Table 7.1-7—SAS FMEA Results
Sheet 1 of 26

No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments		
				Systems W	ith Functions in 4 Divis	ions / Trains				
1	Fuel Building Ventilation System (FBVS)	Containment Isolation	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function		
		(Figure 7.3-62)		b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			
2	Residual Heat Removal System (SIS/	RHR Isolation Valves Interlock (Figure 7.6-11)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function		
	RHRS)				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			
3	Safeguard Building Ventilation System	SBVSE CCWS Pump Room Heat Removal (Figure 7.3-59)		Room Heat Removal	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
	(SBVSE)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			
4	Component Cooling Water System (CCWS)	er System Temperature Control 1 D	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function		
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			

Table 7.1-7—SAS FMEA Results Sheet 2 of 26

No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments	
5	Component Cooling Water System (CCWS)	CCWS Emergency Leak Detection (Figure 7.3-35)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function	
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
6	Emergency Feedwater System (EFWS)	SG Level Control (Figure 7.3-4)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function	
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
7	0,	tter EFWS Pump Flow Master CU in Protection 1 Division (Figure 7.3-4)	Protection		a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
8	Essential Service ESWPBVS ESWS Water Pump Building Ventilation System (ESWPBVS) Temperature Control (Figure 7.3-38)	ter Pump Building Pump Rooms 1 Division ntilation System Temperature Control	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function	
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
			c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			

Table 7.1-7—SAS FMEA Results Sheet 3 of 26

No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments	
9	Main Steam System (MSS)	Steam Generator MSRCV Regulation during Pressure	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function	
		Control (Figure 7.3-12)		b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
10	Main Steam System (MSS)	Steam Generator MSRCV Regulation during Standby	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function	
		Position Control (Figure 7.3-12)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
	Safeguard Building Controlled-Area Ventilation System	d-Area Rooms Heat Removal 1 Division	Rooms Heat Removal 1 Divis	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
	(SBVS)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
	Controlled-Area	trolled-Area Rooms Heat Removal 1 Divis tilation System (Figure 7.3-47)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function	
	(SBVS)				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		

Table 7.1-7—SAS FMEA Results Sheet 4 of 26

			Name of Sensor, Functional Unit, or			Inherent Compensating		
No	System	SAS Function	Equipment (2)	Failure Mode (1)	Method of Detection	Provision	Effect on the SAS Function	Comments
13	Electrical Division of Safeguard Building Ventilation System (SBVSE)	Supply and Recirculation Exhaust Air Flow	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
		Control (Figure 7.3-48)		b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	
14	Safeguard Building Ventilation System	Supply Fan Safe Shut- off (Figure 7.3-49)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
	(SBVSE)	BVSE)		b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	
15	Safeguard Building Ventilation System	Recirculation Fan Safe Shut-off (Figure 7.3-50)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
	(SBVSE)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	
16	Electrical Division of Safeguard Building Ventilation System	ing Shut-off	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
	(SBVSE)		1	b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
			c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		

Table 7.1-7—SAS FMEA Results Sheet 5 of 26

No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments		
17	Safeguard Building Ventilation System	ng Temperature Heater em Control	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function		
	(SBVSE)	(Figure 7.3-52)		b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			
18	Safeguard Building Ventilation System	Freeze Protection (Figure 7.3-53)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function		
	(SBVSE)				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			
19	Safeguard Building Ventilation System	Supply Air Temperature Control for Supply Air Cooling (Figure 7.3-54)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function		
	(SBVSE)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			
20	Safeguard Building Ventilation System	guard Building Control 1 ilation System (Figure 7.3-56)	eguard Building Control 1 Division (Figure 7.3-56)	guard Building Control 1 Division	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
	(SBVSE)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			

