Table 7.1-3—DCS Functional Requirements Allocation Matrix
Sheet 1 of 2

Functional Requirements	DCS Subsystem								
	SICS	PICS	DAS	PS	SAS	RCSL	PAS	SCDS	PACS
Process Control Functions (NSR)									
Non-reactivity related		X					X	X	X
Reactivity related (with rods)		X				X		X	
Reactivity related (without rods)[1]		X				X	X	X	X
Process Limitation Functions (NSR)									
Non-reactivity related		X					X	X	X
Reactivity related (with rods)		X				X		X	
Reactivity related (without rods)[1]		X				X	X	X	X
Reactor Trip (SR)	X			X				X	
ESF Actuation (SR)	X			X				X	X
Safety Controls (SR)									
Automatic[2]	X				X			X	X
Manual Grouped Control[3]	X	X			X		X		X
Manual Component Control[4]	X	X					X		X
Safety Interlocks[5, 6] (SR)	X			X	X			X	X
Severe Accident Controls[7] (NSR)	X	X					X		X
Diverse Reactor Trip (NSR)	X		X					X	
Diverse ESF Actuation (NSR)	X		X					X	X
Process Indications[8] (NSR)		X					X	X	X

Table 7.1-3—DCS Functional Requirements Allocation Matrix
Sheet 2 of 2

Functional Requirements	DCS Subsystem								
	SICS	PICS	DAS	PS	SAS	RCSL	PAS	SCDS	PACS
PAM Indications (SR and NSR)									
PAM Type A[9]	X	X					X	X	X
PAM Type B[9]	X	X					X	X	X
PAM Type C[9]	X	X					X	X	X
PAM Type D		X					X		
PAM Type E		X					X		
Severe Accident Indications[10] (NSR)	X	X					X	X	X
Alarms[11] (NSR)	X	X	X	X	X	X	X	X	

Notes:

1. Process control and limitation functions that are reactivity related and command actuators other than control rods (e.g., reactor boron water makeup) are allocated to RCSL and PAS. RCSL performs the bulk of the logic, and then sends the specific actuator command (i.e., open/close) to the PAS. This provides a common actuator interface from the PICS.

2. Safety automatic control functions are allocated to SICS if an operator interface is needed for the function (e.g., auto/ manual transfer).

3. Safety-related manual grouped controls are allocated to two different paths, which are:

   – SICS -> SAS -> PACS (credited path).

   – PICS -> PAS -> PACS (duplicated path provided so the operator can perform these functions on PICS).

4. Safety-related manual component controls are allocated to two different paths, which are:

   – SICS -> PACS (credited path).

– PICS -> PAS -> PACS (duplicated path provided so the operator can perform these functions on PICS).

5. Safety interlock functions are allocated to SICS if an operator interface is needed for the function (e.g., validating a permissive to enable an interlock).

6. The interlock is allocated to PS if it relies on a permissive that resides in the PS (e.g., P14 permissive for RHR interlock). Otherwise, the interlock is allocated to SAS. This minimizes wiring between the PS and SAS.

7. Severe accident controls are allocated to two different paths, which are:

   – SICS -> PACS (credited path).

   – PICS -> PAS -> PACS (duplicated path provided so the operator can perform these functions on PICS).

8. Process indications are routed as follows:

   – PAS -> PICS (path used if the signal is needed only in PAS).

   – SCDS or PACS (for actuator feedback) -> PAS -> PICS -> (path used if the signal is needed in multiple DCS subsystems).

9. PAM Type A-C indications are allocated to two different paths, which are:

   – SCDS or PACS (for actuator feedback) -> SICS (credited path).

   – SCDS or PACS (for actuator feedback) -> PAS -> PICS (duplicated path provided so the operator can monitor these parameters on PICS).

10. Severe accident indications are allocated to two different paths, which are:

   – SCDS or PACS (for actuator feedback) -> SICS (credited path).

   – SCDS or PACS (for actuator feedback) -> PAS -> PICS (duplicated path provided so the operator can monitor these parameters on PICS).

