Replaced by LCO 3.7.1
in 9/16/93 Letter (enclosed)

3.7 PLANT SYSTEMS

3.7.2 Reactor Cooling Water (RCW) System and Reactor Service Water (RSW) System

LCO 3.7.2 Division A, B and C RCW and RSW subsystems shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One subsystem inoperable.	---------NOTES-------- 1. Enter applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources—Operating," for diesel generator made inoperable by [RSW]. 2. Enter applicable Conditions and Required Actions of LCO 3.4.9, "Residual Heat Removal (RHR) Shutdown Cooling System—Hot Shutdown," for [RHR shutdown cooling] made inoperable by [RCW or RSW]. -----------------------	
	A.1 Restore subsystem to OPERABLE status.	7 days

B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 4.	12 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.2.1	Verify the water level [in each RSW pump well of the intake structure] is ≥ [ ] m (ft) [mean sea level].	24 hours
SR 3.7.2.2	---------------NOTE--------------- Isolation of flow to individual components does not render RCW or RSW System inoperable. ------------------------------------ Verify each RCW and RSW subsystem manual, power operated, and automatic valve in the flow path servicing safety related systems or components, that is not locked, sealed, or otherwise secured in position is in the correct position.	31 days
SR 3.7.2.3	Verify each RCW/RSW subsystem actuates on an actual or simulated initiation signal.	18 months

Replaced

3.7 PLANT SYSTEMS

3.7.~~1.1~~e2 Reactor Building Cooling Water System (RCW), Reactor Service Water (RSW) System and Ultimate Heat Sink (UHS) - Shutdown

LCO 3.7.~~1.1~~e2 Two RCW/RSW divisions and UHS shall be OPERABLE.

APPLICABILITY: MODE 4
MODE 5 except with the reactor cavity to dryer/separator storage pool gate removed and water level ~~<~~ ≥ 7.0m (23 ft) over the top of the reactor pressure vessel flange

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
			~~(continued)~~ e
A. One or more required RCW/RSW divisions inoperable. OR UHS inoperable.	A.1	Enter applicable Conditions and Required Actions of LCO 3.8.2, "AC Sources - Shutdown" for diesel generator(s) made inoperable by RCW/RSW	Immediately
	AND		
	A. 2.	Enter applicable Conditions and Required Actions of LCO 3.4.8, "Residual Heat Removal (RHR) - MODE 4," or LCO 3.9.8, "RHR-Low Water Level", for RHR shutdown cooling made inoperable by RCW/RSW.	Immediately

double line

~~(continued)~~ e

e

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
2 SR 3.7.1.1.1	Verify the water level of each UHS [spray pond] is ≥ [] ft.	24 hours
2 SR 3.7.1.1.2	Verify the water level in each RSW pump well of the intake structure is ≥ [ ] ft.	24 hours
2 SR 3.7.1.1.3	Verify the average water temperature of UHS is ≤ 35°C (95°F).	24 hours
2 SR 3.7.1.1.4	-------------------NOTE------------------- Isolation of flow to individual components does not render RCW/RSW System inoperable. -- Verify each RCW/RSW division manual, power operated, and automatic valve in the flow path servicing safety related systems or components, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
2 SR 3.7.1.1.5	Verify each RCW/RSW division actuates on an actual or simulated initiation signal.	[18] months

3.7 PLANT SYSTEMS

3.7.~~1.2~~ 3 Reactor Building Cooling Water (RCW) System and Reactor Service Water (RSW) System and Ultimate Heat Sink (UHS) - Refueling

LCO 3.7.~~1.2~~ 3 One RCW/RSW division and UHS shall be OPERABLE.

APPLICABILITY: ~~MODES~~ 5 with the reactor cavity to dryer/separator storage ~~pool gate removed and water level ≥ 7.0m (23 ft) over the top~~ of the reactor pressure vessel flange.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. No RCW/RSW division OPERABLE. OR UHS inoperable.	A.1 Enter applicable Conditions and Required Actions of LCO 3.8.2, "AC Source-Refueling" for the diesel generator made inoperable by RCW/RSW. AND A. 2 Enter applicable Conditions and Required Actions of LCO 3.9.7, "RHR-High Water Level", for RHR-Shutdown Cooling made inoperable by RCW/RSW.	Immediately Immediately

remove line

~~ACTIONS (continued)~~ e

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
3 SR 3.7.1.2.1	Verify the water level of each UHS [spray pond] is ≥ [] ft.	24 hours
3 SR 3.7.1.2.2	Verify the water level in each RSW pump well of the intake structure is ≥ [] ft.	24 hours
		~~(continued)~~ e
3 SR 3.7.1.2.3	Verify the average water temperature of UHS is ≤ 35°C (95°F).	24 hours
3 SR 3.7.1.2.4	--------------NOTE-------------- Isolation of flow to individual components does not render RCW/RSW System inoperable. -- Verify RCW/RSW division manual, power operated, and automatic valve in the flow path servicing safety related systems or components, that is not locked, sealed, or otherwise secured in position is in the correct position.	31 days
3 SR 3.7.1.2.5	Verify each RCW/RSW ~~subsystem~~ division actuates on an actual or simulated initiation signal	[18] 6 months

3.7 PLANT SYSTEM

3.7.~~3~~ 4 Control Room Habitability Area (CRHA) ~~HVAC System -~~ Emergency Filtration (EF) ~~Subsystem~~ System

LCO 3.7.~~3~~ 4 Two ~~EF trains~~ divisions of the CRHA ~~HVAC~~ EF System shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3,
During movement of irradiated fuel assemblies in the primary or secondary containment,
During CORE ALTERATIONS,
During operations with a potential for draining the reactor vessel (OPDRVs).