Table 7.1-7—SAS FMEA Results Sheet 6 of 26

No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments
21	Safeguard Building Ventilation System	Air Temperature Control	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
	(SBVSE)	(Figure 7.3-57)		b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	
	afeguard Building W Ventilation System (E	E Emergency Feed Water System (EFWS) Pump Room Heat Removal (Figure 7.3-58)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
	(SBVSE)		58)	b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	
23	Safety Chilled Water System (SCWS)	SCWS Train 1 to Train 2 Switchover on Train 1 Low Evaporator Flow / Chiller Black Box	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the error is alarmed. Loss of one cross-tied train set. One remaining cross-tied train set provides safety function.	No effects on the system function
	SCWS Chiller Evaporator Water Flow Control / LOOI Re-start	SCWS Chiller Evaporator Water Flow Control / LOOP	b) Undetected - Spurious	None	Two redundant cross-tied train sets	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Two redundant cross-tied train sets	Loss of one division / train. Unable to perform automatic SCWS train switchover function for the faulted cross-tied train set. One remaining cross-tied train set provides the safety function.	

					Sheet 7 of 26			
No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments
24	Safety Chilled Water System (SCWS)	SCWS Train 2 to Train 1 Switchover on Train 2 Low Evaporator Flow / Chiller Black Box	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism		Master / Standby CU switchover occurs and the error is alarmed. Loss of one cross-tied train set. One remaining cross-tied train set provides safety function.	No effects on the system function
		Internal Fault / Loss of UHS-CCWS / SCWS Chiller Evaporator Water		b) Undetected - Spurious	None	Two redundant cross-tied train sets	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
		Flow Control / LOOP Re-start Failure (Figure 7.6-6)		c) Undetected - Blocking	None	Two redundant cross-tied train sets	Loss of one division / train. Unable to perform automatic SCWS train switchover function for the faulted cross-tied train set. One remaining cross-tied train set provides the safety function.	
25	Safety Chilled Water System (SCWS)	SCWS Train 3 to Train 4 Switchover on Train 3 Low Evaporator Flow / Chiller Black Box	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master /Standby CU switchover occurs and the error is alarmed. Loss of one cross-tied train set. One remaining cross-tied train set provides safety function.	No effects on the system function
		Internal Fault / Loss of UHS-CCWS / SCWS Chiller Evaporator Water	CWS / iller r Water trol / LOOP	b) Undetected - Spurious	None	Two redundant cross-tied train sets	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
	• • •	Flow Control / LOOP Re-start Failure (Figure 7.6-7)		c) Undetected - Blocking	None	Two redundant cross-tied train sets	Loss of one division / train. Unable to perform automatic SCWS train switchover function for the faulted cross-tied train set. One remaining cross-tied train set provides the safety function.	

Table 7.1-7—SAS FMEA Results Sheet 7 of 26

Table 7.1-7—SAS FMEA	Results
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No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments			
26	Safety Chilled Water System (SCWS)	SCWS Train 4 to Train 3 Switchover on Train 4 Low Evaporator Flow / Chiller Black Box	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the error is alarmed. Loss of one cross-tied train set. One remaining cross-tied train set provides safety function.	No effects on the system function			
		Internal Fault / SCWS Chiller Evaporator Water Flow Control / LOOP		b) Undetected - Spurious	None	Two redundant cross-tied train sets	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.				
	Re-start			c) Undetected - Blocking	None	Two redundant cross-tied train sets	Loss of one division / train. Unable to perform automatic SCWS train switchover function for the faulted cross-tied train set. One remaining cross-tied train set provides the safety function.				
27	Safety Injection and Residual Heat Removal System (SIS/	Automatic RHRS Flow Rate Control (Figure 7.3-60)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function			
	RHRS)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.				
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.				
	1			Systems With F	unctions Within 2 Red	undant Train Sets					
28	Main Control Room Air Conditioning System (CRACS)	Cooler Temperature Control (Figure 7.3-45)	Control 1 Division	ning Control 1 Divis	onditioning Control 1 I	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
				b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.				
			c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.					

Table 7.1-7—SAS FMEA Results Sheet 9 of 26

	T													
No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments						
29	Main Control Room Air Conditioning System (CRACS)	Pressure Control (Figure 7.3-44)Master CU : 1 Division	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function						
				b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.							
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.							
30	Annulus Ventilation System (AVS)	Accident Filtration Train Heater Control (Figure 7.3-31)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function						
					b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.						
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.							
31	Annulus Ventilation System (AVS)		Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function						
											b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.							
32	Component Cooling Water System (CCWS)	Vater System Supply Water Flow 1	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function						
			(Figure 7.3-37)	b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.							
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.							