11. The alarms are provided on PICS. These alarms are generated in the PS, SAS, RCSL, DAS (sent to PAS via HW link), or PAS. A limited number of alarms are provided on SICS. These alarms are generated in DAS, PS, or SAS.

Table 7.1-4—DCS Interface Matrix
Sheet 1 of 4

From	To	Type	Basis
SICS (MCR)	DAS	Hardwired	Manual diverse reactor trip, diverse ESF actuation, diverse ESF resets, diverse permissives
	PS	Hardwired	Manual reactor trip, ESF actuation, ESF resets, permissives
	SAS	Hardwired	Signals to interface with automatic functions (e.g., auto/manual switchover) and manual grouped commands for SAS functions
	PACS	Hardwired	Manual component level control commands, Operational I&C Disable
SICS (RSS)	DAS	Hardwired	MCR-RSS Transfer
	PS	Hardwired	Manual reactor trip, limited ESF resets, limited permissives, MCR-RSS Transfer
	SAS	Hardwired	MCR-RSS Transfer
	PACS	Hardwired	MCR-RSS Transfer
	PICS	Hardwired	MCR-RSS Transfer
PICS	RCSL	Data	Signals to interface with automatic functions (e.g., auto/manual switchover), manual grouped commands for RCSL functions, manual controls for individual rods
	TG I&C	Data	Manual commands related to Turbine Generator operation
	PAS	Data	Signals to interface with automatic functions, manual grouped commands, manual component control commands
	Plant Business Networks	Data	Information to transfer to plant business networks for use by plant staff.

Table 7.1-4—DCS Interface Matrix
Sheet 2 of 4

From	To	Type	Basis
DAS	SICS	Hardwired	Provide information to SICS regarding DAS operation (e.g., DAS reactor trip initiated)
	PAS	Hardwired	Provide DAS information to PAS for display on PICS, provide signals to PAS to coordinate logic on diverse reactor trip or ESF actuation
	RTB	Hardwired	Diverse reactor trip signal
	CRDCS	Hardwired	Diverse reactor trip signal
	TG I&C	Hardwired	Diverse turbine trip signal
	PACS	Hardwired	Diverse ESF actuation signals
PS	SICS	Hardwired	Provide information to SICS regarding PS operation (e.g., PS reactor trip initiated)
	SICS	Data	Provide information to QDS for graphical display and trends
	PICS	Data	Provide information to PICS regarding PS operation (e.g., PS reactor trip initiated)
	SAS	Hardwired	Initiate ESF controls following ESF actuation
	PAS	Hardwired	Provide signals to PAS to coordinate logic on reactor trip or ESF actuation
	RTB	Hardwired	Reactor trip signal
	CRDCS	Hardwired	Reactor trip signal
	TG I&C	Hardwired	Turbine trip signal
	PACS	Hardwired	ESF actuation signals
SAS	SICS	Hardwired	Provide information to SICS regarding SAS operation (e.g., PS reactor trip initiated)
	PICS	Data	Provide information to PICS regarding SAS operation (e.g., PS reactor trip initiated)
	PAS	Hardwired	Provide for coordination of logic between SAS and PAS (if needed)
	PACS	Hardwired	Safety control signals