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One EF ~~train~~ division inoperable.	A.1 Restore EF ~~train~~ division to OPERABLE status.	7 days
B. Required Action and Associated Completion Time of Condition A not met in MODE 1, 2, or 3.	B.1 Be in MODE 3. AND B.2 Be in MODE 4.	12 hours 36 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A not met during movement of irradiated fuel assemblies in the primary or secondary containment, during CORE ALTERATIONS, or during OPDRVs.	------------NOTE------------ LCO 3.0.3 is not applicable. ----------------------------	
	C.1 Place OPERABLE EF ~~train~~ division in ~~isolation~~ standby mode.	Immediately
	OR	
	C.2.1 Suspend movement of irradiated fuel assemblies in the primary and secondary containment.	Immediately
	AND	
	C.2.2 Suspend CORE ALTERATIONS.	Immediately
	AND	
	C.2.3 Initiate action to suspend OPDRVs.	Immediately
D. Two EF ~~trains~~ divisions inoperable in MODE 1, 2, or 3.	D.1 Enter LCO 3.0.3.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Two EF ~~trains~~ divisions inoperable during movement of irradiated fuel assemblies in the primary or secondary containment, during CORE ALTERATIONS, or during OPDRVs.	------------NOTE------------ LCO 3.0.3 is not applicable. ----------------------------	
	E.1 Suspend movement of irradiated fuel assemblies in the primary and secondary containment.	Immediately
	<u>AND</u>	
	E.2 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u>	
	E.3 Initiate action to suspend OPDRVs.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.~~3~~4.1	Operate each EF ~~train~~ division for ≥ 10 continuous hours with the heaters operating.	31 days
SR 3.7.~~3~~4.2	Perform required EF filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP

(continued)

SR 3.7.~~3~~4.3	Verify each EF ~~train~~ division actuates on an actual or simulated initiation signal.	18 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.7.~~3~~4.4	Verify each EF ~~train~~ division can maintain a positive pressure of ≥ [3.17 to 12.68 kg/m²g (.125 to .5 inches) water gauge) relative to adjacent buildings during the isolation mode of operation at a flow rate of ≤ [360] m³/h ([212] cfm).	18 months on a STAGGERED TEST BASIS

2

3

3.7 PLANT SYSTEM

3.7.~~4~~5 Control Room Habitability Area (CRHA) ~~- Control Room~~ Air Conditioning (AC) ~~(CRAC) Subsystem~~ System

LCO 3.7.~~4~~5 Two ~~CRAC subsystems~~ divisions of the CRHA AC System shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3,
During movement of irradiated fuel assemblies in the primary or secondary containment,
During CORE ALTERATIONS,
During operations with a potential for draining the reactor vessel (OPDRVs).

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One ~~CRAC subsystem~~ CRHA AC division inoperable.	A.1	Restore ~~CRAC subsystem~~ CRHA AC division to OPERABLE status.	30 days
B. Required Action and Associated Completion Time of Condition A not met in MODE 1, 2, or 3.	B.1	Be in MODE 3.	12 hours
	AND		
	B.2	Be in MODE 4.	36 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A not met during movement of irradiated fuel assemblies in the primary or secondary containment, during CORE ALTERATIONS, or during OPDRVs.	-------------NOTE------------- LCO 3.0.3 is not applicable. ------------------------------	
	C.1 Place OPERABLE CRHA AC division ~~CRAC subsystem~~ in operation.	Immediately
	OR	
	C.2.1 Suspend movement of irradiated fuel assemblies in the primary and secondary containment.	Immediately
	AND	
	C.2.2 Suspend CORE ALTERATIONS.	Immediately
	AND	
	C.2.3 Initiate action to suspend OPDRVs.	Immediately
D. Two CRHA AC divisions ~~CRAC subsystems~~ inoperable in MODE 1, 2, or 3.	D.1 Enter LCO 3.0.3.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
E. Two ~~CRAC subsystems~~ CRHA AC divisions inoperable during movement of irradiated fuel assemblies in the primary or secondary containment, during CORE ALTERATIONS, or during OPDRVs.	------------NOTE------------ LCO 3.0.3 is not applicable. ----------------------------		
	E.1	Suspend movement of irradiated fuel assemblies in the primary and secondary containment.	Immediately
	<u>AND</u>		
	E.2	Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u>		
	E.3	Initiate action to suspend OPDRVs.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.~~4~~5.1	Verify each ~~CRAC subsystem~~ CRHA AC division has the capability to remove the assumed heat load.	18 months
SR 3.7.~~4~~5.2	Verify each ~~CRAC subsystem~~ CRHA AC division actuates on an actual or simulated initiation signal.	18 months

3.7 PLANT SYSTEMS

3.7.5 Main Condenser Offgas

Delete LCO

LCO 3.7.5 The gross gamma activity rate of the noble gases measured at [the offgas recombiner effluent] shall be ≤ [380] mCi/second [after decay of 30 minutes].

APPLICABILITY: MODE 1,
MODES 2 and 3 with any [main steam line not isolated and] steam jet air ejector (SJAE) in operation.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Gross gamma activity rate of the noble gases not within limit.	A.1 Restore gross gamma activity rate of the noble gases to within limit.	72 hours
B. Required Action and associated Completion Time not met.	[B.1 Isolate all main steam lines.	[12 hours]
	<u>OR</u>]	
	B.2 Isolate SJAE.	12 hours
	<u>OR</u>	
	B.3.1 Be in MODE 3.	12 hours
	<u>AND</u>	
	B.3.2 Be in MODE 4.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.5.1	--------------------NOTE-------------------- Not required to be performed until 31 days after any [main steam line not isolated and] SJAE in operation. -- Verify the gross gamma activity rate of the noble gases is ≤ [380] mCi/second [after decay of 30 minutes].	31 days AND Once within 4 hours after a ≥ 50% increase in the nominal steady state fission gas release after factoring out increases due to changes in THERMAL POWER level

3.7 PLANT SYSTEMS

3.7.6 Main Turbine Bypass System

LCO 3.7.6 The Main Turbine Bypass System shall be OPERABLE.

<u>OR</u>

LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)," limits for an inoperable Main Turbine Bypass System, as specified in the Core Operating Limits Report (COLR), are made applicable.