Table 7.1-7—SAS FMEA Results Sheet 10 of 26

			Name of Sensor, Functional Unit, or			Inherent Compensating								
No	System	SAS Function	Equipment (2)	Failure Mode (1)	Method of Detection	Provision	Effect on the SAS Function	Comments						
33	Ventilation System Heate	Safety-Related Room Heater Control (Figure 7.3-39)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function						
				b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.							
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.							
34	Fuel Building Ventilation System (FBVS)	FBVS EBS / FPCS Pump Rooms Heat Removal	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function						
		(Figure 7.3-40)	(Figure 7.3-40)		b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.						
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.							
35	Fuel Pool Cooling and Purification System (FPCPS)	bling and System FPCPS Pump Trip on Low Spent Fuel Pool 1 Divis (SFP) Level (Figure 7.3-41)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function						
			(Figure 7.3-41)	(Figure 7.3-41)	(Figure 7.3-41)	(Figure 7.3-41)	(Figure 7.3-41)	(Figure 7.3-41)	(Figure 7.3-41)		b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.							
36	Main Control Room Air ConditioningIodine Filtration Train Heater Control (Figure 7.3-42)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function							
			b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.								
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.							

[Name of Sensor, Functional Unit, or		Sheet 11 of 26	Inherent Compensating			
No	System	SAS Function	Equipment (2)	Failure Mode (1)	Method of Detection	Provision	Effect on the SAS Function	Comments	
37	Main Control Room Air Conditioning System (CRACS)	Heater Control for Outside Inlet Air (Figure 7.3-43)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function	
				b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.		
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.		
				C	CWS Switchover Functi	ons		·	
38	Component Cooling Water System (CCWS)	CCWS Common 1.b Automatic Backup Switchover of Train 1 to Train 2 and Train 2 to Train 1 (Figure 7.3-33)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the error is alarmed. Loss of one train set. One remaining train set provides safety function.	No effects on the system function	
				b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.		
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.		
39	Component Cooling Water System (CCWS)	CCWS Common 2.b Automatic Backup Switchover of Train 3 to Train 4 and Train 4	Automatic Backup Switchover of Train 3 to Train 4 and Train 4	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the error is alarmed. Loss of one train set. One remaining train set provides safety function.	No effects on the system function
		to Train 3 (Figure 7.3-33)		b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.		
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.		
40	Component Cooling Water System (CCWS)	CCWS Emergency Leak Detection – Switchover Valves Leakage or Failure	Leak Detection – 1 D Switchover Valves	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the error is alarmed. Loss of one train set. One remaining train set provides safety function.	No effects on the system function
	(Figure 7.3-36)	e 7.3-36)	b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.			
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.		

Table 7.1-7—SAS FMEA Results Sheet 11 of 26

					Sheet 12 of 26				
No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments	
41	Component Cooling Water System (CCWS)	CCWS Switchover Valves Interlock (Figure 7.6-1)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the error is alarmed. Loss of one train set. One remaining train set provides safety function.	No effects on the system function	
				b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train pair. One remaining train set provide safety function.		
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.		
			1	CCWS RCF	P Thermal Barrier Interl	ock Function			
42	1 0	ter System Barrier Containment 1 I WS) Isolation Valve Interlock	er System Barrier Containment 1 Div VS) Isolation Valve Interlock		a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable. The function operates differently because a division cannot actuate the devices in another division after the master/ standby CU switchover occurs.	No effects on the system function
				b) Undetected - Spurious	None	Two redundant train sets and two CU pairs per division, one CU pair per train set	Spurious trigger of one train pair. The system automatically switches over to the other train pair. The other train pair performs the safety function.		
				c) Undetected - Blocking	None	Two redundant train sets and two CU pairs per division, one CU pair per train set	Loss of two CIVs. The remaining valves and train set provides safety function.		
43	43 Component Cooling Water System (CCWS) CCWS RCP Thermal Barrier Containment Isolation Valves Opening Interlock (Figure 7.6-12)	Barrier Containment 1 Division Isolation Valves Opening Interlock		a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable. The function operates differently because a division cannot actuate the devices in another division after the master/ standby CU switchover occurs.	No effects on the system function	
				b) Undetected - Spurious	None	Two redundant train sets and two CU pairs per division, one CU pair per train set	Spurious trigger of one train pair. The system automatically switches over to the other train pair. The other train pair performs the safety function.		
				c) Undetected - Blocking	None	Two redundant train sets and two CU pairs per division, one CU pair per train set	Loss of two CIVs. The remaining valves and train set provides safety function.		

