U.S. EPR Design Certification

RAI 579 Response – US EPR FSAR Markups

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AREVA

Meeting Purpose and Outline

- Purpose of this meeting is to gain NRC review and concurrence on path forward for RAI 579 response
- Review Chapter 5 FSAR Changes
- Review Chapter 7 FSAR Changes
- Review Chapter 16 FSAR Changes
- Review Other Tier 1 and COL Item Changes

5.4.7.2.1 Design Features Addressing Shutdown and Mid-Loop Operations

The design features of the U.S. EPR that support improved safety during shutdown and mid-loop operations, addressing NRC Generic Letter 88-17 (Reference 16) and SECY 93-087 (Reference 17), are as follows:

- Inherent redundancy in the design of the four divisions of safety-related U.S. EPR SIS/RHRS, with each train having separate RCS connections.

- Automatic SIS Actuation (Protection System) ~~and automatic stop of LHSI pumps in RHR mode (PAS)~~ in the event of a low loop level or low delta-P_{sat} (difference between the RCS hot leg temperature and the RCS hot leg saturation temperature). See Figure 7.3-2—SIS Actuation.
  - Automatic safety injection via MHSI with reduced discharge head during low loop level provides RCS makeup in the event of spurious draining of the RCS as described in Section 6.3.1. Operability of MHSI is controlled by Technical Specification 3.5.8.
  - Stage 1 Containment Isolation – isolates CVCS letdown and RHR hot leg suction lines.

- Manual opening and closure of the RHR suction isolation valves (in addition to interlocks) prevent unwanted RHR connection or isolation on irregular RCS pressure. See Figure 7.6-11—RHR Isolation Valves Interlock.

- ~~Automatic safety injection via MHSI with reduced discharge head during low loop level ensures availability of the LHSI pumps for the RHR function. A note in Technical Specification 3.5.8 allows this automatic actuation feature to be removed from service temporarily for personnel protection during selected RCS maintenance activities.~~
  - ~~Routine RCS maintenance (e.g., refueling) will be performed during a full fuel offload.~~
  - ~~Infrequent RCS maintenance (e.g., mid-cycle steam generator repair) will be performed subject to the note in Technical Specification 3.5.8. During these infrequent RCS maintenance activities, automatic MHSI actuation may be disabled (as needed) to ensure personnel protection when fuel is in the reactor vessel. When this provision in Technical Specification 3.5.8 is used, compensatory actions will be taken to provide reasonable assurance that the MHSI function can be promptly restored to manage the plant risk. The risk associated with disabling and restoring MHSI during these evolutions is discussed further in Chapter 19. Additionally, a COL applicant that references the U.S. EPR design certification will assess the risk (impact on the PRA and risk significant human actions) associated with RCS maintenance performed with fuel in the vessel.~~

- Safety Related (SAS) automatic stop of the LHSI pumps in RHR mode in the event of a low loop level or low delta-P_{sat} prevents cavitation of operating LHSI pumps due to air ingestion or steam entering the system.

- In the event of LHSI pump trip, automatic safety injection via MHSI in response to a low loop level or low delta-P_{sat} provides RCS makeup and allows time to re-establish RHR/LHSI heat exchanger flow to reject heat from the RCS and Containment to the plant cooling systems.

- The RHR connection will be automatically isolated and the LHSI pump stopped in the event of a break outside of the containment, based on the safeguard building sump level and pressure sensors. This non-safety function is performed by PAS.

- Spring-loaded safety relief valve, located at the RHR hot leg suction line, protects the SIS/RHRS against over-pressurization when in RHR mode.

- During mid-loop operations, a maximum RHR flow rate will be established which minimizes the probability of suction pipe vortexing while providing adequate decay heat removal.

- Redundant hot leg level sensors that initiate RCS make-up (safety and non-safety related) when the RCS hot leg has reached low level.

- RCS maintenance requiring disabling of MHSI will be performed during a full fuel offload. The design of the U.S. EPR does not include the use of nozzle dams with fuel in the vessel.~~When nozzle dams are installed the following recommendations will be implemented:~~

  - ~~Removal of the pressurizer manway while the nozzle dams are installed and the reactor vessel head is in place. This action limits the pressurization of the RCS and inboard side of the nozzle dams which could follow an extended loss of decay heat removal.~~

  - ~~A hot leg manway will be the first manway to be opened.~~

  - ~~A hot leg nozzle dam will be the last dam to be installed.~~

  - ~~A hot leg manway and its associated hot leg pipe will be kept open to provide an adequate vent path whenever any cold leg openings are made.~~

  - ~~The expeditious actions in GL 88 17 to be implemented any time that nozzle dams are installed.~~

- During mid-loop operation, the RCS loop level is normally controlled by the CVCS low pressure reducing valve to ensure there is sufficient RCS water inventory for operation of the LHSI pumps in RHR mode. The level control, limitation, and protection features are described below:

Loop Level Control Function	The RCS loop level control during mid-loop operation is regulated by the CVCS high pressure charging pumps and CVCS low pressure reducing station. See Section 7.7.2.2.3 for a description of loop level control. After the loop level control mode has been manually validated, certain automatic protection functions are actuated. The nominal control band is shown on Figure 5.4-19.

