2.4.4 Safety Automation System

1.0 Description

The safety automation system (SAS) provides control and monitoring of safety systems.

The SAS has the following safety related functions:

- Provides control and monitoring of systems required to transfer the plant to cold shutdown and maintain it in this state following a design basis event.
- Provides control and monitoring of safety related functions of auxiliary support systems.
- Provides acquisition and processing of Type A, B and C post-accident monitoring variables for display to the operators in the main control room (MCR) and on the remote shutdown station (RSS).
- Provides a safety interlock function.

2.0 Arrangement

2.1 The SAS equipment is located as listed in Table 2.4.4-1—Safety Automation System Equipment.

2.2 Physical separation exists between the four divisions of the SAS.

3.0 Mechanical Design Features

3.1 Equipment identified as Seismic Category I in Table 2.4.4-1 can withstand seismic design basis loads without loss of safety function.

4.0 I&C Design Features, Displays and Controls

4.1 The SAS equipment classified as Class 1E in Table 2.4.4-1 can perform its safety function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

4.2 The SAS receives input signals from the sources listed in Table 2.4.4-2.

4.3 The SAS provides output signals listed in Table 2.4.4-3.

4.4 The SAS provides the interlocks listed in Table 2.4.4-4—Safety Automation System Interlocks.

4.5 The SAS hardware and software are developed using a design process composed of five life cycle phases with each phase having design outputs which must conform to the requirements of that phase. The five life cycle phases are the following:

1) Basic design phase.

2) Detailed design phase.

3) Manufacturing phase.

4) Testing phase.

5) Installation and commissioning phase.

5.0 Electrical Power Design Features

5.1 The components identified as Class 1E in Table 2.4.4-1 are powered from the Class 1E division as listed in Table 2.4.4-1 in a normal or alternate feed condition.

6.0 System Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.4-5 lists the SAS ITAAC.

Table 2.4.4-1—Safety Automation System Equipment

Equipment Description	Equipment Tag Number (1)	Equipment Location	Seismic Category	IEEE Class 1E(2)
SAS Cabinets, Division 1	30DRA1	Safeguard Building 1	I	1^N 2^A
SAS Cabinets, Division 2	30DRA2	Safeguard Building 2	I	2^N 1^A
SAS Cabinets, Division 3	30DRA3	Safeguard Building 3	I	3^N 4^A
SAS Cabinets, Division 4	30DRA4	Safeguard Building 4	I	4^N 3^A

1) Equipment Tag numbers are provided for information and are not part of the design certification.

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 2.4.4-2—Safety Automation System Input Signals

Item #	Signal	Source	# Divisions	IEEE Class 1E
1	Steam Generator Pressure	Protection System	4	Yes
2	Main Steam Relief Control Valve Position	Main Steam System	4	Yes
3	Core Thermal Power	Protection System	4	Yes
4	Main Steam Relief Isolation Valve Position	Main Steam System	4	Yes
5	Steam Generator Level Wide Range	Protection System	4	Yes
6	Emergency Feedwater System Flow	Emergency Feedwater System	4	Yes

Table 2.4.4-3—Safety Automation System Output Signals

Item #	Output Signal	Signal Generation	Recipient	# Divisions	IEEE Class 1E
1	EFW Flow Control Valve Position Signal	Auto	PACS	4	Yes
2	EFW SG Level Control Valve Position Signal	Auto	PACS	4	Yes
3	Main Steam Relief Control Valve Signal	Auto	PACS	4	Yes