APPLICABILITY: THERMAL POWER ≥ 40% RTP.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Requirements of the LCO not met or Main Turbine Bypass System inoperable.	A.1	Satisfy the requirements of the LCO or restore Main Turbine Bypass System to OPERABLE status.	2 hours
B. Required Action and associated Completion Time not met.	B.1	Reduce THERMAL POWER to < 40% RTP.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.6.1	Verify one ~~complete cycle of~~ each main turbine bypass valve.	31 days

(continued)

perform bypass valve opening test to approximately 10% position for each turbine bypass valve.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
3.7.6.2 Perform a system functional test.	18 months
SR 3.7.6.3 Verify the TURBINE BYPASS SYSTEM RESPONSE TIME is within limits.	18 months

3.7 PLANT SYSTEMS

3.7.7 Fuel Pool Water Level

LCO 3.7.7 The fuel pool water level shall be ≥ 7.01 m (23 ft) over the top of irradiated fuel assemblies seated in the spent fuel storage pool.

APPLICABILITY: During movement of irradiated fuel assemblies in the associated fuel storage pool.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Fuel pool water level not within limit.	A.1 --------NOTE--------- LCO 3.0.3 is not applicable. --------------------- Suspend movement of irradiated fuel assemblies in the associated fuel storage pool(s).	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.7.1	Verify the fuel pool water level is ≥ 7.01 m (23 ft) over the top of irradiated fuel assemblies seated in the storage racks.	7 days

B 3.7 PLANT SYSTEMS

Delete file

B 3.7.1 Ultimate Heat Sink (UHS)

Replaced by B3.7.1 by 9/16/93 letter

BASES

BACKGROUND

The UHS is designed to provide sufficient cooling water to the Reactor Service Water (RSW) System to permit safe shutdown and cooldown of the unit and to maintain the unit in a safe shutdown condition and, in the event of an accident, to provide sufficient cooling water to the RSW System to safely dissipate the heat for that accident. The RSW System is described in the Bases for LCO 3.7.2, "Reactor Cooling Water (RCW) System and Reactor Service Water (RSW) System." [This section will describe the UHS design which is site specific.]

APPLICABLE SAFETY ANALYSES

The volume of each water source incorporated in a UHS complex is sized so that sufficient water inventory is available for all [RSW] System post LOCA cooling requirements for a 30 day period with no additional makeup water source available (Ref. 1).

The UHS, satisfies Criterion 3 of the NRC Policy Statement.

LCO

OPERABILITY of the UHS is based on a maximum water temperature of 35°C (95°F). [Other operability requirements for the UHS are site specific.]

APPLICABILITY

In MODES 1, 2, and 3, the UHS is required to be OPERABLE to support OPERABILITY of the equipment serviced by the UHS, and is required to be OPERABLE in these MODES.

In MODES 4 and 5, the OPERABILITY requirements of the UHS is determined by the systems they support.

(continued)

BASES

ACTIONS

A.1

If one or more [UHS active components] are inoperable, action must be taken to restore the inoperable [components] to OPERABLE status within 12 hours.

The 12 hour Completion Time is reasonable, based on the low probability of an accident occurring during the 12 hours that a [UHS active component] is inoperable, the number of available systems, and the time required to complete the Required Action.

B.1 and B.2

If the [UHS active component(s)] cannot be restored to OPERABLE status within the associated Completion Time, or the UHS is determined inoperable for reasons other than Condition A, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 12 hours and in MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.7.1.1

This SR ensures adequate long term (30 days) cooling can be maintained. With the [UHS dedicated water supply] below the minimum level, the affected [RSW] subsystem must be declared inoperable. The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

SR 3.7.1.2

Verification of the UHS temperature ensures that the heat removal capability of the [RSW] System is within the assumptions of the DBA analysis. The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.1.3

Operating each [UHS active component not normally operating] for ≥ 15 minutes ensures that all [the active components] are OPERABLE and that all associated controls are functioning properly. The 31 day Frequency is based on operating experience, the known reliability of the [active components], the redundancy available, and the low probability of significant degradation of the [active components] occurring between Surveillances.

SR 3.7.1.4

This SR verifies that [each UHS active component not normally operating] will automatically switch to the safety or emergency position to provide cooling water exclusively to the safety related equipment during an accident event. This is demonstrated by use of an actual or simulated initiation signal. The LOGIC SYSTEM FUNCTIONAL TEST in SR 3.3.5.1.6 overlaps this SR to provide complete testing of the safety function.

Operating experience has shown that these components usually pass the SR when performed on the 18 month Frequency. Therefore, this Frequency is concluded to be acceptable from a reliability standpoint.

REFERENCES

1. Regulatory Guide 1.27, Revision 2, January 1976.

(continued)

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Replaced by
9/16/93 letter for B 3.7.1

B 3.7 PLANT SYSTEMS

B 3.7.2 [Reactor Building Cooling Water (RCW)] System and [Reactor Service Water (RSW) System]

BASES

BACKGROUND

The [RCW and RSW] Systems together are designed to provide cooling water for the removal of heat from equipment, such as the diesel generators (DGs), residual heat removal (RHR) heat exchangers, and room coolers for Emergency Core Cooling System equipment, required for a safe reactor shutdown following a Design Basis Accident (DBA) or transient. The combined RCW/RSW System also provides cooling to unit components, as required, during normal operation, shutdown, and reactor isolation modes. Upon receipt of a loss of offsite power or loss of coolant accident (LOCA) signal, most but not all nonessential loads are automatically isolated, selected nonessential equipment such as control rod drive (CRD) pump oil coolers, instrument and service air compressor coolers, reactor water cleanup (RWCU) pump coolers and reactor internal pump (RIP) MG set coolers and the essential loads are automatically divided between [RCW/RSW] Divisions A, B, and C. All nonessential equipment can be manually isolated if required. During all plant operating modes, all RCW/RSW divisions have at least one pump operating and, therefore, if a LOCA occurs, the RCW/RSW Systems will already be in operation.