Max1 RCS Loop Level Limitation Function	This setpoint initiates an open command for the CVCS low pressure letdown control valve in order to prevent inadvertent filling of the steam generator bowls(without nozzle dams). The Max1 setpoint is shown on Figure 5.4-19.
Min1 RCS Loop Level Limitation Function	This setpoint initiates full closure of the CVCS low pressure letdown control valve and the RHR and CVCS isolation valves in order to protect the LHSI pumps that are operating in RHR mode. This function covers the entire temperature range of the RHR system operation. The Min1 setpoint is shown on Figure 5.4-19.
Min1p RCS Loop Level Safety Function	This setpoint initiates the SIS in case of low RCS level in the primary loops in the event of a sudden drop in RCS level during mid-loop operation in order to protect the RHR pumps and maintain adequate core cooling. to provide RCS makeup and a stage 1 containment isolation signal. This setpoint also initiates automatic stop of the LHSI pumps in RHR mode to prevents cavitation of operating LHSI pumps due to air ingestion. The Min1p setpoint is shown on Figure 5.4-19.

- The reactor pressure vessel (RPV) water level is continually monitored during an outage with a level sensor. The level sensor taps are located on the top and bottom of each hot leg approximately ten feet from the steam generator center line and approximately six feet closer to the steam generator than the LHSI RHR discharge nozzle.

Temperature sensors, located at the RCS hot legs, allow temperature measurement of each hot leg when in a reduced inventory condition.

Figure 5.1-3—RCS Elevation

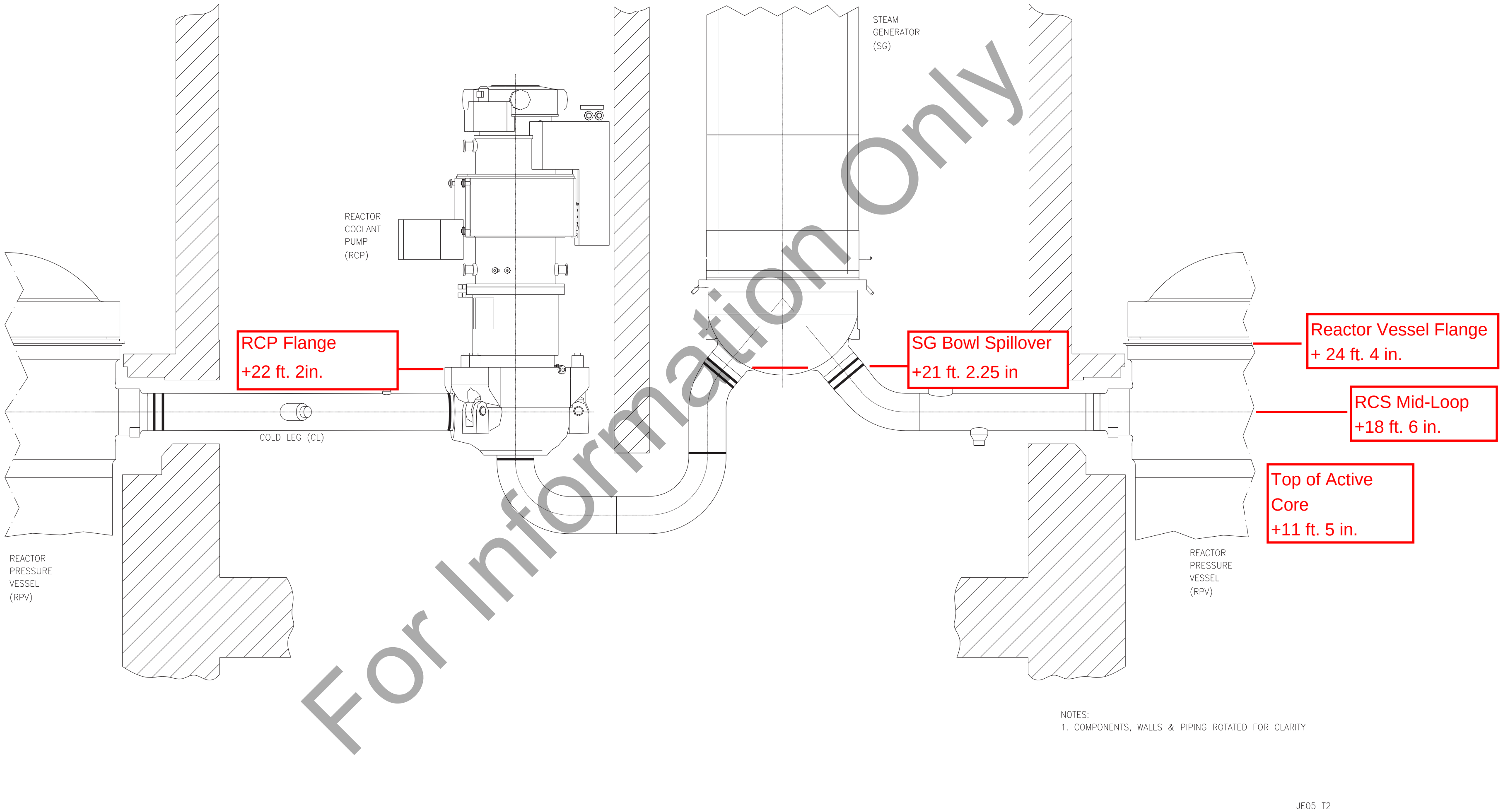
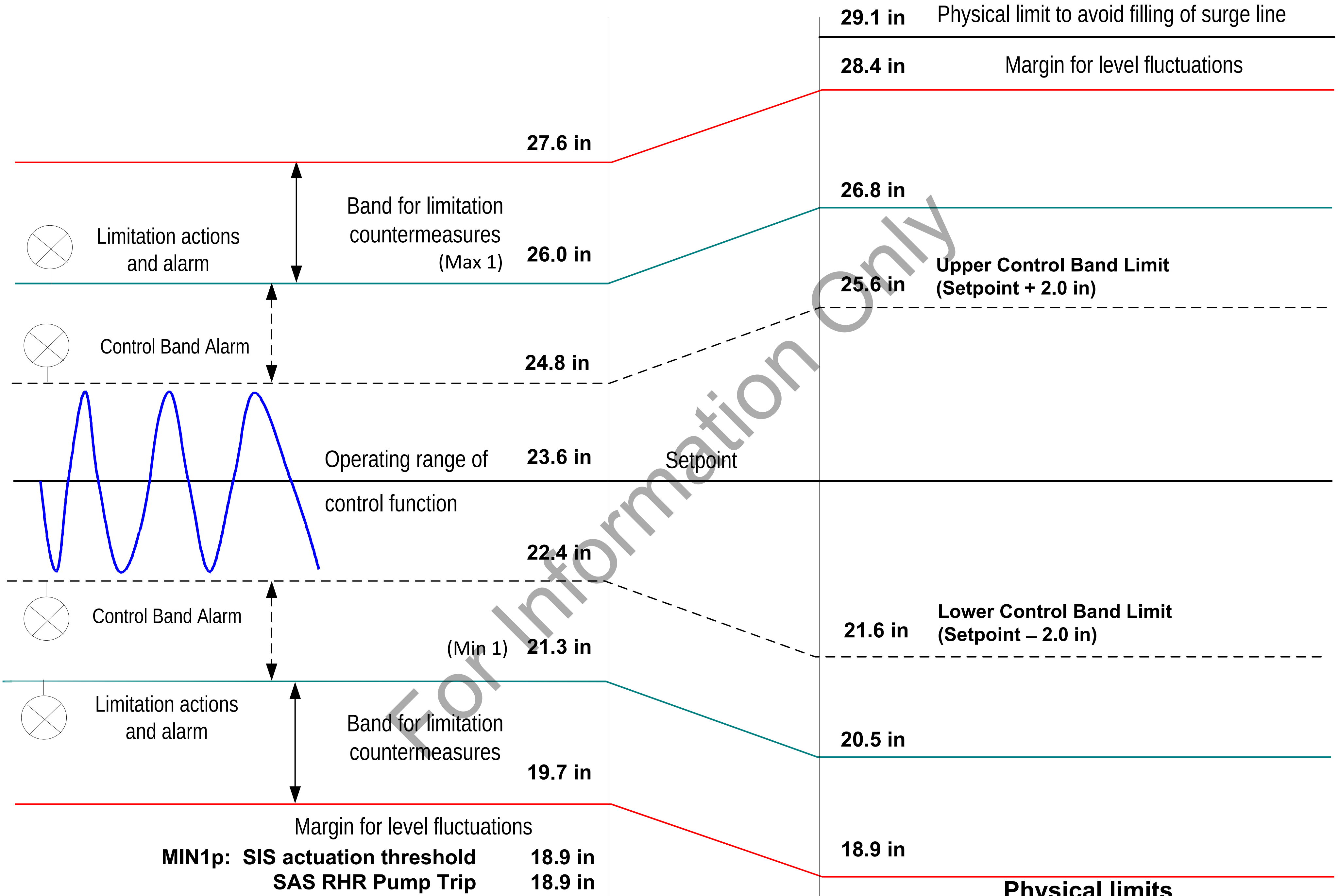


