2.8.7 Steam Generator Blowdown System

Design Description

1.0 System Description

The steam generator blowdown system (SGBS) is a non-safety-related system with safety-related portions. It assists in maintaining the chemical characteristics of the secondary water within permissible limits. The SGBS is safety related from its connections to the steam generators to the outer containment isolation valves. The remaining portion of the blowdown system downstream of the outer containment isolation valves is non-safety-related.

The SGBS provides the following safety-related functions:

- Containment isolation.
- SG blowdown isolation (emergency feedwater (EFW) actuation signal, or high main steam activity signal with a partial cooldown signal, or high SG level signal with a partial cooldown signal).

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

- SG blowdown isolation (high SGBS blowdown activity signal with a partial cooldown).

2.0 Arrangement

2.1 The functional arrangement of the SGBS is as described in the Design Description of Section 2.8.7, Tables 2.8.7-1— SGBS Equipment Mechanical Design and 2.8.7-2— SGBS Equipment I&C and Electrical Design, and as shown on Figure 2.8.7-1—SGBS Functional Arrangement.

2.2 Deleted.

3.0 Mechanical Design Features

3.1 Valves listed in Table 2.8.7-1 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 design basis accident conditions.

3.2 Deleted.

3.3 Equipment identified as Seismic Category I in Table 2.8.7-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.8.7-1.

3.4 ASME Code Class 1, 2 and 3 piping systems are designed in accordance with ASME Code Section III requirements.

3.5 As-built ASME Code Class 1, 2 and 3 components are reconciled with the design requirements.

3.6 Pressure-boundary welds in ASME Code Class 1, 2 and 3 components meet ASME Code Section III non-destructive examination requirements.

3.7 ASME Code Class 1, 2 and 3 components retain their pressure-boundary integrity at their design pressure.

3.8 ASME Code Class 1, 2 and 3 components are fabricated, installed, and inspected in accordance with ASME Code Section III requirements.

3.9 Deleted.

3.10 Deleted.

3.11 Deleted.

3.12 Deleted.

3.13 Deleted.

4.0 I&C Design Features, Displays, and Controls

4.1 Displays listed in Table 2.8.7-2 are indicated on the PICS operator workstations in the MCR and the RSS.

4.2 Controls on the PICS operator workstations in the MCR and the RSS perform the function listed in Table 2.8.7-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.8.7-2 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.

4.4 Interlocks for the SGBS blowdown isolation valves listed in Table 2.8.7-2 result in closure of the affected SG under the following signals:

- EFW actuation signal,
- High main steam activity signal with a partial cooldown signal,
- High SG level signal with a partial cooldown signal,
- High SGBS blowdown activity signal with a partial cooldown signal.

5.0 Electrical Power Design Features

5.1 Equipment designated as Class 1E in Table 2.8.7-2 are powered from the Class 1E division as listed in Table 2.8.7-2 in a normal or alternate feed condition.

5.2 Deleted.

6.0 Environmental Qualifications

6.1 Equipment designated as harsh environment in Table 2.8.7-2 will perform the function listed in Table 2.8.7-1 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 Class 1E valves listed in Table 2.8.7-2 will function to change position as listed in Table 2.8.7-1 under normal operating conditions.

7.2 Deleted.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.8.7-3 lists the SGBS ITAAC.

Table 2.8.7-1—SGBS Equipment Mechanical Design
Sheet 1 of 2

Description	Tag Number(1)	Location	ASME Code Section III	Function	Seismic Category
SG 1 cold leg blowdown isolation valve	30LCQ10AA002	Reactor Building	yes	close	I
SG 2 cold leg blowdown isolation valve	30LCQ20AA002	Reactor Building	yes	close	I
SG 3 cold leg blowdown isolation valve	30LCQ30AA002	Reactor Building	yes	close	I
SG 4 cold leg blowdown isolation valve	30LCQ40AA002	Reactor Building	yes	close	I
SG 1 hot leg blowdown isolation valve	30LCQ10AA001	Reactor Building	yes	close	I
SG 2 hot leg blowdown isolation valve	30LCQ20AA001	Reactor Building	yes	close	I
SG 3 hot leg blowdown isolation valve	30LCQ30AA001	Reactor Building	yes	close	I
SG 4 hot leg blowdown isolation valve	30LCQ40AA001	Reactor Building	yes	close	I
SG 1 common blowdown isolation valve	30LCQ10AA003	Reactor Building	yes	close	I
SG 2 common blowdown isolation valve	30LCQ20AA003	Reactor Building	yes	close	I
SG 3 common blowdown isolation valve	30LCQ30AA003	Reactor Building	yes	close	I
SG 4 common blowdown isolation valve	30LCQ40AA003	Reactor Building	yes	close	I