The combined RCW/RSW System includes three separate subsystems (A, B, and C). Each subsystem consists of the ultimate heat sink (UHS), and independent cooling water header, an independent service water loop, and the associated pumps, heat exchangers, piping, valves and instrumentation. Each subsystem includes two RCW pumps, two RSW pumps, and three RCW to RSW heat exchangers. Each subsystem is sized to provide sufficient cooling capacity to support the required safety related systems in its respective division during safe shutdown of the unit following a loss-of-coolant accident (LOCA).

Cooling water is pumped from the UHS by the RSW pump(s) in each subsystem to the supply header serving the respective RCW/RSW heat exchangers. After removing heat from the respective RCW subsystem the water is pumped back to the UHS. In a separate closed loop, cooling water is circulated

(continued)

BASES

BACKGROUND (continued)

by the pump(s) in each RCW subsystem through the essential components to be cooled and back through the RCW/RSW heat exchangers. Thus, the heat removed from the components by the RCW is transferred to the RSW, and then ultimately rejected to the UHS.

Subsystems A, B, and C supply cooling water to redundant equipment required for a safe reactor shutdown. Additional information on the design and operation of the RCW and RSW systems along with the specific equipment for which the combined RCW/RSW System supplies cooling water is provided in SSAR, Chapter 9, Ref. 1). The combined three division RCW/RSW System is designed to withstand a single active or passive failure coincident with a loss-of-offsite power without losing the capability to supply adequate cooling water to equipment required for safe reactor shutdown.

Following a DBA or transient, the RCW/RSW System will operate automatically with operator action. Manual initiation of supported systems is, however, performed for some cooling operations (e.g., shutdown cooling).

APPLICABLE SAFETY ANALYSES

Sufficient water inventory is available for all [RCW/RSW] System post LOCA cooling requirements for a 30 day period with no additional makeup water source available. The ability of the [RCW/RSW] System to support long term cooling of the reactor containment is assumed in evaluations of the equipment required for safe reactor shutdown presented in the SSAR, Chapters [9] and [15] (Refs. 1 and 2, respectively). These analyses include the evaluation of the long term primary containment response after a design basis LOCA.

The ability of the [RCW/RSW] System to provide adequate cooling to the identified safety equipment is an implicit assumption for the safety analyses evaluated in References 1 and 2. The ability to provide onsite emergency AC power is dependent on the ability of the [RCW/RSW] System to cool the DGs. The long term cooling capability of the RHR, core spray, and RHR service water pumps is also dependent on the cooling provided by the [RCW/RSW] System.

The [combined RCW/RSW] System, together with the UHS, satisfy Criterion 3 of the NRC Policy Statement.

(continued)

BASES

LCO

The [RCW/RSW] subsystems are independent of each other to the degree that each has separate controls, power supplies, and the operation of one does not depend on the other. In the event of a DBA, one subsystem of [RCW/RSW] is required to provide the minimum heat removal capability assumed in the safety analysis for the system to which it supplies cooling water. To ensure this requirement is met, three subsystems of [RCW/RSW] must be OPERABLE. At least two subsystems will operate, if the worst single active failure occurs coincident with the loss of offsite power.

A subsystem is considered OPERABLE when both associated RCW and associated RSW pumps are OPERABLE, all three RCW/RSW heat exchangers are OPERABLE, the UHS is OPERABLE and the associate piping, valves, instrumentation and controls required to perform the safety-related functions are OPERABLE.

The isolation of the [RCW/RSW] System to components or systems may render those components or systems inoperable, but does not affect the OPERABILITY of the [RCW/RSW] System.

APPLICABILITY

In MODES 1, 2, and 3, the RCW and RSW Systems are required to be OPERABLE to support OPERABILITY of the equipment serviced by the combined Systems. Therefore, the [RCW/RSW] System are required to be OPERABLE in these MODES.

In MODES 4 and 5, the OPERABILITY requirements of the [RCW/RSW] System are determined by the systems it supports.

ACTIONS

A.1

If one RCW pump and/or one RSW pump and/or one RCW/RSW heat exchanger in the same subsystem is inoperable (i.e., if less than a minimum complement of one RCW pump, one RSW pump and two RCW/RSW heat exchanger are OPERABLE in one subsystem, action must be taken to restore inoperable component(s), and thus the subsystem affected, to OPERABLE status within 30 days. In this condition sufficient redundant equipment is still available to provide cooling water to the required safety related components and sufficient heat removal

(continued)

ACTIONS

A.1 (continued)

capacity is still available to adequately cool safety related loads, even assuming the worst case single failure. However, in the degraded mode of this condition, overall reliability is reduced and a subsystem may not be capable of removing heat from the respective RHR heat exchanger at a rate consistent with design basis assumptions and modeling in the analysis for long term containment cooling (depending on other factors such actual UHS temperature).

With a minimum complement of one RCW pump, one RSW pump, and two RCW/RSW heat exchangers, a subsystem is capable of performing its safety related cooling function, consistent with design basis assumptions, for all required modes with the exception of containment cooling. However, beyond design basis calculations performed to support PRA success criteria (Ref. 3) demonstrate that successful operation of only one of three RHR subsystems (in the suppression pool cooling mode) is needed to prevent conditions inside the containment from exceeding its ultimate capacity (see B 3.6.2.3). Thus, should a DBA occur while in this slightly degraded Condition, even considering a coincident worst case single failure, the combined RCW/RSW and RHR system would retain the capability to ultimately protect containment integrity.

The 30-day Completion Time is reasonable, based on the low probability of an accident occurring during the 30 days that a component is inoperable in one or more subsystems, the number of available redundant subsystems, the substantial cooling capability still remaining in a subsystem(s) in this Condition, and the expected high subsystem availability afforded by a system where most of the equipment, including the minimum required for most functions, is normally operating.