Figure 5.4-19 Level Control During Midloop Operation



MIN1p: SIS actuation threshold 18.9 in

SAS RHR Pump Trip 18.9 in

Setpoints are approximate based on future operational procedures and setpoint calculations considering uncertainty bands.

Table 7.1-5—SAS Automatic Safety Function

System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Function Initiation[7]
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 7.6.1.2.5 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	Continuous Operation
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 7.6.1.2.5 and 9.2.8.	NO	NA	NA	Continuous Operation
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	Manual

System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Function Initiation[7]
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	

Table 7.1-7—SAS FMEA Results
Sheet 15 of 28

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 With Functions Utilizing Voting Logic								
50	In-Containment Refueling Water Storage Tank System (IRWST)	IRWST Boundary Isolation for Preserving IRWST Water Inventory Interlock (Figure 7.6-4)	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 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.	
51	Deleted							
52	Deleted							
51	Safety Injection and Residual Heat Removal System (SIS/RHRS)	Automatic Trip of LHSI Pump (in RHR Mode) on Low Psat (Figure 7.6-9)	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.	
52	Safety Injection and Residual Heat Removal System (SIS/RHRS)	Automatic Trip of LHSI Pump (in RHR Mode) on Low RCS Loop Level (Figure 7.6-10)	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.	
Systems With Functions in 4 Division/Trains								

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
53	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
				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	Safety Injection and Residual Heat Removal System (SIS/ RHRS)	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
				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 26 of 28