Table 7.1-4—DCS Interface Matrix
Sheet 3 of 4

From	To	Type	Basis
RCSL	PICS	Data	Provide information to PICS regarding RCSL operation (e.g., ACT control mode)
	PAS	Hardwired	Provide command signals for actuators used in RCSL functions other than control rods (e.g., RBMWS components for Boron control)
	CRDCS	Hardwired	Actuation commands for control rods
	TG I&C	Hardwired	Turbine actuation signals related to reactivity control and limitation functions
PAS	PICS	Data	Provide process and safety indications to PICS, provide information to PICS regarding PAS operation (e.g., auto/manual status, etc)
	PACS	Data	Actuator commands
	Actuators/ Black Boxes	Hardwired	Actuator commands
	TG I&C	Hardwired	TG I&C actuation commands
SCDS	SICS	Hardwired	Distribute DCS input signals to SICS
	DAS	Hardwired	Distribute DCS input signals to DAS
	PS	Hardwired	Distribute DCS input signals to PS
	SAS	Hardwired	Distribute DCS input signals to SAS
	RCSL	Hardwired	Distribute DCS input signals to RCSL
	PAS	Hardwired	Distribute DCS input signals to PAS
PACS	SICS	Hardwired	Actuator checkbacks
	SAS	Hardwired	Actuator checkbacks
	PAS	Data	Actuator checkbacks
Sensors/ Black Boxes	SCDS	Hardwired	Send signals to the DCS for distribution to multiple DCS subsystems
	PAS	Hardwired	Send non-safety related signals to the DCS if only needed in PAS
Actuators/ Black Boxes	PACS	Hardwired	Actuator checkbacks
	PAS	Hardwired	Actuator checkbacks

Table 7.1-4—DCS Interface Matrix
Sheet 4 of 4

From	To	Type	Basis
CRDCS	RCSL	Hardwired	Control rod checkbacks
TG I&C	RCSL	Hardwired	Turbine generator information needed in RCSL functions (e.g., 1st stage pressure)
	PAS	Hardwired	Turbine generator information needed in PAS functions
	PICS	Data	Indications and actuator checkbacks for equipment controlled by TG I&C

Notes:

1. Table 7.1-3 shows the major internal and external DCS interfaces needed for monitoring and control of the plant. Additional interfaces may be necessary, such as those interfaces that are necessary to implement testing, bypassed and inoperable status, data storage (time stamping) requirements. Additional interfaces not defined in Table 7.1-3 that are needed to fulfill requirements is implemented using the following rules:

   – The interfaces are hardwired.

   – The interfaces between safety and non-safety systems will be implemented using qualified electrical isolation devices in accordance with the applicable regulatory requirements and codes and standards.

2. Each entry in the DCS interface matrix shows interfaces in a unidirectional fashion, even though interfaces may be bidirectional. For example, Figure 7.1-3 shows bidirectional hardwired connections between PS and SICS. Table 7.1-4 shows two entries for this, one for the interface from SICS to PS, and one for the interface from PS to SICS.

Table 7.1-5—SAS Automatic Safety Function
Sheet 1 of 20

System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Annulus Ventilation System (AVS)	Accident Filtration Train Heater Control (Figure 7.3-31)	This function is described in Sections 6.2.3, 6.5.1, and 7.3.1.3.1.	NO	N/A	N/A	
Annulus Ventilation System (AVS)	Accident Train Switchover (Figure 7.3-32)	This function is described in Sections 6.2.3, 6.5.1, and 7.3.1.3.1.	NO	N/A	N/A	
Component Cooling Water System (CCWS)	Common 1.b Automatic Backup Switchover of Train 1 to Train 2 (Figure 7.3-33)	This function is described in Sections 7.3.1.4.1 and 9.2.2.	Interdivisional communications is required because sensors in Div. 1 that determine a loss of Train 1, are used to initiate Train 2 and switchover equipment in Div. 2.	Discrete	None	
Component Cooling Water System (CCWS)	Common 1.b Automatic Backup Switchover of Train 2 to Train 1 (Figure 7.3-33)	This function is described in Sections 7.3.1.4.1 and 9.2.2.	Similar to Train 1 to Train 2 Switchover	Discrete	None	
Component Cooling Water System (CCWS)	Common 2.b Automatic Backup Switchover of Train 3 to Train 4 (Figure 7.3-33)	This function is described in Sections 7.3.1.4.1 and 9.2.2.	Similar to Train 1 to Train 2 Switchover, but for Train 3 to Train 4	Discrete	None	
Component Cooling Water System (CCWS)	Common 2.b Automatic Backup Switchover of Train 4 to Train 3 (Figure 7.3-33)	This function is described in Sections 7.3.1.4.1 and 9.2.2.	Similar to Train 1 to Train 2 Switchover, but for Train 4 to Train 3	Discrete	None	