No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments		
				Systems W	/ith Functions Utilizing	Voting Logic				
44	In-Containment Refueling Water Storage Tank System (IRWST)	IRWST Boundary Isolation for Preserving IRWST Water Inventory	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs in faulted division. Voting logic remains 2/4 in faulted division. Voting logic in other divisions is modified to 2/3.	No effects on the system function		
		Interlock (Figure 7.6-4)		b) Undetected - Spurious	None	Redundant divisions/ trains	Spurious trigger of one division / train. Voting in other divisions becomes 1/3.			
				c) Undetected - Blocking	None	Redundant divisions/ trains	Loss of one division / train. Voting in other divisions becomes 2/3.			
45	Safety Injection and Residual Heat Removal System (SIS/ RHRS)	sidual Heat LHSI Pump (in RHR moval System (SIS/ Mode) on Low ΔPsat	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs in faulted division. Voting logic remains 2/4 in faulted division. Voting logic in other divisions is modified to 2/3.	No effects on the system function		
				b) Undetected - Spurious	None	Redundant divisions/ trains	Spurious trigger of one division / train. Voting in other divisions becomes 1/3.			
				c) Undetected - Blocking	None	Redundant divisions/ trains	Loss of one division / train. Voting in other divisions becomes 2/3.			
46	Safety Injection and Residual Heat Removal System (SIS/ RHRS)	LHSI Pump (in RHR	LHSI Pump (in RHR Mode) on Low-Low	LHSI Pump (in RHR Mode) on Low-Low RCS Loop Level	HSI Pump (in RHR 1 Division ode) on Low-Low CS Loop Level	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs in faulted division. Voting logic remains 2/4 in faulted division. Voting logic in other divisions is modified to 2/3.	No effects on the system function
			5-10)	b) Undetected - Spurious	None	Redundant divisions/ trains	Spurious trigger of one division / train. Voting in other divisions becomes 1/3.	_		
				c) Undetected - Blocking	None	Redundant divisions/ trains	Loss of one division / train. Voting in other divisions becomes 2/3.			
				Systems	With Functions in 4 Div	ision/Trains	·	·		
47	Fuel Building Ventilation System (FBVS)	Isolation of FBVS on Containment Isolation (Figure 7.3-62)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function.	No effects on the system function		
			are 7.3-62)	b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
					c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		

Table 7.1-7—SAS FMEA Results

Table 7.1-7—SAS FMEA Result	ts
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No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments
48		RHR Isolation Valves Interlock (Figure 7.6-11)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Three remaining divisions / trains provide safety function.	No effects on the system function
	RHRS)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	
49	Component Cooling Water System (CCWS)	ling CCWS Emergency Temperature Control (Figure 7.3-34)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	_
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	
50	Component Cooling Water System (CCWS)	CCWS Emergency Leak Detection (Figure 7.3-35)	etection	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	_
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	
51	Emergency Feedwater System (EFWS)	SG Level Control (Figure 7.3-4)	ure 7.3-4) เ	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	

Table 7.1-7—SAS FMEA Results Sheet 15 of 26

No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments	
52	Emergency Feedwater System (EFWS)	EFWS Pump Flow Protection (Figure 7.3-4)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function	
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
53	Essential Service Water Pump Building Ventilation System	Temperature Control	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function	
	(ESWPBVS)	(Figure 7.3-38)	(Figure 7.3-38)		b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
					c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	
54	Main Control Room Air Conditioning System (CRACS)	Cooler Temperature Control (Figure 7.3-45)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function	
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
55		Pressure Control (Figure 7.3-44)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function	
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		