Table 2.8.7-1—SGBS Equipment Mechanical Design
Sheet 2 of 2

Description	Tag Number(1)	Location	ASME Code Section III	Function	Seismic Category
SG 1 blowdown flow rate control valve	30LCQ10AA104	Reactor Building	yes	pressure retaining component	I
SG 2 blowdown flow rate control valve	30LCQ20AA104	Reactor Building	yes	pressure retaining component	I
SG 3 blowdown flow rate control valve	30LCQ30AA104	Reactor Building	yes	pressure retaining component	I
SG 4 blowdown flow rate control valve	30LCQ40AA104	Reactor Building	yes	pressure retaining component	I
Blowdown flash tank	30LCQ50BB001	Reactor Building	yes	pressure retaining component	I
Blowdown flash tank pressure relief valve	30LCQ52AA191	Reactor Building	yes	pressure retaining component	I
SG Blowdown Cooler – First Stage	30LCQ51AC001	Reactor Building	yes	pressure retaining component	I
SG Blowdown Cooler – First Stage	30LCQ51AC002	Reactor Building	yes	pressure retaining component	I
Inner containment isolation valve	30LCQ52AA001	Reactor Building	yes	close (Containment Isolation)	I
Inner containment isolation valve	30LCQ51AA002	Reactor Building	yes	close (Containment Isolation)	I
Outer containment isolation valve	30LCQ52AA002	Safeguard Building 1	yes	close (Containment Isolation)	I
Outer containment isolation valve	30LCQ51AA003	Safeguard Building 4	yes	close (Containment Isolation)	I

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

Table 2.8.7-2—SGBS 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 Controls
SG 1 hot leg blowdown isolation valve	30LCQ10AA001	Reactor Building	1^N 2^A	yes	yes	Close/Close
SG 1 cold leg blowdown isolation valve	30LCQ10AA002	Reactor Building	1^N 2^A	yes	yes	Close/Close
SG 1 common blowdown isolation valve	30LCQ10AA003	Reactor Building	3^N 4^A	yes	yes	Close/Close
SG 2 hot leg blowdown isolation valve	30LCQ20AA001	Reactor Building	2^N 1^A	yes	yes	Close/Close
SG 2 cold leg blowdown isolation valve	30LCQ20AA002	Reactor Building	2^N 1^A	yes	yes	Close/Close
SG 2 common blowdown isolation valve	30LCQ20AA003	Reactor Building	3^N 4^A	yes	yes	Close/Close
SG 3 hot leg blowdown isolation valve	30LCQ30AA001	Reactor Building	3^N 4^A	yes	yes	Close/Close
SG 3 cold leg blowdown isolation valve	30LCQ30AA002	Reactor Building	3^N 4^A	yes	yes	Close/Close
SG 3 common blowdown isolation valve	30LCQ30AA003	Reactor Building	2^N 1^A	yes	yes	Close/Close
SG 4 hot leg blowdown isolation valve	30LCQ40AA001	Reactor Building	4^N 3^A	yes	yes	Close/Close

Table 2.8.7-2—SGBS 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 Controls
SG 4 cold leg blowdown isolation valve	30LCQ40AA002	Reactor Building	4^{N} 3^{A}	yes	yes	Close/Close
SG 4 common blowdown isolation valve	30LCQ40AA003	Reactor Building	2^{N} 1^{A}	yes	yes	Close/Close
Inner containment isolation valve	30LCQ52AA001	Reactor Building	1^{N} 2^{A}	yes	yes	Close/Close
Inner containment isolation valve	30LCQ51AA002	Reactor Building	4^{N} 3^{A}	yes	yes	Close/Close
Outer containment isolation valve	30LCQ52AA002	Safeguard Building 1	3^{N} 4^{A}	no	yes	Close/Close
Outer containment isolation valve	30LCQ51AA003	Safeguard Building 4	2^{N} 1^{A}	no	yes	Close/Close

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

2. ^{N} denotes the division equipment is normally powered from; ^{A} denotes the division equipment is powered from when alternate feed is implemented.

Table 2.8.7-3—Steam Generator Blowdown System ITAAC
Sheet 1 of 5

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The functional arrangement of the SGBS is as described in the Design Description of Section 2.8.7, Tables 2.8.7-1 and 2.8.7-2, and as shown on Figure 2.8.7-1.	An inspection of the as-built SGBS functional arrangement will be performed.	The SGBS conforms to the functional arrangement as described in the Design Description of Section 2.8.7, Tables 2.8.7-1 and 2.8.7-2, and as shown on Figure 2.8.7-1.
2.2	Deleted.	Deleted.	Deleted.
3.1	Valves listed in Table 2.8.7-1 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 design basis accident conditions.	Tests or type tests of valves will be performed to demonstrate that the pumps and valves function under design basis accident conditions.	A report concludes that the valves listed in Table 2.8.7-1 are capable of performing their intended function for a full range of system differential pressure and flow, ambient temperatures, and available voltage (as applicable) under design basis accident conditions.
3.2	Deleted.	Deleted.	Deleted.
3.3	Equipment identified as Seismic Category I in Table 2.8.7-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.8.7-1.	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 2.8.7-1 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 2.8.7-1 to verify that the equipment, including anchorage, are installed per the approved design requirements.	a. Test/analysis reports conclude that the equipment identified as Seismic Category I in Table 2.8.7-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.8.7-1 including the time required to perform the listed function. b. Inspection reports conclude that the equipment identified as Seismic Category I in Table 2.8.7-1, including anchorage, are installed per the approved design requirements.