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
94	Safeguard Building Controlled-Area Ventilation System (SBVS)	Iodine Filtration Train Electric Heater Control (Figure 7.3-66)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Two redundant divisions/ trains	Loss of one train set. One remaining train set provides safety function.	No effects on the system function
				b) Undetected - Spurious	None	Two redundant divisions/ trains	Spurious trigger of one train pair. One remaining train set provides safety function.	
				c) Undetected - Blocking	None	Two redundant divisions/ trains	Loss of one train set. One remaining train set provides safety function.	
Systems With Functions Utilizing Voting Logic								
95	In-Containment Refueling Water Storage Tank System (IRWST)	IRWST Boundary Isolation for Preserving IRWST Water Inventory Interlock (Figure 7.6-4)	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
				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.	
~~96~~	~~Deleted~~							
~~97~~	~~Deleted~~							
96	Safety Injection and Residual Heat Removal System (SIS/RHRS)	Automatic Trip of LHSI Pump (in RHR Mode) on Low Psat (Figure 7.6-9)	Loss of 1 Division	d) 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
				e) Undetected -Spurious	None	Redundant divisions/trains	One division sends a spurious actuation. Voting logic in other divisions becomes 1/3.	
				f) Undetected - Blocking	None	Redundant divisions/trains	Loss of Master CU and Standby CU in faulted division. Voting logic in other divisions is modified to 2/3.	
97	Safety Injection and Residual Heat Removal System (SIS/RHRS)	Automatic Trip of LHSI Pump (in RHR Mode) on Low RCS Loop Level (Figure 7.6-10)	Loss of 1 Division	d) 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
				e) Undetected -Spurious	None	Redundant divisions/trains	One division sends a spurious actuation. Voting logic in other divisions becomes 1/3.	
				f) Undetected - Blocking	None	Redundant divisions/trains	Loss of Master CU and Standby CU in faulted division. Voting logic in other divisions is modified to 2/3.	
CCWS Switchover Functions								

98	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)	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.	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	Spurious trigger of one pilot valve. Remaining pilot valves provide safety function.	
				c) Undetected - Blocking	None	Two redundant trains pairs	Loss of one pilot valve. Remaining pilot valves provide safety function.	
99	Component Cooling Water System (CCWS)	CCWS Common 2.b Automatic Backup Switchover of Train 3 to Train 4 and Train 4 to Train 3 (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.	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	Spurious trigger of one pilot valve. Remaining pilot valves provide safety function.	
				c) Undetected - Blocking	None	Two redundant trains pairs	Loss of one pilot valve. Remaining pilot valves provide safety function.	

the P14 permissive, providing a third diverse condition that must be satisfied to allow valve opening.

Another safety-related interlock prevents the opening of the RHR RCPB isolation valves, unless the LHSI suction isolation valve is closed. This prevents the LHSI suction from the IRWST from being exposed to the higher pressures of the RCS. The functional logic for this RHR isolation valve interlock is shown in Figure 7.6-11— RHR Isolation Valves Interlock.

When RHR is connected, an inadvertent increase in RCS pressure does not result in an automatic signal to close the RHR RCPB isolation valves. However, the following design features prevent an increasing pressure from exceeding the RHR system design pressure:

- Interlock holding the MHSI large miniflow lines open (see Section 7.6.1.2.6).
- Pressurizer safety relief valves operating in their LTOP mode (see Section 7.3.1.2.13).
- Spring loaded safety valves on the RHR suction lines.

During an intentional increase in pressure, when RCS temperature and pressure exceed the P14 permissive setpoint, the operator is prompted to manually inhibit the P14 permissive, and is then allowed to close the RHR RCPB isolation valves.

The operational status of the PS on a divisional basis is provided to the operator. Indications and alarms are provided to the operator regarding the state of the P14 permissive signal. Additionally, the following indications are provided to the operator to verify correct operation of the interlock:

- Open or closed position of first RHR RCPB isolation valve (each train).
- Open or closed position of second RHR RCPB isolation valve (each train).

7.6.1.2.2 SIS / RHRS Automatic Trip of LHSI Pump (in RHR Mode) on Low ΔPsat Interlock

The SIS/RHRS has a safety-related function to provide the RCS residual heat removal to reach cold shutdown, refueling modes and to control primary temperature. The function to automatically trip the LHSI pump upon a low ΔPsat signal supports the safety-related function of providing residual heat removal by maintaining LHSI pump operability by shutting down the pump to prevent pump damage due to inadequate net positive suction head (NPSH) or unavailability due to steam binding following a failure that results in RCS conditions approaching saturation. The functional logic is shown in Figure 7.6-9 - SIS/RHRS Automatic Trip of LHSI Pump (in RHR Mode) on Low ΔPsat Interlock.

7.6.1.2.3 SIS / RHRS Automatic Trip of LHSI Pump (in RHR Mode) on Low RCS Loop Level Interlock

The SIS/RHRS has a safety-related function to provide the RCS residual heat removal to reach cold shutdown, refueling modes and to control primary temperature. The function to automatically trip the LHSI pump upon a low RCS loop level signal supports the safety-related function of providing residual heat removal by maintaining LHSI pump operability by shutting down the pump to prevent pump damage or unavailability due to air binding following a failure that results in low RCS loop level. The functional logic is shown in Figure 7.6-10 - SIS/RHRS Automatic Trip of LHSI Pump (in RHR Mode) on Low RCS Loop Level Interlock.

7.6.1.2.4 Safety Injection Accumulator Interlocks

There are four accumulators, one associated with each of the four independent SIS trains. Borated water is injected into the RCS from the accumulators when RCS pressure falls below the internal pressure of the accumulators.

The operation of the SI accumulators is described in Section 6.3.

Each accumulator is connected to the cold leg injection line of its respective RCS loop through two check valves and a motor operated isolation valve in series. Each isolation valve is interlocked to remain fully open above a specified RCS pressure value in Modes 1, 2, 3, and 4. This pressure value is the P12 permissive threshold. The accumulators are used to provide safety injection into the RCS during higher pressures.