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Component Cooling Water System (CCWS)	Emergency Temperature Control (Figure 7.3-34)	This function is described in Sections 7.3.1.4.1 and 9.2.2.	NO	N/A	N/A	
Component Cooling Water System (CCWS)	Emergency Leak Detection (Figure 7.3-35)	This function is described in Sections 7.3.1.4.1 and 9.2.2.	NO	N/A	N/A	
Component Cooling Water System (CCWS)	Switchover Valve Interlock (Figure 7.6-1)	This function is described in Sections 7.6.1.2.5 and 9.2.2.	If the either of the supply and return valves for a given Train (1 or 2, 3 or 4) are open with respect to a given header (1.a, 1.b, 2.a, or 2.b) then the other corresponding train supply and return valves are given a close command. Train 1 valves are in Div 1, Train 2 valves in Div 2 and so on. Therefore, the signals are sent across divisions for the close command discussed. Hence, the on coming trains supply and return valves are not allowed to open until the corresponding off going trains supply and return valves are closed.	Discrete	None	

Table 7.1-5—SAS Automatic Safety Function
Sheet 3 of 20

System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Component Cooling Water System (CCWS)	RCP Thermal Barrier Containment Isolation Valve Interlock (Figure 7.6-2)	This function is described in Sections 7.6.1.2.5 and 9.2.2.	The Inner and Outer Containment Isolation Valves are powered from different divisions. For the Common 1.b header, the outer valves (supply and return) are supplied by Div 1 and the inner valves by Div 4. The opposite is true for the Common 2.b header. To be able to switch between headers, at least one of the supply valves (outer or inner) and one of the return valves (outer or inner) must be closed. Therefore, the state (open or closed) of these valves must be communicated across divisions.	Discrete	Vote	

Table 7.1-5—SAS Automatic Safety Function
Sheet 4 of 20

System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Component Cooling Water System (CCWS)	CCWS RCP Thermal Barrier Containment Isolation Valves Opening Interlock (Figure 7.6-12).	This function is described in Sections 7.6.1.2.5 and 9.2.2.	The Inner and Outer Containment Isolation Valves are powered from different divisions. For the Common 1.b header, the outer valves (supply and return) are supplied by Div 1 and the inner valves by Div 4. The opposite is true for the Common 2.b header. To be able to switch between headers, at least one of the supply valves (outer or inner) and one of the return valves (outer or inner) must be closed. Therefore, the state (open or closed) of these valves must be communicated across divisions.	Discrete	Vote	

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Component Cooling Water System (CCWS)	Emergency Leak Detection - Switchover Valves Leakage or Failure (Figure 7.3-36)	This function is described in Sections 7.3.1.4.1 and 9.2.2.	This function looks at surge tank level in the two corresponding Trains (Trains 1 and 2, Trains 3 and 4) that feed a common header. If the surge tank level in the on-line train is lowering while the surge tank level the off-line train is rising then a seat leakage on one of the off line train switchover valves is likely. Therefore, interdivisional communication is required since information from more than one division is being utilized.	Discrete	Vote	
Component Cooling Water System (CCWS)	SCWS Condenser Supply Water Flow Control (Figure 7.3-37)	This function is described in Sections 7.3.1.4.1 and 9.2.2.	NO	NA	NA	
Emergency Feedwater System (EFWS)	SG Level Control (Figure 7.3-4)	1. This function is described in Sections 7.3.1.3.2 and 10.4.9.	NO	N/A	N/A	
Emergency Feedwater System (EFWS)	EFW Pump Flow Protection (Figure 7.3-4)	1. This function is described in Sections 7.3.1.3.2 and 10.4.9.	NO	N/A	N/A	

