2.4.24 Diverse Actuation System

Design Description

1.0 System Description

The diverse actuation system (DAS) is a non-safety-related I&C system.

The DAS is provided to mitigate anticipated operational occurrences (AOOs) or postulated accidents (PAs) concurrent with a software common-cause failure of the protection system (PS).

2.0 Arrangement

2.1 The location of the DAS equipment is as listed in Table 2.4.24-1—Diverse Actuation System Equipment.

2.2 Physical separation exists between the divisions of the DAS as listed in Table 2.4.24-1.

3.0 I&C Design Features, Displays, and Controls

3.1 The DAS design is accomplished through a phased approach which includes the following (or equivalent) phases:

1. System Requirements Phase.
2. System Design Phase.
3. Software/Hardware Requirements Phase.
4. Software/Hardware Design Phase.
5. Software/Hardware Implementation Phase.
6. Software/Hardware Validation Phase.
7. System Integration Phase.
8. System Validation Phase.

3.2 The technology used by the DAS is a technology that is not microprocessor based.

3.3 The DAS generates signals for automatic actuation of the functions listed in Table 2.4.24-2—Functions Automatically Actuated by the DAS.

3.4 The DAS allows manual, system-level actuation of the functions listed in Table 2.4.24-3—Functions Manually Actuated through the DAS.

3.5 The DAS response time from sensor output through equipment actuation for the functions listed in Table 2.4.24-2 is less than the value required to satisfy the diverse actuation function response time assumptions.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.24-4 lists the DAS ITAAC.

Table 2.4.24-1—Diverse Actuation System Equipment

Description	Location
DAS Cabinets Division 1	Safeguard Building 1
DAS Cabinets Division 2	Safeguard Building 2
DAS Cabinets Division 3	Safeguard Building 3
DAS Cabinets Division 4	Safeguard Building 4

Table 2.4.24-2—Functions Automatically Actuated by the DAS

Reactor trip on low SG pressure
Reactor trip on low SG level
Reactor trip on high SG level
Reactor trip on low reactor coolant system (RCS) flow (two loops)
Reactor trip on low-low RCS flow (one loop)
Reactor trip on high neutron flux (power range)
Reactor trip on low hot leg pressure
Reactor trip on high pressurizer (PZR) pressure
Turbine trip on reactor trip
EFWS actuation on low SG level
SIS actuation on low PZR pressure
Main steam isolation on low SG pressure
Containment isolation on high containment activity (also includes functions that cascade from containment isolation: Annulus ventilation and Safeguard Building HVAC reconfiguration)
MFWS isolation on low SG pressure
MFWS isolation on high SG level
Opening of containment hydrogen mixing dampers on high containment pressure or high containment service compartment/containment equipment compartment differential pressure
Start station blackout diesels

Table 2.4.24-3—Functions Manually Actuated through the DAS

Safety Injection System Actuation
Containment Isolation (Stage 1)
EFW Actuation
Reactor Trip
Containment Hydrogen Mixing Dampers Open

Table 2.4.24-4—Diverse Actuation System ITAAC
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Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The location of the DAS equipment is as listed in Table 2.4.24-1.	An inspection of the location of the as-built DAS equipment will be performed.	The DAS equipment listed in Table 2.4.24-1 is located as listed in Table 2.4.24-1.
2.2	Physical separation exists between the divisions of the DAS as listed in Table 2.4.24-1.	An inspection will be performed to verify that the as-built divisions of the DAS are located in separate Safeguard Buildings.	The divisions of the DAS are located in separate Safeguard Buildings as listed in Table 2.4.24-1.
3.1	The DAS design is accomplished through a phased approach which includes the following (or equivalent) phases: 1. System Requirements Phase. 2. System Design Phase. 3. Software/Hardware Requirements Phase. 4. Software/Hardware Design Phase. 5. Software/Hardware Implementation Phase. 6. Software/Hardware Validation Phase. 7. System Integration Phase. 8. System Validation Phase.	a. Analyses will be performed to verify that the outputs for the DAS System Requirements Phase conform to the requirements of that phase. b. Analyses will be performed to verify that the outputs for the DAS System Design Phase conform to the requirements of that phase. c. Analyses will be performed to verify that the outputs for the DAS Software/Hardware Requirements Phase conform to the requirements of that phase. d. Analyses will be performed to verify that the outputs for the DAS Software/Hardware Design Phase conform to the requirements of that phase.	a. A report concludes that the outputs for the DAS System Requirements Phase conform to the requirements of that phase. b. A report concludes that the outputs for the DAS System Design Phase conform to the requirements of that phase. c. A report concludes that the outputs for the DAS Software/Hardware Requirements Phase conform to the requirements of that phase. d. A report concludes that the outputs for the DAS Software/Hardware Design Phase conform to the requirements of that phase.

Table 2.4.24-4—Diverse Actuation System ITAAC
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Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
		e. Analyses will be performed to verify that the outputs for the DAS Software/Hardware Implementation Phase conform to the requirements of that phase.	e. A report concludes that the outputs for the DAS Software/Hardware Implementation Phase conform to the requirements of that phase.
		f. Analyses will be performed to verify that the outputs for the DAS Software/Hardware Validation Phase conform to the requirements of that phase.	f. A report concludes that the outputs for the DAS Software/Hardware Validation Phase conform to the requirements of that phase.
		g. Analyses will be performed to verify that the outputs for the DAS System Integration Phase conform to the requirements of that phase.	g. A report concludes that the outputs for the DAS System Integration Phase conform to the requirements of that phase.
		h. Analyses will be performed to verify that the outputs for the DAS System Validation Phase conform to the requirements of that phase.	h. A report concludes that the outputs for the DAS System Validation Phase conform to the requirements of that phase.
3.2	The technology used by the DAS is a technology that is not microprocessor based.	An analysis will be performed to verify that the technology in the DAS is a technology that is not microprocessor based.	A report concludes the technology used by the DAS is a technology that is not microprocessor based.
3.3	The DAS generates signals for automatic actuation of the functions listed in Table 2.4.24-2.	Tests will be performed using test input signals.	The DAS generates signals for automatic actuation of the functions listed in Table 2.4.24-2.
3.4	The DAS allows manual, system-level actuation of the functions listed in Table 2.4.24-3.	Tests will be performed using manual actuation signals.	The DAS allows manual actuation of the functions listed in Table 2.4.24-3.

Table 2.4.24-4—Diverse Actuation System ITAAC
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Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.5	The DAS response time from sensor output through equipment actuation for the functions listed in Table 2.4.24-2 is less than the value required to satisfy the diverse actuation function response time assumptions.	Tests will be performed to verify DAS response times are less than the value required to satisfy the diverse actuation function response time assumptions.	A report concludes that DAS response times are less than the value required to support the diverse actuation function response time assumptions for the DAS functions listed in Table 2.4.24-2.

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