Figure 7.6-9 - SIS / RHRS Automatic Trip of LHSI Pump (in RHR Mode) on Low ΔPsat Interlock

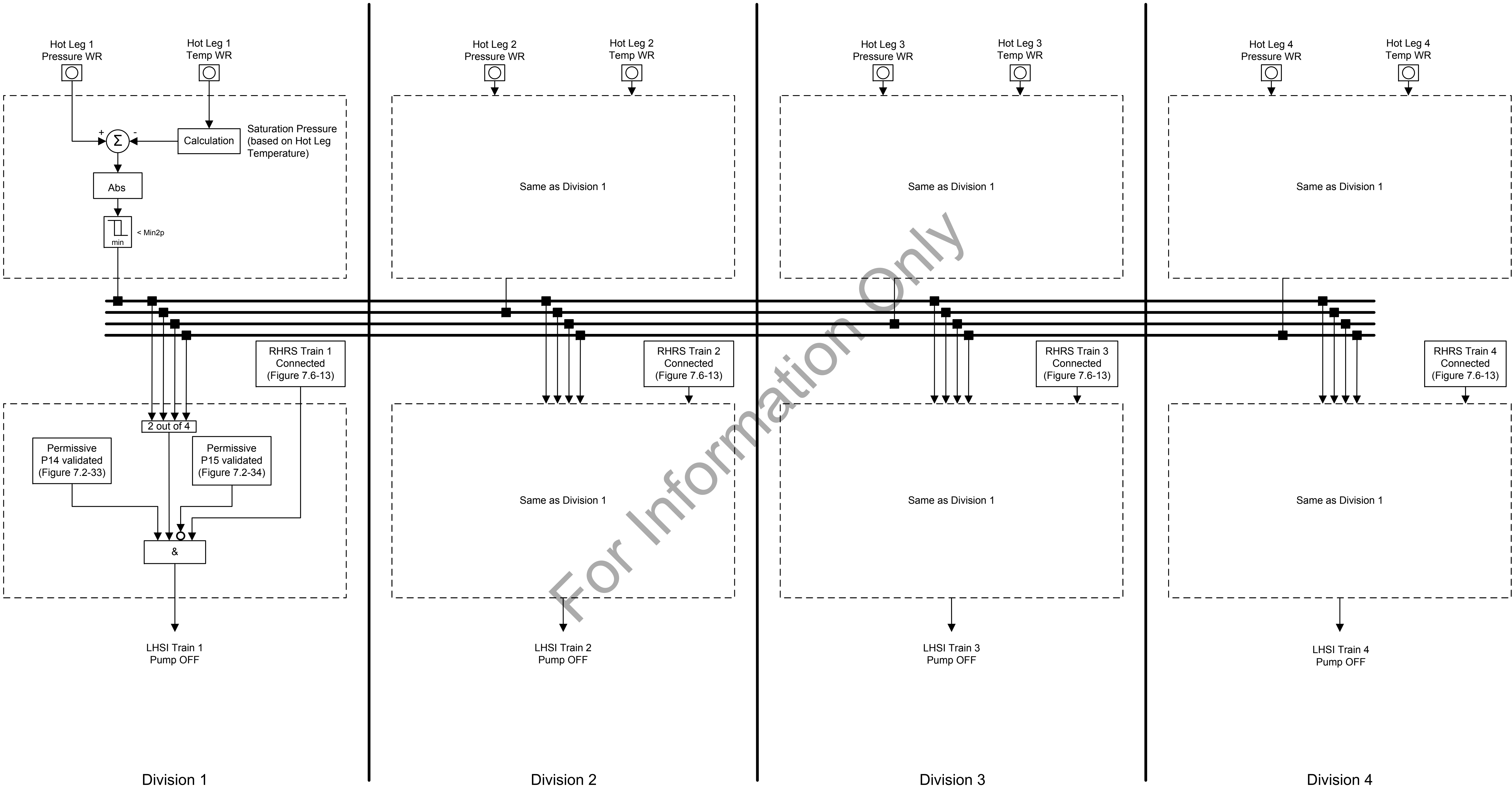


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Figure 7.6-10 - SIS / RHRS Automatic Trip of LHSI Pump (in RHR Mode) on Low RCS Loop Level Interlock