Table 7.1-7—SAS FMEA Result	S
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No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments		
56	Main Steam System (MSS)	Steam Generator MSRCV Regulation during Pressure	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function		
		Control (Figure 7.3-12)		b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			
57	Main Steam System (MSS)	Steam Generator MSRCV Regulation during Standby	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function		
		Position Control (Figure 7.3-12)		b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	_		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			
	Safeguard Building Controlled-Area Ventilation System	SIS/RHRS Pump Rooms Heat Removal (Figure 7.3-46)	ea Rooms Heat Removal	ntrolled-Area Rooms Heat Removal ntilation System (Figure 7.3-46)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function
	(SBVS)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
					c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
	Safeguard Building Controlled-Area Ventilation System	CCWS/EFWS Valve Rooms Heat Removal (Figure 7.3-47)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function		
	(SBVS)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
							c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.

Table 7.1-7—SAS FMEA Re	esults
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No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments		
60	Safeguard Building Ventilation System	Supply and Recirculation Exhaust Air Flow	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function		
	(SBVSE)	Control (Figure 7.3-48)		b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			
61	Ventilation System	Supply Fan Safe Shut- off (Figure 7.3-49)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function		
	(SBVSE)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.			
62	Safeguard Building Ventilation System	Recirculation Fan Safe Shut-off (Figure 7.3-50)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function		
	(SBVSE)				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
					c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
63	Safeguard Building Ventilation System	Exhaust Fan Safe Shut-off (Figure 7.3-51)	Shut-off	uard Building Shut-off	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function
	(SBVSE)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
					c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		

Table 7.1-7—SAS FMEA Results Sheet 18 of 26

No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments	
64	Safeguard Building Ventilation System	Supply Air Temperature Heater Control	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function	
	(SBVSE)	(Figure 7.3-52)		b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
65	Safeguard Building Ventilation System	guard Building (Figure 7.3-53) tilation System	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function	
	(SBVSE)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
	Safeguard Building Ventilation System	guard Building Temperature Control tilation System for Supply Air	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function	
	(SBVSE)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
67	Safeguard Building Ventilation System	of Battery Room Heater Loss Control (Figure 7.3-56)	ard Building Control	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function
	(SBVSE)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	_	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		

Table 7.1-7—SAS FMEA	Results
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No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments			
68	Electrical Division of Safeguard Building Ventilation System	Battery Room Supply Air Temperature Control	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function			
	(SBVSE)	(Figure 7.3-57)		b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.				
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.				
69	Electrical Division of Safeguard Building Ventilation System	Emergency Feed Water System (EFWS) Pump Room Heat Removal (Figure 7.3-58)	Water System EFWS) Pump Room	Water System (EFWS) Pump Room	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function	
	(SBVSE)		gure 7.3-58)	b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.				
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.				
70	Electrical Division of Safeguard Building Ventilation System	Pump Room Heat	Pump Room Heat Removal	Pump Room Heat	Pump Room Heat	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function
	(SBVSE)				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.				

