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.
- Provides integrity of the IRWST boundary.

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

3.3 Deleted.

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

3.5 Deleted.

3.6 Deleted.

3.7 Deleted.

3.8 Deleted.

3.9 SAHRS piping shown as ASME Code Section III on Figure 2.3.3-1 is designed in accordance with ASME Code Section III requirements.

3.10 SAHRS piping shown as ASME Code Section III on Figure 2.3.3-1 is installed in accordance with an ASME Code Section III Design Report.

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

3.12 SAHRS piping shown as ASME Code Section III on Figure 2.3.3-1 retains pressure boundary integrity at design pressure.

3.13 SAHRS piping shown as ASME Code Section III on Figure 2.3.3-1 is installed and inspected in accordance with ASME Code Section III requirements.

3.14 Components listed in Table 2.3.3-1 as ASME Code Section III are designed in accordance with ASME Code Section III requirements.

3.15 Components listed in Table 2.3.3-1 as ASME Code Section III are fabricated in accordance with ASME Code Section III requirements.

3.16 Pressure boundary welds on components listed in Table 2.3.3-1 as ASME Code Section III are in accordance with ASME Code Section III requirements.

3.17 Components listed in Table 2.3.3-1 as ASME Code Section III retain pressure boundary integrity at design pressure.

3.18 Components listed in Table 2.3.3-1 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 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 Deleted.

6.0 Environmental Qualifications

6.1 Components 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 during and following design basis events.

7.0 Equipment and System Performance

7.1 Deleted.

7.2 Class 1E valves listed in Table 2.3.3-2 perform the functions listed in Table 2.3.3-1 under system operating 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)

Description	Tag Number (1)	Location	ASME Code Section III	Function	Seismic Category
SAHRS Suction Side Containment Isolation Valve	30JMQ40AA001	Safeguard Building 4	Yes	Open-Close (Containment Isolation)	I
SAHRS Pump	30JMQ40AP001	Safeguard Building 4	No	N/A	N/A
SAHRS Heat Exchanger	30JMQ40AC001 (Shell 1) 30JMQ40AC004 (Shell 2)	Safeguard Building 4	No	N/A	N/A
Spray Function Outside Containment Isolation Valve	30JMQ41AA001	Safeguard Building 4	Yes	Open-Close (Containment Isolation)	I
Active Cooling Function Outside Containment Isolation Valve	30JMQ42AA001	Safeguard Building 4	Yes	Open-Close (Containment Isolation)	I
IRWST Backflush Function Outside Containment Isolation Valve	30JMQ43AA001	Safeguard Building 4	Yes	Close (Containment Isolation)	I
Spray Function Inside Containment Isolation Check Valve	30JMQ41AA002	Reactor Building	Yes	Open-Close	I
Active Cooling Function Inside Containment Isolation Check Valve	30JMQ42AA002	Reactor Building	Yes	Open-Close	I
IRWST Backflush Function Inside Containment Isolation Check Valve	30JMQ43AA002	Reactor Building	Yes	Close	I
Spray Header	30JMQ41BR004	Reactor Building	No	N/A	II
Passive Cooling Function Flow Reducer	30JMQ42BP001	Reactor Building	Yes	N/A	I

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

Description	Tag Number (1)	Location	ASME Code Section III	Function	Seismic Category
Passive Cooling Function Flow Reducer	30JMQ42BP003	Reactor Building	Yes	N/A	I
Passive Flooding Line Isolation Valve	30JMQ42AA003	Reactor Building	No	Open (Corium Cooling)	II
Passive Flooding Line Motorized Isolation Valve	30JMQ42AA004	Reactor Building	Yes	Open (Corium Cooling)	I
Passive Flooding Line Isolation Valve	30JMQ42AA005	Reactor Building	No	Open (Corium Cooling)	II
Passive Flooding Line Motorized Isolation Valve	30JMQ42AA006	Reactor Building	Yes	Open (Corium Cooling)	I

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

Description	Tag Number (1)	Location	IEEE Class 1E (2) (3)	EQ – Harsh Env.	PACS	MCR Displays	MCR Controls
SAHRS Suction Side Containment Isolation Valve	30JMQ40AA001	Safeguard Building 4	1^{N},2^{A}	Yes	Yes	Yes	Open-Close
SAHRS Pump	30JMQ40AP001	Safeguard Building 4	4^{N}	N/A	Yes	N/A	Start-Stop
Spray Function Outside Containment Isolation Valve	30JMQ41AA001	Safeguard Building 4	4^{N},3^{A}	Yes	Yes	Yes	Open-Close
Active Cooling Function Outside Containment Isolation Valve	30JMQ42AA001	Safeguard Building 4	4^{N},3^{A}	Yes	Yes	Yes	Open-Close
IRWST Backflush Function Outside Containment Isolation Valve	30JMQ43AA001	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.

3) Safety electrical components in the SAHRS are being qualified for DBEs, not beyond DBEs.