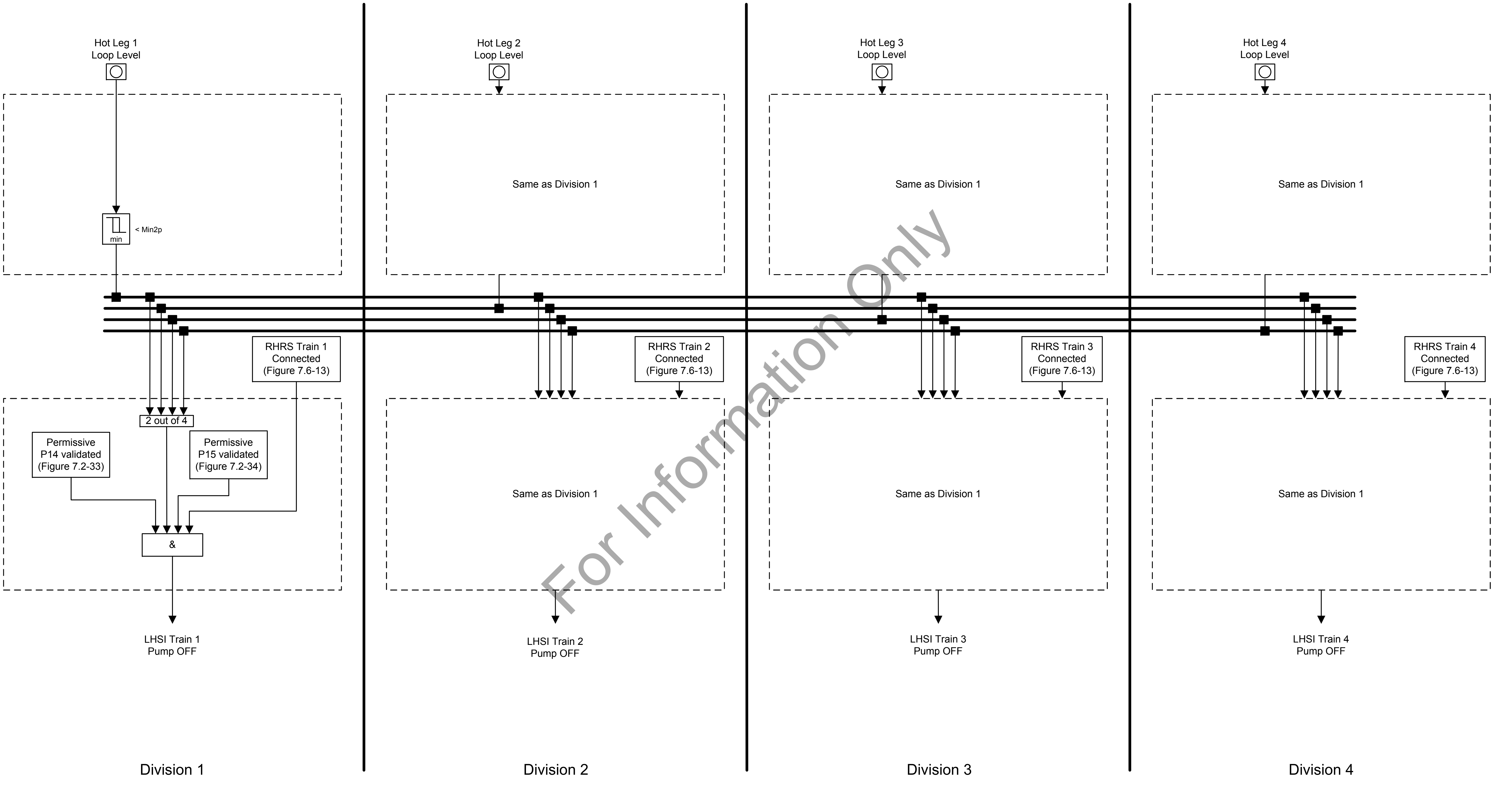
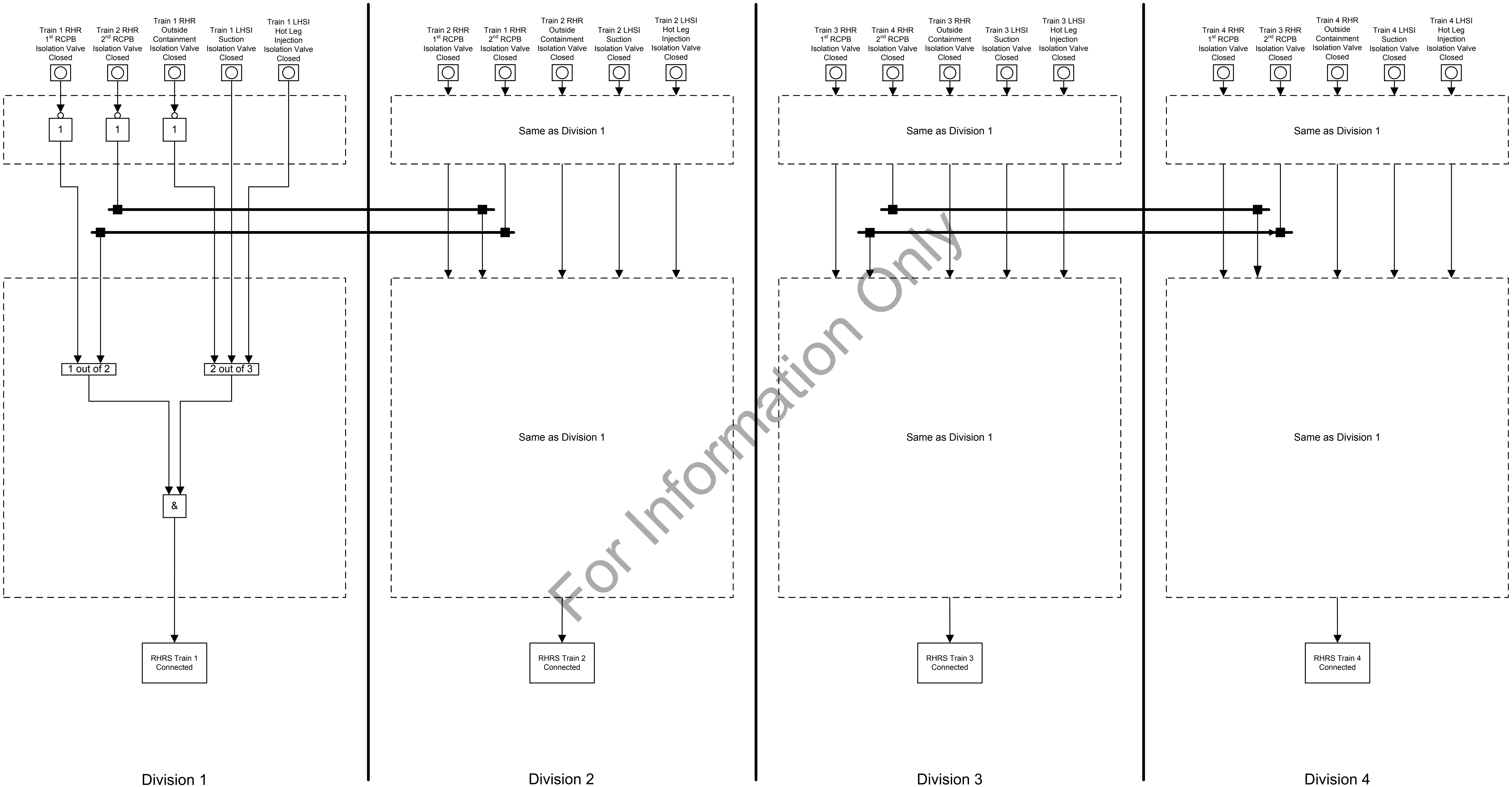