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Essential Service Water Pump Building Ventilation System (ESWPBVS)	ESWS Pump Rooms Temperature Control (Figure 7.3-38)	This function is described in Sections 7.3.1.4.3 and 9.4.11.	NO	N/A	N/A	
Fuel Building Ventilation System (FBVS)	Safety-Related Rooms Heater Control (Figure 7.3-39)	This function is described in Sections 7.3.1.4.4 and 9.4.2.	NO	N/A	N/A	
Fuel Building Ventilation System (FBVS)	EBS / FPCS Pump Rooms Heat Removal (Figure 7.3-40)	This function is described in Sections 7.3.1.4.4 and 9.4.2.	NO	N/A	N/A	
Fuel Building Ventilation System (FBVS)	Isolation of FBVS on Containment Isolation (Figure 7.3-62)	This function is described in Sections 7.3.1.4.4 and 9.4.2.3.	NO	N/A	N/A	
Fuel Pool Cooling and Purification System (FPCPS)	Pump Trip on Low SFP Level (Figure 7.3-41)	2. This function is described in Sections 7.3.1.4.5 and 9.1.3.	NO	N/A	N/A	
In-Containment Refueling Water Storage Tank System (IRWST)	IRWST Boundary Isolation for Preserving IRWST Water Inventory Interlock (Figure 7.6-4)	This function is described in Sections 6.3 and 7.6.1.2.6.	Interdivisional communications is required because an IRWST low level discrete signal is generated in each division, and 2/4 voting logic is used to close IRWST isolation valves in Division 1 and 4.	Discrete	Vote	

Table 7.1-5—SAS Automatic Safety Function
Sheet 7 of 20

System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Main Control Room Air Conditioning System (CRACS)	Iodine Filtration Train Heater Control (Figure 7.3-42)	This function is described in Sections 6.5.1, 7.3.1.3.3, and 9.4.1.	NO	N/A	N/A	
Main Control Room Air Conditioning System (CRACS)	Heater Control for Outside Inlet Air (Figure 7.3-43)	This function is described in Sections 6.5.1, 7.3.1.3.3, and 9.4.1.	NO	N/A	N/A	
Main Control Room Air Conditioning System (CRACS)	Pressure Control (Figure 7.3-44)	This function is described in Sections 6.5.1, 7.3.1.3.3, and 9.4.1.	NO	N/A	N/A	
Main Control Room Air Conditioning System (CRACS)	Cooler Temperature Control (Figure 7.3-45)	This function is described in Sections 6.5.1, 7.3.1.3.3, and 9.4.1.	NO	N/A	N/A	
Main Steam System (MSS)	Steam Generator MSRCV Regulation during Standby Position Control (Figure 7.3-12)	This function is described in Sections 7.3.1.3.4 and 10.3.	NO	N/A	N/A	

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Main Steam System (MSS)	Steam Generator MSRCV Regulation during Pressure Control (Figure 7.3-12)	This function is described in Sections 7.3.1.3.4 and 10.3.	The MSRIV closed position is detected via 2 out of 4 voting (the position switches are associated with Div 1 through 4).	Discrete	Vote	
Residual Heat Removal System (RHR)	RHR Isolation Valves Interlock (Figure 7.6-11)	This function is described in Sections 7.6.1.2.8 and 5.4.7.	NO	N/A	N/A	
Safeguard Building Controlled-Area Ventilation System (SBVS)	SIS/RHRS Pump Rooms Heat Removal (Figure 7.3-46)	This function is described in Sections 7.3.1.3.5 and 9.4.5.	NO	N/A	N/A	
Safeguard Building Controlled-Area Ventilation System (SBVS)	CCWS/EFWS Valve Rooms Heat Removal (Figure 7.3-47)	This function is described in Sections 7.3.1.3.5 and 9.4.5.	NO	N/A	N/A	
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Supply and Recirculation-Exhaust Air Flow Control (Figure 7.3-48)	This function is described in Sections 7.3.1.4.6 and 9.4.6.	NO	N/A	N/A	

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Supply Fan Safe Shut-off (Figure 7.3-49)	This function is described in Sections 7.3.1.4.6 and 9.4.6.	NO	N/A	N/A	
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Recirculation Fan Safe Shut-off (Figure 7.3-50)	This function is described in Sections 7.3.1.4.6 and 9.4.6.	NO	N/A	N/A	
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Exhaust Fan Safe Shut-off (Figure 7.3-51)	This function is described in Sections 7.3.1.4.6 and 9.4.6.	NO	N/A	N/A	
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Supply Air Temperature Heater Control (Figure 7.3-52)	This function is described in Sections 7.3.1.4.6 and 9.4.6.	NO	N/A	N/A	