The Required Action is modified by a Note indicating that the provisions of LCO 3.0.4 are not applicable. This is acceptable given the substantial degree of redundancy provided by the RCW/RSW and supported systems and the significant operational capability that still exists, in this marginally degraded condition.

(continued)

BASES

ACTIONS (continued)

B.1

With one [RCW/RSW] subsystem inoperable for reasons other than Condition A, the [RCW/RSW] subsystem must be restored to OPERABLE status within 7 days. With the unit in this condition, the remaining OPERABLE [RCW/RSW] subsystems are adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure in one of the OPERABLE [RCW/RSW] subsystems could result in a potentially significant reduction in the overall heat removal capability.

The 7 day Completion Time is based on the redundant [RCW/RSW] System capabilities afforded by the OPERABLE subsystems, and the low probability of an accident occurring during this time period.

Required Action B.1 is modified by two Notes indicating that the applicable Conditions of LCO 3.8.1, "AC Sources—Operating," LCO 3.4.7, "Residual Heat Removal (RHR) Shutdown Cooling System—Hot Shutdown," be entered and Required Actions taken if the inoperable [RCW/RSW] subsystem results in an inoperable DG or RHR shutdown cooling, respectively. This is in accordance with LCO 3.0.6 and ensures the proper actions are taken for these components.

C.1

If one RCW pump and/or one RSW pump and/or one RCW/RSW heat exchanger in the same subsystem is inoperable in each of two separate subsystem, one RCW/RSW subsystem must be restored to OPERABLE status within 7 days. In this condition, sufficient redundant equipment is still available to provide cooling water to the required safety related components and sufficient heat removal capacity is still available to adequately cool safety related loads. However, a subsystem may not be capable of removing heat from the respective RHR heat exchanger at a rate consistent with design basis assumptions and modeling in the analysis for long term containment cooling. Nonetheless, with a minimum complement of one RCW pump, one RSW pump, and two RCW/RSW heat exchangers, a subsystem is still capable to performing its safety related cooling function, consistent with design basis assumptions, for all other modes. Furthermore, beyond design basis calculations performed to support PRA success

(continued)

ACTIONS

C.1

criteria (Ref. 3) demonstrate that only one of three RHR subsystems (in the suppression pool cooling mode) is needed to ultimately protect containment integrity (see B 3.6.2.3). Therefore, continued operations for a limited time is justified. However, in the degraded mode of this Condition, overall reliability and heat removal capability is reduced from that of Condition A, and thus a more restrictive Completion Time is imposed.

The 7 day Completion Time is reasonable, based on the low probability of an accident occurring during the 7 days that one or more redundant components are inoperable in each of two subsystems, the number of available redundant subsystems, the substantial cooling capability still remaining in subsystems in this Condition, and the expected high subsystem availability afforded by a system where most of the equipment, including the minimum required for most functions, is normally operating.

The Required Action is modified by a Note indicating that the applicable Conditions of LCO 3.4.7, "Residual Heat Removal (RHR) Shutdown Cooling - Hot Shutdown" be entered and Required Actions taken if the inoperable RCW/RSW subsystem results in an inoperable required RHR-Shutdown Cooling subsystem. This is in accordance with LCO 3.0.6 and ensures the proper actions are taken for these components.

D.1 and D.2

If the [RCW/RSW] subsystems cannot be restored to OPERABLE status within the associated Completion Times of Conditions A, B, or C, or two [RCW/RSW] subsystems are inoperable for reasons other than Condition C, or all three RCW/RSW subsystems are inoperable, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 12 hours and in MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.2.1

This SR verifies the water level [in each RSW pump well of the intake structure] to be sufficient for the proper operation of the [RSW] pumps (net positive suction head and pump vortexing are considered in determining this limit). The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

SR 3.7.2.2

Verifying the correct alignment for each manual, power operated, and automatic valve in each [RCW/RSW] subsystem flow path provides assurance that the proper flow paths will exist for [RCW/RSW] operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing. A valve is also allowed to be in the nonaccident position, and yet considered in the correct position, provided it can be automatically realigned to its accident position within the required time. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

This SR is modified by a Note indicating that isolation of the [RCW/RSW] System to components or systems may render those components or systems inoperable, but does not affect the OPERABILITY of the [RCW/RSW] System. As such, when all [RCW/RSW] pumps, valves, and piping are OPERABLE, but a branch connection off the main header is isolated, the [RCW/RSW] System is still OPERABLE.

The 31 day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

SR 3.7.2.3

This SR verifies that the automatic isolation valves of the [RSCW/RSW] System will automatically switch to the safety or

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

emergency position to provide cooling water exclusively to the safety related equipment, and limited nonsafety related equipment, during an accident event. This is demonstrated by the use of an actual or simulated initiation signal. This SR also verifies the automatic start capability of the RCW and RSW pumps that are in standby and automatic valuing in each of the standby RCW/RSW heat exchangers [and automatic start capability of required UHS active components] in each subsystem.

Operating experience has shown that these components usually pass the SR when performed at the 18 month Frequency. Therefore, this Frequency is concluded to be acceptable from a reliability standpoint.

REFERENCES

1. ABWR SSAR, Chapter [9].
2. ABWR SSAR, Chapter [15].
3. [later]

B 3.7 PLANT SYSTEMS

B 3.7.2 Reactor Building Cooling Water (RCW) System, Reactor Service Water (RSW) System and Ultimate Heat Sink (UHS) - Shutdown