Table 7.1-7—SAS FMEA	Results
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No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments		
71	Safety Chilled Water System (SCWS)	SCWS Train 1 to Train 2 Switchover on Train 1 Low Evaporator Flow /	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant cross-tied train sets	The error in the faulted division is alarmed. Loss of one cross-tied train set. One remaining cross-tied train set provides safety function.	No effects on the system function		
		Chiller Black Box Internal Fault / SCWS Chiller Evaporator Water		b) Undetected - Spurious	None	Two redundant cross-tied train sets	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
		Flow Control / LOOP Re-start Failure (Figure 7.6-5)	OP	c) Undetected - Blocking	None	Two redundant cross-tied train sets	Loss of one division / train. Unable to perform automatic SCWS train switchover function for the faulted cross-tied train set. One remaining cross-tied train set provides the safety function.			
72	System (SCWS)	System (SCWS) Train 1 Switchover on Train 2 Low Evaporator Flow /	Train 1 Switchover on Train 2 Low	m (SCWS) Train 1 Switchover on Train 2 Low Evaporator Flow /	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant cross-tied train sets	The error in the faulted division is alarmed. Loss of one cross-tied train set. One remaining cross-tied train set provides safety function.	No effects on the system function
		Chiller Black Box Internal Fault / Loss of UHS-CCWS / SCWS Chiller	nternal Fault / Loss	b) Undetected - Spurious	None	Two redundant cross-tied train sets	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
	Evaporato Flow Con Re-start	Evaporator Water Flow Control / LOOP		c) Undetected - Blocking	None	Two redundant cross-tied train sets	Loss of one division / train. Unable to perform automatic SCWS train switchover function for the faulted cross-tied train set. One remaining cross-tied train set provides the safety function.			
73	System (SCWS) Train 4 Switchover on Train 3 Low Evaporator Flow / Chiller Black Box Internal Fault / Loss of UHS-CCWS / SCWS Chiller Evaporator Water Flow Control / LOOP Re-start	em (SCWS) Train 4 Switchover on Train 3 Low Evaporator Flow / Chiller Black Box Internal Fault / Loss of UHS-CCWS / SCWS Chiller Evaporator Water Flow Control / LOOP	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant cross-tied train sets	The error in the faulted division is alarmed. Loss of one cross-tied train set. One remaining cross-tied train set provides safety function.	No effects on the system function		
			rnal Fault / Loss HS-CCWS /	b) Undetected - Spurious	None	Two redundant cross-tied train sets	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.			
			Evaporator Water Flow Control / LOOP Re-start		c) Undetected - Blocking	None	Two redundant cross-tied train sets	Loss of one division / train. Unable to perform automatic SCWS train switchover function for the faulted cross-tied train set. One remaining cross-tied train set provides the safety function.		

Т	able	7.1-7-	-SAS	FMEA	Results
		Sh	eet 21	of 26	

No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments	
	Safety Chilled Water System (SCWS)	SCWS Train 4 to Train 3 Switchover on Train 4 Low Evaporator Flow /	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant cross-tied train sets	The error in the faulted division is alarmed. Loss of one cross-tied train set. One remaining cross-tied train set provides safety function.	No effects on the system function	
		Chiller Black Box Internal Fault / SCWS Chiller Evaporator Water		b) Undetected - Spurious	None	Two redundant cross-tied train sets	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
		Flow Control / LOOP Re-start Failure (Figure 7.6-8)		c) Undetected - Blocking	None	Two redundant cross-tied train sets	Loss of one division / train. Unable to perform automatic SCWS train switchover function for the faulted cross-tied train set. One remaining cross-tied train set provides the safety function.		
	Safety Injection and Residual Heat Removal System (SIS/	Automatic RHRS Flow Rate Control (Figure 7.3-60)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function	
	RHRS)			b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.		
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.		
	·		•	Systems With F	Functions Within 2 Red	undant Train Sets	•		
76	Annulus Ventilation System (AVS)	Accident Filtration Train Heater Control (Figure 7.3-31)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant train sets	Loss of one train set. One remaining train set	One train set remains functional	
				b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train set. One remaining train set provide safety function.		
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.		
77	Annulus Ventilation System (AVS)	Accident Train Switchover (Figure 7.3-32)	Switchover	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant train sets	Loss of one train set. One remaining train set	One train set remains functional
				b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train set. One remaining train set provide safety function.		
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.		

Table 7.1-7—SAS FMEA Results Sheet 22 of 26

					1			
No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments
78	Component Cooling Water System (CCWS) SUPPly Water Flow Control	Supply Water Flow Control	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant train sets	Loss of one train set. One remaining train set	One train set remains functional
		(Figure 7.3-37)		b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train set. One remaining train set provide safety function.	
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.	
79		Safety-Related Room Heater Control (Figure 7.3-39)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant train sets	Loss of one train set. One remaining train set	One train set remains functional
			b)	b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train set. One remaining train set provide safety function.	
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.	
80	Fuel Building Ventilation System (FBVS)	FBVS EBS / FPCS Pump Rooms Heat Removal	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant train sets	Loss of one train set. One remaining train set	One train set remains functional
		(Figure 7.3-40)		b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train set. One remaining train set provide safety function.	
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.	
81	Purification System	Cooling and on System (SFP) Level (Figure 7.3-41)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant train sets	Loss of one train set. One remaining train set	One train set remains functional
			(Figure 7.3-41)	(Figure 7.3-41) b) Undeter	b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train set. One remaining train set provide safety function.
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.	