Figure 7.6-13 - RHRS Trains Connected Interlock



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3.3 INSTRUMENTATION

3.3.2 Engineered Safety Feature Actuation System (ESFAS) Instrumentation

LCO 3.3.2 The ESFAS instrumentation for each Function in Table 3.3.2-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.2-1.

ACTIONS

-- NOTE --
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more Functions with one or more divisions inoperable.	A.1	Enter the applicable Condition referenced in Table 3.3.2-1.	Immediately
B. One Input & Acquisition Logic division inoperable.	B.1	Verify Actuation Logic voting is modified.	6 hours
C. One required Input & Acquisition Logic division inoperable.	C.1	Verify Actuation Logic voting is modified.	6 hours
	<u>AND</u>		
	C.2	Restore required Input & Acquisition Logic division to OPERABLE status.	72 hours

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.8 ECCS - Shutdown, MODES 5 and 6

LCO 3.5.8 Two Medium Head Safety Injection (MHSI) trains shall be OPERABLE.

~~NOTE~~

~~The required OPERABLE MHSI trains may be removed from service for up to 24 hours with vessel level at or above mid-loop reactor vessel level provided no operations are permitted that would cause perturbation of RCS inventory.~~

APPLICABILITY: MODE 5,
MODE 6 with the refueling cavity not filled.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required MHSI train inoperable.	A.1 Restore required MHSI train to OPERABLE status.	72 hours
B. Two required MHSI trains inoperable.	B.1 Initiate action to restore at least one MHSI train to OPERABLE status.	Immediately
C. Required Action and associated Completion Time not met.	C.1.1 Initiate action to be in MODE 5 with the RCS pressure boundary intact and ≥ 25% pressurizer level.	Immediately
	<u>OR</u>	
	C.1.2 Initiate action to achieve refueling cavity water level ≥ 23 feet above the reactor vessel flange.	Immediately
	<u>AND</u>	
	C.2 Suspend positive reactivity additions.	Immediately

BASES

LCO (continued)

During an event requiring ECCS MHSI actuation, a flow path is required to provide an abundant supply of water from the IRWST to the RCS via the ECCS pumps and to its associated four cold leg injection nozzles.

~~The LCO modified by a Note allows the required OPERABLE MHSI trains to be removed from service for up to 24 hours for personnel protection during RCS maintenance activities, such as installation of nozzle dams and replacement of reactor coolant pump seals, provided no operations are permitted that would cause perturbation of RCS inventory.~~

APPLICABILITY

In MODES 1, 2, and 3, the OPERABILITY requirements for ECCS are covered by LCO 3.5.2. MODE 4 OPERABILITY is covered by LCO 3.5.3.

In MODES 5 and 6, two OPERABLE ECCS MHSI trains are acceptable and provide for single failure consideration.

Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.4, "RHR Loops - High Water Level," and LCO 3.9.5, "RHR Loops - Low Water Level."

ACTIONS

A.1

With one required MHSI train inoperable, the inoperable MHSI train must be returned to OPERABLE status within 72 hours. The 72 hour Completion Time is based on an NRC reliability evaluation (Ref. 5) and is a reasonable time for repair of many ECCS components.

An ECCS MHSI train is inoperable if it is not capable of delivering design flow to the RCS. Individual components are inoperable if they are not capable of performing their design function or supporting systems are not available.

B.1

If two required ECCS MHSI trains are inoperable, immediate action must be taken to restore at least one MHSI train to OPERABLE status.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.5.1	Verify one RHR loop is in operation and circulating reactor coolant at a flow rate of ≥ 2200 gpm and < 2700 gpm.	12 hours
SR 3.9.5.2	-------------------------------NOTE------------------------------ Not required to be performed until 24 hours after a required RHR loop not in operation. -- Verify correct breaker alignment and indicated power are available to each required LHSI pump.	7 days

BASES

ACTIONS (continued)

c. Each penetration providing direct access from the containment atmosphere to the outside atmosphere must be either closed by a manual or automatic isolation valve, blind flange, or equivalent, or verified to be capable of being closed by an OPERABLE Containment Ventilation System.

With the RHR loop requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Performing the actions stated above ensures that all containment penetrations are either closed or can be closed so that the dose limits are not exceeded.