BASES

BACKGROUND	A description of the RCW and RSW Systems and the UHS are provided in the Bases for LCO 3.7.1, "Reactor Building Cooling Water (RCW) System, Reactor Service Water (RSW) System and Ultimate Heat Sink (UHS) - Operating."
APPLICABLE SAFETY ANALYSES	The volume of water incorporated in the UHS is sized so that sufficient water inventory is available for all RCW/RSW System post LOCA cooling requirements for a 30 day period with no additional makeup water source available (Ref. 1). The ability of the RCW/RSW System to support long term cooling of the reactor or containment is assumed in evaluations of the equipment required for safe reactor shutdown presented in the SSAR, Sections 9.2.11, 6.2.1.1.3.3.1.4, and Chapter 15, (Refs 2, 3, and 4, respectively). The long term cooling analyses following a design basis LOCA demonstrates that only one division of the RCW/RSW System is required, post LOCA, to support long term cooling of the reactor or containment. To provide redundancy, a minimum of two RCW/RSW divisions are required to be OPERABLE in MODES 4 and 5 except with the reactor cavity to dryer/separator storage pool gate removed and water level ≥ 7.0 m (23 ft) over the top of the reactor pressure vessel flange. The combined RCW/RSW System, together with the UHS, satisfy Criterion 3 of the NRC Policy Statement.
LCO	Two divisions of the RCW/RSW System and the UHS are required to be OPERABLE to ensure the effective operation of the RHR System in removing heat from the reactor, and the effective operation of other safety related equipment during a DBA or transient. Requiring two division to be OPERABLE ensures that one division will be available to provide adequate capability to meet cooling requirements of the equipment required for safe shutdown in the event of a single failure. Operability of the UHS and the RCW/RSW System is defined in the Basis for LCO 3.7.1.

(continued)

BASES

APPLICABILITY

In MODES 4 and 5, except with the reactor cavity to dryer/separator storage pool gate removed and water level ≥ 7.0 m (23 ft) over the top of the reactor pressure vessel flange, two divisions of the RCW/RSW System and the UHS are required to be OPERABLE to support OPERABILITY of the equipment serviced by the RCW/RSW System and UHS, and are required to be OPERABLE in these MODES.

In MODES 1, 2, and 3, the OPERABILITY requirements of the RCW/RSW System and UHS are specified in LCO 3.7.1.

In MODE 5 with the reactor cavity to dryer/separator storage pool gate removed and water level ≥ 7.0 m (23 ft) over the top of the reactor pressure vessel flange, the OPERABILITY requirements of the RCW/RSW System and UHS are specified in LCO 3.7.3, "RCW/RSW System and UHS - Refueling."

ACTIONS

A.1

If one or more required RCW/RSW division(s) or the UHS is inoperable, then immediately, those required feature(s) supported by the inoperable RCW/RSW division(s) or the UHS must be declared inoperable (i.e., Emergency Diesel Generator, RHR heat exchanger) and the applicable Conditions and Required Actions of the appropriate LCOs for the inoperable required feature(s) must be entered. For the applicable shutdown MODES, an inoperable RCW/RSW division or UHS requires entering the Conditions of LCO 3.8.2, AC Sources-Shutdown," for a diesel generator made inoperable and either LCO 3.4.8, "Residual Heat Removal (RHR) Shutdown Cooling System-Cold Shutdown," or LCO 3.9.8, "Residual Heat Removal (RHR) Low Water Level" for RHR shutdown cooling made inoperable. This is in accordance with LCO 3.0.6 and ensures the proper actions are taken for these components.

SURVEILLANCE REQUIREMENTS

SR 3.7.2.1

This SR ensures adequate long term (30 days) cooling can be maintained. With the UHS water source below the minimum level, the affected RCW/RSW division must be declared inoperable. The 24 hour Frequency is based on operating

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.2.2

experience relate to trending of the parameter variations during the applicable MODES. This SR verifies the water level in each RSW pump well of the intake structure to be sufficient for the proper operation of the RSW pumps (net positive suction head and pump vortexing are considered in determining this limit). The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

SR 3.7.2.3

Verification of the UHS temperature ensures that the heat removal capability of the RCW/RSW System is within the assumptions of the DBA analysis. The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

SR 3.7.2.4

Verifying the correct alignment for each manual, power operated, and automatic valve in each RCW/RSW division flow path provides assurance that the proper flow paths will exist for RCW/RSW operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing. A valve is also allowed to be in the nonaccident position and yet considered in the correct position, provided it can be automatically realigned to its accident position. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of potentially being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

This SR is modified by a Note indicating that isolation of the RCW/RSW System to components or systems may render those components or systems inoperable, but does not affect the OPERABILITY of the RCW/RSW System. As such, when all RCW/RSW pumps, valves, and piping are OPERABLE, but a branch connection off the main header is isolated, the RCW/RSW System is still OPERABLE.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.2.4 (continued)

The 31 day Frequency is based on engineering judgement, is consistent with the procedural controls governing valve operation, and ensure correct valve positions.

SR 3.7.2.5

This SR verifies that the automatic isolation valves of the RCW/RSW System will automatically switch to the safety or emergency position to provide cooling water exclusively to the safety related equipment, and limited non-safety related equipment, during an accident event. This is demonstrated by use of an actual or simulated initiation signal. This SR also verifies the automatic start capability of the RCW/RSW pumps that are in standby and automatic valving in each of the standby RCW/RSW heat exchangers in each division. The LOGIC SYSTEM FUNCTIONAL TEST in SR 3.3.5.1.4 overlaps this SR to provide complete testing of the safety function.

Operating experience has shown that these components usually pass the SR when performed on the 18 month Frequency. Therefore, this Frequency is concluded to be acceptable from a reliability standpoint.

REFERENCES

1. Regulatory Guide 1.27, Revision 2, January 1976.
2. ABWR SSAR, Sections 9.2.11 and 9.2.15.
3. ABWR SSAR, Section 6.2.1.1.3.3.1.4.
4. ABWR SSAR, Chapter 15.

