed to verify the existence of an analysis which reconciles as-fabricated deviations to the ASME Code Design Report as required by ASME Code Section III.	For portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1, ASME Code Data Reports (N-5) exist and conclude that reconciliation (NCA-3554) of the as-installed system with the Design Report (NCA-3550) has occurred.

Table 2.3.3-3—SAHRS ITAAC (5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.11	Pressure boundary welds in portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1 are in accordance with ASME Code Section III.	Inspections of pressure boundary welds verify that welding is performed in accordance with ASME Code Section III requirements.	ASME Code Section III Data Reports exist and conclude that pressure boundary welding for portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1 has been performed in accordance with ASME Code Section III.
3.12	Portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1 retain their pressure boundary integrity at their design pressure.	Hydrostatic tests will be performed on the as-fabricated system.	For portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1, ASME Code Section III Data Reports exist and conclude that hydrostatic test results comply with ASME Code Section III requirements.
3.13	Portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1 are installed in accordance with ASME Code Section III requirements.	An inspection for the existence of ASME N–5 Data Reports will be performed.	For portions of the SAHRS piping shown as ASME Code Section III in Figure 2.3.3-1, N–5 Data Reports exist and conclude that installation is in accordance with ASME Code Section III requirements.
4.1	Controls exist in the MCR as identified in Table 2.3.3-2.	Tests will be performed for the existence of control signals from the MCR to the equipment listed in Table 2.3.3-2.	The controls listed in Table 2.3.3-2 as being in the MCR exist in the MCR.
4.2	Equipment listed as being controlled by a PACS module in Table 2.3.3-2 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 2.3.3-2 responds to the state requested by the test signal.
5.1	The components designated as Class 1E in Table 2.3.3-2 are powered from the Class 1E division as listed in Table 2.3.3-2 in a normal or alternate feed condition.	a. Testing will be performed for components designated as Class 1E in Table 2.3.3-2 by providing a test signal in each normally aligned division.	a. The test signal provided in the normally aligned division is present at the respective Class 1E component identified in Table 2.3.3-2.

Table 2.3.3-3—SAHRS ITAAC (5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
		b. Testing will be performed for components designated as Class 1E in Table 2.3.3-2 by providing a test signal in each division with the alternate feed aligned to the divisional pair.	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 2.3.3-2.
5.2	Valves listed in Table 2.3.3-2 fail as-is on loss of power.	Testing will be performed for the valves listed in Table 2.3.3-2 to fail as-is on loss of power.	Following loss of power, the valves listed in Table 2.3.3-2 fail as-is.
6.1	Components listed as Class 1E in Table 2.3.3-2, that are designated as harsh environment, will perform the function listed in Table 2.3.3-1 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 2.3.3-2 to perform the function listed in Table 2.3.3-1 for the environmental conditions that could occur before and during a design basis accident.	a. A report exists and concludes that the Class 1E equipment listed for harsh environment in Table 2.3.3-2 can perform the function listed in Table 2.3.3-1 before and during design basis accidents for the time required to perform the listed function.
		b. For equipment listed for harsh environment in Table 2.3.3-2, an inspection will be performed of the as-installed Class 1E equipment and the associated wiring, cables and terminations.	b. Inspection concludes the as-installed Class 1E equipment and associated wiring, cables, and terminations as listed in Table 2.3.3-2 for harsh environment conform with the design.
7.1	The SAHRS heat exchanger as listed in Table 2.3.3-1 has the capacity to transfer the design heat load to the CCWS.	Tests and analyses will be performed to demonstrate the capability of the SAHRS heat exchanger as listed in Table 2.3.3-1 to transfer the heat load to the CCWS.	A report exists and concludes that the SAHRS system has the capacity to remove the design heat load via the heat exchanger listed in Table 2.3.3-1.

Table 2.3.3-3—SAHRS ITAAC (5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
7.2	Class 1E valves listed in Table 2.3.3-2 perform the function listed in Table 2.3.3-1 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 2.3.3-2 to change position as listed in Table 2.3.3-1 under system design conditions.	The as-installed valve changes position as listed in Table 2.3.3-1 under system design conditions.
7.3	Containment isolation valves listed in Table 2.3.3-1 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 2.3.3-1 to close within the containment isolation response time following initiation of a containment isolation signal.	Containment isolation valves listed in Table 2.3.3-1 close within 60 seconds following initiation of a containment isolation signal.

Next File