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Freeze Protection (Figure 7.3-53)	This function is described in Sections 7.3.1.4.6 and 9.4.6.	NO	N/A	N/A	
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Supply Air Temperature Control for Supply Air Cooling (Figure 7.3-54)	This function is described in Sections 7.3.1.4.6 and 9.4.6.	NO	N/A	N/A	
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Battery Room Heater Control (Figure 7.3-56)	This function is described in Sections 7.3.1.4.6 and 9.4.6.	NO	N/A	N/A	
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Battery Room Supply Air Temperature Control (Figure 7.3-57)	This function is described in Sections 7.3.1.4.6 and 9.4.6.	NO	N/A	N/A	

**Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Electrical Division of Safeguard Building Ventilation System (SBVSE)	EFWS Pump Room Heat Removal (Figure 7.3-58)	This function is described in Sections 7.3.1.4.6 and 9.4.6.	NO	N/A	N/A	
Electrical Division of Safeguard Building Ventilation System (SBVSE)	CCWS Pump Room Heat Removal (Figure 7.3-59)	This function is described in Sections 7.3.1.4.6 and 9.4.6.	NO	N/A	N/A	
Safety Chilled Water System (SCWS)	Train 1 to Train 2 Switchover on Train 1 Low Evaporator Flow Interlock (Figure 7.6-5)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 1 is associated with Div 1 and Train 2 with Div 2. Div 1 and Div 2 are cross connected. When switching between trains (due to system faults - e.g., low evaporator flow) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Safety Chilled Water System (SCWS)	Train 2 to Train 1 Switchover on Train 2 Low Evaporator Flow Interlock (Figure 7.6-6)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 1 is associated with Div 1 and Train 2 with Div 2. Div 1 and Div 2 are cross connected. When switching between trains (due to system faults - e.g., low evaporator flow) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	
Safety Chilled Water System (SCWS)	Train 3 to Train 4 Switchover on Train 3 Low Evaporator Flow Interlock (Figure 7.6-7)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 3 is associated with Div 3 and Train 4 with Div 4. Div 3 and Div 4 are cross connected. When switching between trains (due to system faults - e.g., low evaporator flow) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Safety Chilled Water System (SCWS)	Train 4 to Train 3 Switchover on Train 4 Low Evaporator Flow Interlock (Figure 7.6-8)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 3 is associated with Div 3 and Train 4 with Div 4. Div 3 and Div 4 are cross connected. When switching between trains (due to system faults - e.g., low evaporator flow) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	
Safety Chilled Water System (SCWS)	Train 1 to Train 2 Switchover on Train 1 Chiller Black Box Internal Fault Interlock (Figure 7.6-5)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 1 is associated with Div 1 and Train 2 with Div 2. Div 1 and Div 2 are cross connected. When switching between trains (due to system faults - chiller black box internal fault) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Safety Chilled Water System (SCWS)	Train 2 to Train 1 Switchover on Train 2 Chiller Black Box Internal Fault Interlock (Figure 7.6-6)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 1 is associated with Div 1 and Train 2 with Div 2. Div 1 and Div 2 are cross connected. When switching between trains (due to system faults - chiller black box internal fault) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	
Safety Chilled Water System (SCWS)	Train 3 to Train 4 Switchover on Train 3 Chiller Black Box Internal Fault Interlock (Figure 7.6-7)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 3 is associated with Div 3 and Train 4 with Div 4. Div 3 and Div 4 are cross connected. When switching between trains (due to system faults - chiller black box internal fault) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Safety Chilled Water System (SCWS)	Train 4 to Train 3 Switchover on Train 4 Chiller Black Box Internal Fault Interlock (Figure 7.6-8)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 3 is associated with Div 3 and Train 4 with Div 4. Div 3 and Div 4 are cross connected. When switching between trains (due to system faults - chiller black box internal fault) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	
Safety Chilled Water System (SCWS)	Train 2 to Train 1 Switchover on Loss of UHS-CCWS Interlock (Figure 7.6-6)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 1 is associated with Div 1 and Train 2 with Div 2. Div 1 and Div 2 are cross connected. When switching between Trains (due to an external system fault (loss of UHS-CCWS)) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Safety Chilled Water System (SCWS)	Train 3 to Train 4 Switchover on Loss of UHS-CCWS Interlock (Figure 7.6-7)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 3 is associated with Div 3 and Train 4 with Div 4. Div 3 and Div 4 are cross connected. When switching between Trains (due to an external system fault (loss of UHS-CCW)) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	
Safety Chilled Water System (SCWS)	Train 1 to Train 2 Switchover on LOOP Re-start Failure Interlock (Figure 7.6-5)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 1 is associated with Div 1 and Train 2 with Div 2. Div 1 and Div 2 are cross connected. When switching between trains (LOOP re-start failure of the previous operating train or with its corresponding EDG) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Safety Chilled Water System (SCWS)	Train 2 to Train 1 Switchover on LOOP Re-start Failure Interlock (Figure 7.6-6)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 1 is associated with Div 1 and Train 2 with Div 2. Div 1 and Div 2 are cross connected. When switching between trains (LOOP re-start failure of the previous operating train or with its corresponding EDG) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	