Table 2.4.4-4—Safety Automation System Interlocks

Isolation of Component Cooling Water System (CCWS) Trains

Table 2.4.4-5—Safety Automation System ITAAC (3 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The location of the SAS equipment is as listed in Table 2.4.4-1.	An inspection will be performed of the location of the equipment listed in Table 2.4.4-1.	The equipment listed in Table 2.4.4-1 is located as listed in Table 2.4.4-1.
2.2	Separation exists between the four divisions of the SAS.	Inspection will be performed to verify that redundant divisions of the SAS are located in separate buildings.	The four divisions of the SAS are located in separate buildings.
3.1	Equipment identified as Seismic Category I in Table 2.4.4-1 can withstand seismic design basis loads without loss of safety function.	a. Type tests, analyses, or a combination of type tests and analyses will be performed on the equipment listed as Seismic Category I in Table 2.4.4-1 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 2.4.4-1 to verify that the equipment including anchorage is installed as specified on the construction drawings.	a. Tests/analysis reports exist and conclude that the equipment listed as Seismic Category I in Table 2.4.4-1 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 2.4.4-1 including anchorage is installed as specified on the construction drawings.
4.1	Equipment listed as Class 1E in Table 2.4.4-1 can perform its safety function when subjected to electromagnetic interference EMI, RFI, ESD, and power surges.	Type tests, tests, analyses or a combination of these will be performed for the Class 1E equipment listed in Table 2.4.4-1.	A report exists and concludes that the equipment listed as Class 1E in Table 2.4.4-1 can perform its safety function when subjected to electromagnetic interference EMI, RFI, ESD, and power surges.
4.2	The SAS receives input signals from the sources listed in Table 2.4.4-2.	Tests will be performed to verify the existence of input signals.	The SAS receives input signals from the sources listed in Table 2.4.4-2.
4.3	The SAS provides output signals listed in Table 2.4.4-3.	Tests will be performed to verify the existence of output signals.	The SAS provides output signals to the recipients listed in Table 2.4.4-3.

Table 2.4.4-5—Safety Automation System ITAAC (3 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.4	The SAS provides the interlocks listed in Table 2.4.4-4.	Tests will be performed using test signals to verify the operation of the interlocks listed in Table 2.4.4-4.	The interlocks listed in Table 2.4.4-4 respond as specified when activated by a test signal.
4.5	The SAS hardware and software are developed using a design process composed of five life cycle phases with each phase having design outputs which must conform to the requirements of that phase. The five life cycle phases are the following: 1) Basic design phase. 2) Detailed design phase. 3) Manufacturing phase. 4) Testing phase. 5) Installation and commissioning phase.	a. Inspections will be performed to verify that the SAS basic design phase process has design outputs. b. Analyses will be performed to verify that the design outputs for the SAS basic design phase conform to the requirements of that phase. c. Inspections will be performed to verify that the SAS detailed design phase process has design outputs. d. Analyses will be performed to verify that the design outputs for the SAS detailed design phase conform to the requirements of that phase. e. Inspections will be performed to verify that the SAS manufacturing phase process has design outputs. f. Inspections will be performed to verify that the SAS testing phase process has design outputs. g. Analyses will be performed to verify that the design outputs for the SAS testing phase conform to the requirements of that phase.	a. A report exists and provides the design outputs for the basic design phase of the SAS hardware and software design process. b. A verification and validation (V&V) report exists and concludes that the design outputs conform to the requirements of the SAS basic design phase. c. A report exists and provides the design outputs for the detailed design phase of the SAS hardware and software design process. d. A V&V report exists and concludes that the design outputs conform to the requirements of the SAS detailed design phase. e. A report exists and provides the design outputs for the manufacturing phase of the SAS hardware and software design process. f. A report exists and provides the design outputs for the testing phase of the SAS hardware and software design process. g. A V&V report exists and concludes that the design outputs of the testing phase conform to the requirements of the SAS testing phase.

Table 2.4.4-5—Safety Automation System ITAAC (3 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
		h. Inspections will be performed to verify that the SAS installation and commissioning phase process has design outputs.	h. A report exists and provides the design outputs for the installation and commissioning phase of the SAS hardware and software design process.
		i. Analyses will be performed to verify that the design outputs for the SAS installation and commissioning phase conform to the requirements of that phase.	i. A V&V report exists and concludes that the design outputs of the SAS installation and commissioning phase conform to the requirements of the installation and commissioning phase.
5.1	The components identified as Class 1E in Table 2.4.4-1 are powered from the Class 1E division as listed in Table 2.4.4-1 in a normal or alternate feed condition.	a. Testing will be performed for components identified as Class 1E in Table 2.4.4-1 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 components identified in Table 2.4.4-1.
		b. Testing will be performed for components identified as Class 1E in Table 2.4.4-1 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 components identified in Table 2.4.4-1.

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