The Completion Time of 4 hours allows fixing of most RHR problems and is reasonable, based on the low probability of the coolant boiling in that time and the features available to maintain RHR operation and vessel level (Ref. 1).

SURVEILLANCE REQUIREMENTS

SR 3.9.5.1

This Surveillance demonstrates that one RHR loop is in operation and circulating reactor coolant. The minimum flow rate specified is to prevent thermal and boron stratification in the core. The maximum flow rate specified is to minimize the potential for pump air ingestion. The Frequency of 12 hours is sufficient, considering the flow, temperature, pump control, and alarm indications available to the operator for monitoring the RHR System in the control room.

SR 3.9.5.2

Verification that the required pump is OPERABLE ensures that an additional LHSI pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the required pump. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience. This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a required pump is not in operation.

REFERENCES

1. FSAR Section 5.4.7.

Table 1.8-2—U.S. EPR Combined License Information Items
Sheet 17 of 39

Item No.	Description	Section
3E-1	A COL applicant that references the U.S. EPR design certification will address critical sections relevant to site-specific Seismic Category I structures.	3E
5.2-1	Deleted.	
5.2-2	A COL applicant that references the U.S. EPR design certification will identify additional ASME code cases to be used.	5.2.1.2
5.2-3	A COL applicant that references the U.S. EPR design certification will identify the implementation milestones for the site-specific ASME Section XI preservice and inservice inspection program for the reactor coolant pressure boundary, consistent with the requirements of 10 CFR 50.55a (g). The program will identify the applicable edition and addenda of the ASME Code Section XI, and will identify additional relief requests and alternatives to Code requirements.	5.2.4
5.2-4	A COL applicant that references the U.S. EPR design certification will develop procedures in accordance with RG 1.45, Revision 1.	5.2.5.5
5.3-1	A COL applicant that references the U.S. EPR design certification will identify the implementation milestones for the material surveillance program.	5.3.1.6
5.3-2	A COL applicant that references the U.S. EPR design certification will provide a plant-specific pressure and temperature limits report (PTLR), consistent with an approved methodology.	5.3.2.1
5.3-3	A COL applicant that references the U.S. EPR design certification will provide plant-specific RT_{PTS} values in accordance with 10 CFR 50.61 for vessel beltline materials.	5.3.2.3
5.3-4	A COL applicant that references the U.S. EPR design certification will provide plant-specific surveillance data to benchmark BAW-2241P-A and demonstrate applicability to the specific plant.	5.3.1.6.2
5.4-1	A COL applicant that references the U.S. EPR design certification will identify the edition and addenda of ASME Section XI applicable to the site specific Steam Generator inspection program.	5.4.2.5.2.2
~~5.4-2~~	~~A COL applicant that references the U.S. EPR design certification will assess the risk (impact on the PRA and risk significant human actions) associated with RCS maintenance performed with fuel in the vessel.~~	~~5.4.7.2.1~~
6.1-1	A COL applicant that references the U.S. EPR design certification will review the fabrication and welding procedures and other QA methods of ESF component vendors to verify conformance with RGs 1.44 and 1.31.	6.1.1.1

Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables
Sheet 9 of 9

System	Function Name	Input Variable
Safety Injection and Residual Heat Removal System (SIS/RHRS)	Automatic RHRS Flow Rate Control	RHRS Flow Rate Signal
		RHRS Temperature
		RHRS Pump Discharge Pressure
	RHR Isolation Valves Interlock	LHSI Suction Isolation Valve Position
		RHR 1st RCPB Isolation Valve Position
		RHR 2nd RCPB Isolation Valve Position
	Automatic Trip of LHSI Pump (in RHR Mode) on Low Delta Psat Interlock	Hot Leg Temperature (WR) Hot Leg Pressure (WR)
	Automatic Trip of LHSI Pump (in RHR Mode) on Low RCS Loop Level Interlock	Hot Leg Loop Level

Table 2.4.4-3—Safety Automation System Interlocks

CCWS Switchover Valves Interlock
CCWS RCP Thermal Barrier Containment Isolation Valve Interlock
CCWS RCP Thermal Barrier Containment Isolation Valves Opening Interlock
IRWST Boundary Isolation for Preserving IRWST Water Inventory Interlock
SCWS Train 1 to Train 2 Switchover on Train 1 Loss of Pump / Loss of Chiller / SCWS Chiller
Evaporator Water Flow Control / LOOP Re-Start Failure Interlock
SCWS Train 2 to Train 1 Switchover on Train 2 Loss of Pump / Loss of Chiller / SCWS Chiller
Evaporator Water Flow Control / LOOP Re-Start Failure Interlock
SCWS Train 3 to Train 4 Switchover on Train 3 / SCWS Chiller Evaporator Water Flow Control / LOOP Re-Start Failure Interlock
SCWS Train 4 to Train 3 Switchover on Train 4 Loss of Pump / Loss of Chiller / SCWS Chiller
Evaporator Water Flow Control / LOOP Re-Start Failure Interlock
Automatic Trip of LHSI Pump (in RHR Mode) on Low Delta Psat Interlock
Automatic Trip of LHSI Pump (in RHR Mode) on Low RCS Loop Level Interlock
RHR Isolation Valves Interlock

Path Forward

1. **Provide final response to RAI 579 to NRC on 5/30/14**
2. **Provide Chapter 5 Closure Package to NRC on 6/12/14**
3. **Update of Chapter 19 and PRA insights and conclusions with completion of Chapter 19 work**