Table 2.3.3-3—Severe Accident Heat Removal System ITAAC (6 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 on 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	Valves listed in Table 2.3.3-1 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 2.3.3-1 will be conducted to demonstrate that the 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 2.3.3-1 function under conditions ranging from normal operating to design-basis accident conditions.
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.
3.3	Deleted.	Deleted.	Deleted.
3.4	Components identified as Seismic Category I in Table 2.3.3-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.3.3-1.	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 2.3.3-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements.	a. Seismic qualification reports (SQDP, EQDP, or analyses) exist and conclude that the Seismic Category I components identified in Table 2.3.3-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.3.3-1 including the time required to perform the listed function.

Table 2.3.3-3—Severe Accident Heat Removal System ITAAC (6 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
		b. Inspections will be performed of the Seismic Category I components identified in Table 2.3.3-1 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).	b. Inspection reports exist and conclude that the Seismic Category I components identified in Table 2.3.3-1, including anchorage, are installed as specified on the construction drawings and deviations have been reconciled to the seismic qualification reports (SQDP, EQDP, or analyses).
3.5	Deleted.	Deleted.	Deleted.
3.6	Deleted.	Deleted.	Deleted.
3.7	Deleted.	Deleted.	Deleted.
3.8	Deleted.	Deleted.	Deleted.
3.9	SAHRS piping shown as ASME Code Section III on Figure 2.3.3-1 is designed in accordance with ASME Code Section III requirements.	Inspections of the ASME Code Section III Design Reports (NCA-3550) and associated reference documents will be performed. **{{DAC}}**	ASME Code Section III Design Reports (NCA-3550) exist and conclude that SAHRS piping shown as ASME Code Section III on Figure 2.3.3-1 complies with ASME Code Section III requirements. **{{DAC}}**
3.10	SAHRS piping shown as ASME Code Section III on Figure 2.3.3-1 is installed in accordance with an ASME Code Section III Design Report.	Analyses to reconcile as-built deviations to the ASME Code Design Reports (NCA-3550) will be performed.	For SAHRS piping shown as ASME Code Section III on Figure 2.3.3-1, ASME Code Data Reports (N-5) exist and conclude that design reconciliation (NCA-3554) has been completed in accordance with the ASME Code Section III for the as-built system. The report(s) document the as-built condition.

Table 2.3.3-3—Severe Accident Heat Removal System ITAAC (6 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.11	Pressure boundary welds in SAHRS piping shown as ASME Code Section III on 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 SAHRS piping shown as ASME Code Section III on Figure 2.3.3-1 has been performed in accordance with ASME Code Section III.
3.12	SAHRS piping shown as ASME Code Section III on Figure 2.3.3-1 retains pressure boundary integrity at design pressure.	Hydrostatic tests will be performed on the as-built system.	For SAHRS piping shown as ASME Code Section III on 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	SAHRS piping shown as ASME Code Section III on Figure 2.3.3-1 is installed and inspected in accordance with ASME Code Section III requirements.	An inspection of the as-built piping will be performed.	For SAHRS piping shown as ASME Code Section III on Figure 2.3.3-1, N–5 Data Reports exist and conclude that installation and inspection are in accordance with ASME Code Section III requirements.
3.14	Components listed in Table 2.3.3-1 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 2.3.3-1 comply with ASME Code Section III requirements.
3.15	Components listed in Table 2.3.3-1 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 2.3.3-1 comply with ASME Code Section III requirements and any deviations to the design report have been reconciled.

Table 2.3.3-3—Severe Accident Heat Removal System ITAAC (6 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.16	Pressure boundary welds on components listed in Table 2.3.3-1 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 2.3.3-1, 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.
3.17	Components listed in Table 2.3.3-1 as ASME Code Section III retain pressure boundary integrity at design pressure.	Hydrostatic tests will be performed on the components.	For components listed as ASME Code Section III in Table 2.3.3-1, ASME Code Section III Data Reports exist and conclude that hydrostatic test results comply with ASME Code Section III requirements.
3.18	Components listed in Table 2.3.3-1 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 2.3.3-1 have been installed 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.

Table 2.3.3-3—Severe Accident Heat Removal System ITAAC (6 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
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. 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.	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. 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	Deleted.	Deleted.	Deleted.
6.1	Components 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 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 2.3.3-2 to perform the function listed in Table 2.3.3-1 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 2.3.3-2 can perform the function listed in Table 2.3.3-1 during and following design basis events including the time required to perform the listed function.
		b. Components listed as harsh environment in Table 2.3.3-2 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 2.3.3-2 as harsh environment has been installed per the construction drawings and any deviations have been reconciled to the EQDP.
7.1	Deleted.	Deleted.	Deleted.

Table 2.3.3-3—Severe Accident Heat Removal System ITAAC (6 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 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 2.3.3-2 to change position as listed in Table 2.3.3-1 under system operating conditions.	The valve changes position as listed in Table 2.3.3-1 under system operating 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