Table 7.1-5—SAS Automatic Safety Function
Sheet 18 of 20

System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Safety Chilled Water System (SCWS)	Train 3 to Train 4 Switchover on LOOP Re-start Failure Interlock (Figure 7.6-7)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 3 is associated with Div 3 and Train 4 with Div 4. Div 3 and Div 4 are cross connected. When switching between trains (LOOP re-start failure of the previous operating train or with its corresponding EDG) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	

Table 7.1-5—SAS Automatic Safety Function
Sheet 19 of 20

System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Safety Chilled Water System (SCWS)	Train 4 to Train 3 Switchover on LOOP Re-start Failure Interlock (Figure 7.6-8)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	Train 3 is associated with Div 3 and Train 4 with Div 4. Div 3 and Div 4 are cross connected. When switching between trains (LOOP re-start failure of the previous operating train or with its corresponding EDG) an auto-start of the standby train occurs. Interdivisional communication is necessary because a verification of prerequisites is required to make sure the on-coming train is in standby mode and that the appropriate cross-tie valves are in the open position.	Discrete	Vote	
Safety Chilled Water System (SCWS)	SCWS Chiller Evaporator Water Flow Control (Trains 1 and 4) Interlock (Figure 7.6-5 through Figure 7.6-8)	This function is described in Sections 7.6.1.2.7 and 9.2.8.	NO	NA	NA	
Safety Injection and Residual Heat Removal System (SIS/ RHRS)	Automatic RHRS Flow Rate Control (Figure 7.3-60)	This function is described in Sections 5.4.7, 6.3, and 7.3.1.3.6.	NO	NA	NA	

Table 7.1-5—SAS Automatic Safety Function
Sheet 20 of 20

System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments
Safety Injection and Residual Heat Removal System (SIS/ RHRS)	Automatic Trip of LHSI Pump (in RHR Mode) on Low ΔPsat Interlock (Figure 7.6-9)	This function is described in Sections 5.4.7, 6.3, and 7.6.1.2.2.	Interdivisional communications is required because a low ΔPsat discrete signal is generated in each division, and 2/4 voting logic is used to trip the LHSI pump. Valve position measurements from multiple divisions are used to determine if an RHR train is connected.	Discrete	Vote	
Safety Injection and Residual Heat Removal System (SIS/ RHRS)	Automatic Trip of LHSI Pump (in RHR Mode) on Low-Low RCS Loop Level Interlock (Figure 7.6-10)	This function is described in Sections 5.4.7, 6.3, and 7.6.1.2.3.	Interdivisional communications is required because a low-low RCS loop level discrete signal is generated in each division, and 2/4 voting logic is used to trip the LHSI pump. Valve position measurements from multiple divisions are used to determine if an RHR train is connected.	Discrete	Vote	

Notes:

1. System – Mechanical system described in the referenced FSAR section.
2. Function Name – The automatic safety-related function is controlled by SAS in each mechanical system.
3. Function Safety Basis – Safety-related functions that provide reasonable assurance of either:
   - The integrity of the reactor coolant pressure boundary.