B 3.7 PLANT SYSTEMS

B 3.7.3 Reactor Building Cooling Water (RCW) System, Reactor Service Water (RSW) System and Ultimate Heat Sink (UHS) - Refueling

BASES

BACKGROUND	A description of the RCW and RSW Systems and the UHS are provided in the Bases for LCO 3.7.1, "Reactor Building Cooling Water (RCW) System, Reactor Service Water (RSW) System and Ultimate Heat Sink (UHS) - Operating." In MODE 5 with the reactor vessel water level ≥ 7.0 m (23 ft) over the vessel flange the unit components to which the RCW/RSW System is required to supply cooling water is greatly reduced from normal operation. For example, LCO 3.8.2, "AC Sources-Shutdown" and LCO 3.9.7, "RHR-High Water Level" require one DG and one RHR subsystem to be OPERABLE, respectively, and LCO 3.5.2, "ECCS-Shutdown" does not require any ECCS components to be OPERABLE for this condition.
APPLICABLE SAFETY ANALYSES	The volume of water incorporated in the UHS is sized so that sufficient water inventory is available for all RCW/RSW System post LOCA cooling requirements for a 30 day period with no additional makeup water source available (Ref. 1). The ability of the RCW/RSW System to support long term cooling of the reactor or containment is assumed in evaluations of the equipment required for safe reactor shutdown presented in the SSAR, Sections 9.2.11, 6.2.1.1.3.3.1.4, and Chapter 15, (Refs. 2, 3, and 4, respectively). With the unit in MODE 5 and with the reactor cavity to dryer/separator storage gate removed and water level ≥ 7.0 m (23 ft) over the top of the reactor pressure vessel flange, the volume of water in the reactor vessel provides a heat sink for decay heat removal. However, to provide redundancy, a minimum of one RCW/RSW division is required to be OPERABLE. The combined RCW/RSW System, together with the UHS, satisfies Criterion 3 of the NRC Policy Statement.

(continued)

BASES

LCO

One division of the RCW/RSW System and the UHS are required to be OPERABLE to ensure the effective operation of the RHR System in removing heat from the reactor. LCO 3.9.7, "RHR-High Water Level" requires that one RHR subsystem be OPERABLE in operation in MODE 5 with the water level ≥ 7.0 m (23 ft) above the RPV flange. Only one subsystem is required because the volume of water above the RPV flange provides backup decay heat removal capability. Operability of the UHS and the RCW/RSW System is defined in the Basis for LCO 3.7.1.

APPLICABILITY

In MODE 5 with the reactor cavity to dryer/separator storage pool gate removed and water level ≥ 7.0 m (23 ft) over the top of the reactor pressure vessel flange, one division of the RCW/RSW System and the UHS are required to be OPERABLE to support OPERABILITY of the equipment serviced by the RCW/RSW System and UHS, and are required to be OPERABLE in this MODE.

In MODES 1, 2, and 3, the OPERABILITY requirements of the RCW/RSW System and UHS are specified in LCO 3.7.1.

In MODES 4 and 5, except with the reactor cavity to dryer/separator storage pool gate removed and water level ≥ 7.0 m (23 ft) over the top of the reactor pressure vessel flange, the OPERABILITY requirements of the RCW/RSW System and UHS are specified in LCO 3.7.2, "RCW/RSW System and UHS - Shutdown."

ACTIONS

A.1

If no RCW/RSW division is operable or the UHS is inoperable, then, immediately, those required feature(s) supported by the inoperable required RCW/RSW division or UHS must be declared inoperable (i.e., Emergency Diesel Generator, RHR heat exchanger) and the applicable Conditions and Required Actions of the appropriate LCOs for the inoperable required feature(s) must be entered. An inoperable RCW/RSW division or UHS requires entering the Conditions of LCO 3.8.2, "AC Sources-Shutdown," for a diesel generator made inoperable and LCO 3.9.7, "Residual Heat Removal (RHR)-High Water

(continued)

BASES

ACTIONS

A.1 (continued)

Level" for RHR shutdown cooling made inoperable. This is in accordance with LCO 3.0.6 and ensures the proper actions are taken for these components.

SURVEILLANCE REQUIREMENTS

SR 3.7.3.1

This SR ensures adequate long term (30 days) cooling can be maintained. With the UHS water source below the minimum level, the affected RCW/RSW division must be declared inoperable. The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

SR 3.7.3.2

This SR verifies the water level in each RSW pump well of the intake structure to be sufficient for the proper operation of the RSW pumps (net positive suction head and pump vortexing are considered in determining this limit). The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

SR 3.7.3.3

Verification of the UHS temperature ensure that the heat removal capability of the RCW/RSW System is within the assumptions of the DBA analysis. The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

SR 3.7.3.4

Verifying the correct alignment for each manual, power operated, and automatic valve in each RCW/RSW division flow path provides assurance that the proper flow paths will exist for RCW/RSW operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the

(continued)

BASES

correct position prior to locking, sealing, or securing. A valve is also allowed to be in the nonaccident position and yet considered in the correct position, provided it can be automatically realigned to its accident position. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of potentially being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

This SR is modified by a Note indicating that isolation of the RCW/RSW System to components or systems may render those components or systems inoperable, but does not affect the OPERABILITY of the RCW/RSW System. As such, when all RCW/RSW pumps, valves, and piping are OPERABLE, but a branch connection off the main header is isolated, the RCW/RSW System is still OPERABLE.

The 31 day Frequency is based on engineering judgement, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

SR 3.7.3.5

This SR verifies that the automatic isolation valves of the RCW/RSW System will automatically switch to the safety or emergency position to provide cooling water exclusively to the safety related equipment, and limited non-safety related equipment, during an accident event. This is demonstrated by use of an actual or simulated initiation signal. This SR also verifies the automatic start capability of the RCW/RSW pumps that are in standby and automatic valving in each of the standby RCW/RSW heat exchangers in each division. The LOGIC SYSTEM FUNCTIONAL TEST in SR 3.3.5.1.4 overlaps this SR to provide complete testing of the safety function.

Operating experience has shown that these components usually pass the SR when performed on the 18 month Frequency. Therefore, this Frequency is concluded to be acceptable from a reliability standpoint.

(continued)

BASES

REFERENCES

1. Regulatory Guide 1.27, Revision 2, January 1976.
2. ABWR SSAR, Sections 9.2.11 and 9.2.15.
3. ABWR SSAR, Section 6.2.1.1.3.3.1.4.
4. ABWR SSAR, Chapter 15.