Table 7.1-7—SAS FMEA Results Sheet 23 of 26

No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments			
82	Main Control Room Air Conditioning System (CRACS)	Iodine Filtration Train Heater Control (Figure 7.3-42)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant train sets	Loss of one train set. One remaining train set	One train set remains functional			
				b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train set. One remaining train set provide safety function.				
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.				
83	Main Control Room Air Conditioning System (CRACS)	Heater Control for Outside Inlet Air (Figure 7.3-43)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant train sets	Loss of one train set. One remaining train set	One train set remains functional			
						b) Undetected - Spurious	None	Two redundant train sets	Spurious trigger of one train set. One remaining train set provide safety function.		
				c) Undetected - Blocking	None	Two redundant train sets	Loss of one train set. One remaining train set provides safety function.				
				Systems W	ith Functions Utilizing	Voting Logic					
84	In-Containment Refueling Water Storage Tank System	g Water Isolation for Fank System Preserving IRWST	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Redundant divisions/ trains	Loss of Master CU and Standby CU in faulted division. Voting logic in other divisions is modified to 2/3.	No effects on the system function			
	(IRWST)		Interlock	Interlock	Interlock		b) Undetected - Spurious	None	Redundant divisions/ trains	One division sends a spurious actuation. Voting logic in other divisions becomes 1/3.	
				c) Undetected - Blocking	None	Redundant divisions/ trains	Loss of Master CU and Standby CU in faulted division. Voting logic in other divisions becomes 2/3.				
85	Safety Injection and Residual Heat Removal System (SIS/	LHSI Pump (in RHR Mode) on Low ΔPsat	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Redundant divisions/ trains	Loss of Master CU and Standby CU in faulted division. Voting logic in other divisions is modified to 2/3.	No effects on the system function			
	RHRS)	(Figure 7.6-9)	⁷ igure 7.6-9) b)	b) Undetected - Spurious	None	Redundant divisions/ trains	One division sends a spurious actuation. Voting logic in other divisions becomes 1/3.				
					c) Undetected - Blocking	None	Redundant divisions/ trains	Loss of Master CU and Standby CU in faulted division. Voting logic in other divisions becomes 2/3.			

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No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments
86	•		Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Redundant divisions/ trains	Loss of Master CU and Standby CU in faulted division. Voting logic in other divisions is modified to 2/3.	No effects on the system function
	RHRS)	RCS Loop Level (Figure 7.6-10)		b) Undetected - Spurious	None	Redundant divisions/ trains	One division sends a spurious actuation. Voting logic in other divisions becomes 1/3.	
				c) Undetected - Blocking	None	Redundant divisions/ trains	Loss of Master CU and Standby CU in faulted division. Voting logic in other divisions becomes 2/3.	
				C	CWS Switchover Funct	ions	l	
87	Component Cooling Water System (CCWS)	oling CCWS Common 1.b Automatic Backup Switchover of Train 1 to Train 2 and Train 2 to Train 1 (Figure 7.3-33)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Failed sensor marked invalid; two redundant train pairs.	Unable to automatically perform switchover function in the faulted division. Loss of 1 train pair	A second pair serves its associated heat loads. Adequate cooling is provided by the second train pair.
			o Train 1		b) Undetected - Spurious	None	Two redundant trains pairs	Unable to automatically perform switchover function in the faulted division. Loss of 1 train pair
				c) Undetected - Blocking	None	Two redundant trains pairs	Unable to automatically perform switchover function in the faulted division. Loss of 1 train pair	
88	Component Cooling Water System (CCWS)	CCWS Common 2.b Automatic Backup Switchover of Train 3	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Failed sensor marked invalid; two redundant train pairs.	Unable to automatically perform switchover function in the faulted division. Loss of 1 train pair	A second pair serves its associated heat loads. Adequate cooling is provided by the second train pair
		to Train 4 and Train 4 to Train 3 (Figure 7.3-33)		b) Undetected - Spurious	None	Two redundant trains pairs	Unable to automatically perform switchover function in the faulted division. Loss of 1 train pair	
				c) Undetected - Blocking	None	Two redundant trains pairs	Unable to automatically perform switchover function in the faulted division. Loss of 1 train pair	
89	Component Cooling Water System (CCWS)	CCWS Emergency Leak Detection – Switchover Valves	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Failed sensor marked invalid; two redundant train pairs.	Unable to automatically perform switchover function in the faulted division. Loss of 1 train pair	A second pair serves its associated heat loads. Adequate cooling is provided by the second train pair
		Leakage or Failure (Figure 7.3-36)	Figure 7.3-36)	b) Undetected - Spurious	None	Two redundant trains pairs	Unable to automatically perform switchover function in the faulted division. Loss of 1 train pair	
				c) Undetected - Blocking	None	Two redundant trains pairs	Unable to automatically perform switchover function in the faulted division. Loss of 1 train pair	