Table 2.8.7-3—Steam Generator Blowdown System ITAAC
Sheet 2 of 5

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.4	ASME Code Class 1, 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 the 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 the ASME Code Class 1, 2 and 3 piping system complies with the requirements of the ASME Code Section III. {{DAC}}
3.5	As-built ASME Code Class 1, 2 and 3 components are reconciled with the design requirements.	A reconciliation analysis of ASME Code Class 1, 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 1, 2 and 3 components, and document the results of the reconciliation analysis.
3.6	Pressure-boundary welds in ASME Code Class 1, 2 and 3 components meet ASME Code Section III non-destructive examination requirements.	An inspection of the as-built pressure-boundary welds in ASME Code Class 1, 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 1, 2 and 3 components.
3.7	ASME Code Class 1, 2 and 3 components retain their pressure-boundary integrity at their design pressure.	A hydrostatic test will be conducted on ASME Code Class 1, 2 and 3 components that are required to be hydrostatically tested by the ASME Code Section III.	ASME Code Data Report(s) exist and conclude that the results of the hydrostatic test of ASME Code Class 1, 2 and 3 components comply with the requirements of ASME Code Section III.
3.8	ASME Code Class 1, 2 and 3 components 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 1, 2 and 3 components will be conducted.	ASME Code Data Report(s) exist that conclude that ASME Code Class 1, 2 and 3 components are fabricated, installed, and inspected in accordance with ASME Code Section III requirements.
3.9	Deleted.	Deleted.	Deleted.

Table 2.8.7-3—Steam Generator Blowdown System ITAAC
Sheet 3 of 5

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.10	Deleted.	Deleted.	Deleted.
3.11	Deleted.	Deleted.	Deleted.
3.12	Deleted.	Deleted.	Deleted.
3.13	Deleted.	Deleted.	Deleted.
4.1	Displays listed in Table 2.8.7-2 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 2.8.7-2 are indicated on the PICS operator workstations in the MCR by using test input signals to PICS. b. Tests will be performed to verify that the displays listed in Table 2.8.7-2 are indicated on the PICS operator workstations in the RSS by using test input signals inputs to PICS.	a. Displays listed in Table 2.8.7-2 are indicated on the PICS operator workstations in the MCR. b. Displays listed in Table 2.8.7-2 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 2.8.7-2.	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 2.8.7-2. b. Controls on the PICS operator workstations in the RSS perform the function listed in Table 2.8.7-2.
4.3	Equipment listed as being controlled by a PACS module in Table 2.8.7-2 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 2.8.7-2 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 2.8.7-3—Steam Generator Blowdown System ITAAC
Sheet 4 of 5

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.4	Interlocks for the SGBS blowdown isolation valves listed in Table 2.8.7-2 result in closure of the affected SG under the following signals: • EFW actuation signal, • High main steam activity signal with a partial cooldown signal, • High SG level signal with a partial cooldown signal, • High SGBS blowdown activity signal with a partial cooldown signal.	Test will be performed using test input signals to verify interlocks initiate the following: • EFW actuation signal, • High main steam activity signal with a partial cooldown signal, • High SG level signal with a partial cooldown signal, • High SGBS blowdown activity signal with a partial cooldown signal.	Interlocks for the SGBS blowdown isolation valves listed in Table 2.8.7-2 result in closure of the affected SG when activated by a test input signal: • EFW actuation signal, • High main steam activity signal with a partial cooldown signal, • High SG level signal with a partial cooldown signal, • High SGBS blowdown activity signal with a partial cooldown signal.
5.1	Equipment designated as Class 1E in Table 2.8.7-2 are powered from the Class 1E division as listed in Table 2.8.7-2 in a normal or alternate feed condition.	a. Testing will be performed by providing a test input signal in each normally aligned division. b. Testing will be performed by providing a test input signal in each division with the alternate feed aligned to the divisional pair.	a. The test input signal provided in the normally aligned division is present at the respective Class 1E equipment identified in Table 2.8.7-2. 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 2.8.7-2.
5.2	Deleted.	Deleted.	Deleted.

Table 2.8.7-3—Steam Generator Blowdown System ITAAC
Sheet 5 of 5

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
6.1	Equipment designated as harsh environment in Table 2.8.7-2 will perform the function listed in Table 2.8.7-1 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 2.8.7-2 to perform the function listed in Table 2.8.7-1 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 2.8.7-2 to verify that the equipment, including anchorage, are installed per the approved design requirements.	a. EQDPs conclude that the equipment designated as harsh environment in Table 2.8.7-2 can perform the function listed in Table 2.8.7-1 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. Inspection reports conclude that the equipment designated as harsh environment in Table 2.8.7-2, including anchorage, are installed per the approved design requirements.
7.1	Class 1E valves listed in Table 2.8.7-2 will function to change position as listed in Table 2.8.7-1 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 2.8.7-2 change position as listed in Table 2.8.7-1 under normal operating conditions.
7.2	Deleted.	Deleted.	Deleted.