   - The capability to shut down the reactor and maintain it in a safe shutdown condition.
   - The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures.

4. Interdivisional Communication – Point-to-point data communications between different safety divisions of SAS.

5. Type of Data – Analog or Discrete Signal. This column is meant to indicate the type of information sent between divisions, not the transmission means by which the information is sent (hardwired, data message, etc.).

6. Signal Selection Type – Vote. Vote is defined as:

   - 1 out of x, where x is the number of inputs to the logic block. If one or more inputs is TRUE, then the output will be TRUE. This logic may be implemented with an OR gate.
   - x out of x, where x is the number of inputs to the logic block. If x number of inputs are TRUE, then the output will be TRUE. This logic may be implemented using an AND gate.
   - y out of x, where x is the number of inputs to the logic block and y is a value between 2 and x. If the number of inputs equal or greater than y is TRUE, then the output will be TRUE.
   - Interdivisional voting requires one or more inputs to a logic block to originate from multiple divisions.

Table 7.1-6—Function Processor Operational States
Sheet 1 of 2

CPU State	CPU Operation	CPU Output	State Use	CPU Operability[1]	Maintenance Bypass
Cyclic processing state	Processor operates normally.	Active	Normal operation.	Operable	No
Parameterization state	Processor operates normally[2].	Active	Modify predefined, changeable parameters.	Inoperable	No
Functional test state	Cyclic processing of the function diagrams is initially stopped and can be controlled at the SU[3].	Hardwired Outputs: Set to failsafe state. The default failsafe state is 0 for digital outputs and low for analog outputs, and can be user defined if other failsafe states are needed. Data Outputs: Data messages are transmitted with test status and are discarded by receiving CPUs in cyclic processing and parameterization states. They are evaluated by receiving CPUs that are also in functional test state. They are not processed by receiving CPUs that are in diagnosis state.	Modify parameters and control function processor outputs.	Inoperable	Yes

Table 7.1-6—Function Processor Operational States
Sheet 2 of 2

CPU State	CPU Operation	CPU Output	State Use	CPU Operability[1]	Maintenance Bypass
Diagnosis state	All service commands are supported without any restrictions. The cyclic processing of the function diagrams is initially stopped and can be controlled at the SU.	Hardwired Outputs: Set to failsafe state. The default failsafe state is 0 for digital outputs and low for analog outputs, and can be user defined if other failsafe states are needed. Communication Module: Data messages are disabled. No messages are sent from the CPU in diagnosis state. Receiving CPUs will respond to this as a loss of communications.	Application software can be loaded and state used to troubleshoot.	Inoperable	Yes

Notes:

1. With regards to Technical Specifications.

2. Parameterization State communication - While in Parameterization State, operation of a function processor is not impacted. It receives messages, processes the information, and sends messages as it does in Cyclic Operation. On the TXS platform, the parameters that are changed get changed as a batch, meaning that the changes are entered and then manually verified. When the acknowledgment is given, and the new parameter values are placed into the function processor, the changes are made in a single cycle. During cycle 1, the old approved values are used for processing, and during cycle 2, the new approved values are used for processing. This prevents the Parameterization State from having an impact on function processor communications. In addition to this, the outgoing messages will be verified by the receiving function processor prior to processing.

3. Function Test State - Function processors in the Function Test State can be allowed to send messages via the SU. These messages are marked as test messages and are discarded, and never processed by the other function processors, unless they are also in the Function Test State. This capability is necessary for testing or trouble shooting that requires communication between the APU and ALU to take place.