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No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments
90	Component Cooling Water System (CCWS)	CCWS Switchover Valves Interlock (Figure 7.6-1)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Failed sensor marked invalid; two redundant train pairs.	Unable to automatically perform switchover function in the faulted division. Loss of 1 train pair	A second pair serves its associated heat loads. Adequate cooling is provided by the second train pair
				b) Undetected - Spurious	None	Two redundant trains pairs	Unable to automatically perform switchover function in the faulted division. Loss of 1 train pair	
				c) Undetected - Blocking	None	Two redundant trains pairs	Unable to automatically perform switchover function in the faulted division. Loss of 1 train pair	
				CCWS RCF	P Thermal Barrier Interl	ock Function		·
91	Component Cooling Water System (CCWS)	Barrier Containment Isolation Valve	rier Containment ation Valve	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant train sets in two divisions	The failed division's valves fail as-is. The other division provides the interlock function.	In each division one CU pair will detect one train set and provide the necessary actuations. The other CU pair in a division will detect the other train set and provide it's necessary actuations. This provides additional reliability, because if one CU is inoperable in
		Interlock (Figure 7.6-2)		b) Undetected - Spurious	None	Two redundant train sets and two CU pairs per division, one CU pair per train set	See Comments.	
				c) Undetected - Blocking	None	Two redundant train sets and two CU pairs per division, one CU pair per train set	See Comments.	a division, the system can still perform its interlock function. An undetected failure of a whole division for this function would be an undetected failure of multiple CU pairs in a division, which is beyond a single failure and over conservative. Therefore a undetected failure of a whole division is not considered for this function.

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					Sheet 26 of 26			
No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments
92	Component Cooling Water System (CCWS)	CCWS RCP Thermal Barrier Containment Isolation Valves	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant train sets in two divisions	The failed division's valves fail as-is. The other division provides the interlock function.	In each division one CU pair will detect one train set and provide the necessary actuations. The
		Opening Interlock (Figure 7.6-12).		b) Undetected - Spurious	None	Two redundant train sets and two CU pairs per division, one CU pair per train set	See Comments.	 other CU pair in a division will detect the other train set and provide it's necessary actuations. This provides additional reliability, because if one CU is inoperable in a division, the system can still perform its interlock function. An undetected failure of a whole division for this function would be an undetected failure of multiple CU pairs in a division, which is beyond a single failure and over conservative. Therefore a undetected failure of a whole division is not considered for this function.
				c) Undetected - Blocking	None	Two redundant train sets and two CU pairs per division, one CU pair per train set	See Comments.	
					All SAS Functions			
93	All systems for which SAS performs a function.	All SAS functions	Standby CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Master/Standby CU configuration.	None - Master CU in affected division remains functional	No effects on the system function
				b) Undetected - Spurious	None	Master/Standby CU configuration.	None - Master CU in affected division remains functional	
				c) Undetected - Blocking	None	Master/Standby CU configuration.	None - Master CU in affected division remains functional	

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Notes:

- 1. Failure Mode The failure cause is not identified in the system-level analysis. The failure modes are selected to bound the results of any specific failure cause. Specific failure causes can be identified only after specific equipment is selected and application software is developed.
- 2. This FMEA has been analyzed for loss of a CU and loss of a division failure. These types of failures encompass any single failure within a division, (i.e. loss of a sensor, hardwired logic failure / fault).