B 3.7 PLANT SYSTEMS

B 3.7.~~3~~ 4 Control Room Habitability Area (CRHA) ~~HVAC System -~~ Emergency Filtration (EF) ~~Subsystem~~ System

BASES

BACKGROUND

The Emergency Filtration ~~sub~~system of the CRHA HVAC System, provides a radiologically controlled environment from which the unit can be safely operated following a Design Basis Accident (DBA).

The safety related function of the Emergency Filtration ~~sub~~system used to control radiation exposure consists of two independent and redundant high efficiency air filtration ~~trains~~ divisions for treatment of a mixture of recirculated air ~~or~~ and a minimum of outside ~~supply~~ air supplied for pressurization of the main control room area envelope (MCAE). Each ~~subsystem~~ division consists of ~~a demister,~~ an electric heater, a prefilter, a high efficiency particulate air (HEPA) filter, an activated charcoal adsorber section, a second HEPA filter, a fan, and the associated ductwork and dampers. ~~Demisters remove water droplets from the airstream.~~ Prefilters and HEPA filters remove particulate matter that may be radioactive. The charcoal adsorbers provide a holdup period for gaseous iodine, allowing time for decay.

~~In addition to the safety related standby emergency filtration function, parts of the Emergency Filtration subsystem are operated to maintain the control room environment during normal operation.~~ Upon receipt of the initiation signal(s) (indicative of conditions that could result in radiation exposure to ~~control room~~ MCAE personnel), the Emergency Filtration ~~sub~~system automatically switches to the ~~isolation~~ high radiation mode of operation to prevent infiltration of contaminated air into the ~~control room~~ MCAE. ~~A system of dampers isolates the control room, and control room air flow is recirculated and processed through either of the two filter trains.~~

The Emergency Filtration ~~sub~~system is designed to maintain the ~~control room~~ MCAE environment for a 30 day continuous occupancy after a DBA, without exceeding a 5 rem whole body dose. Emergency Filtration ~~sub~~system operation in maintaining the control room habitability is discussed in the SSAR, Sections 6.4.1 and 9.4.1 (Refs. ~~1~~ B3.7.4-1 and ~~3~~ B3.7.4-2, respectively).

(continued)

B3.7.4-3
B3.7.4-4 stet

BASES

APPLICABLE SAFETY ANALYSES

The ability of the Emergency Filtration ~~sub~~system to maintain the habitability of the control room is an explicit assumption for the safety analyses presented in the SSAR, Chapters 6 and 15 (Refs. 3 and 4, respectively). The ~~isolation~~ filtration mode of the Emergency Filtration ~~sub~~system is assumed to operate following a loss of coolant accident, main steam line break, and fuel handling accident. The radiological doses to ~~control room~~ MCAE personnel as a result of the various DBAs are summarized in Reference 4. No single active or passive failure will cause the loss of outside or recirculated air from the ~~control room~~ MCAE.

B3.7.4-4 stet

The Emergency Filtration ~~sub~~system satisfies Criterion 3 of the NRC Policy Statement.

LCO

Two redundant ~~trains~~ divisions of the Emergency Filtration ~~sub~~system are required to be OPERABLE to ensure that at least one is available, assuming a single failure disables the other ~~train~~ division. Total system failure could result in exceeding a dose of 5 rem to the control room operators in the event of a DBA.

The Emergency Filtration ~~sub~~system is considered OPERABLE when the individual components necessary to control operator exposure are OPERABLE in both ~~trains~~ divisions. A ~~train~~ division is considered OPERABLE when its associated:

a. Fan is OPERABLE;

b. HEPA filter and charcoal adsorber are not excessively restricting flow and are capable of performing their filtration functions; and

c. Heater, demister, ductwork, valves, and dampers are OPERABLE, and air circulation can be maintained.

In addition, the ~~control room~~ MCAE boundary must be maintained, including the integrity of the walls, floors, ceilings, ductwork, and ~~access~~ double entry doors with vestibule between.

(continued)

BASES

APPLICABILITY

In MODES 1, 2, and 3, the Emergency Filtration ~~sub~~system must be OPERABLE to control operator exposure during and following a DBA, since the DBA could lead to a fission product release.

In MODES 4 and 5, the probability and consequences of a DBA are reduced due to the pressure and temperature limitations in these MODES. Therefore, maintaining the Emergency Filtration ~~sub~~system OPERABLE is not required in MODE 4 or 5, except for the following situations under which significant radioactive releases can be postulated:

a. During operations with a potential for draining the reactor vessel (OPDRVs);

b. During CORE ALTERATIONS; and

c. During movement of irradiated fuel assemblies in the primary or secondary containment.

ACTIONS

A.1

With one Emergency Filtration ~~train~~ division inoperable, the inoperable Emergency Filtration ~~train~~ must be restored to OPERABLE status within 7 days. With the unit in this condition, the remaining OPERABLE Emergency Filtration ~~train~~ division is adequate to perform ~~control room~~ MCAE radiation protection. However, the overall reliability is reduced because a single failure in the OPERABLE ~~train~~ could result in loss of Emergency Filtration ~~sub~~system function. The 7 day Completion Time is based on the low probability of a DBA occurring during this time period, and that the remaining ~~subsystem~~ division can provide the required capabilities.

B.1 and B.2

In MODE 1, 2, or 3, if the inoperable Emergency Filtration ~~train~~ division cannot be restored to OPERABLE status within the associated Completion Time, the unit must be placed in a MODE that minimizes risk. To achieve this status, the unit must be placed in at least MODE 3 within 12 hours and in MODE 4 within 36 hours. The allowed Completion Times are

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

C.1, C.2.1, C.2.2, and C.2.3

The Required Actions of Condition C are modified by a Note indicating that LCO 3.0.3 does not apply. If moving irradiated fuel assemblies while in MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Therefore, inability to suspend movement of irradiated fuel assemblies is not sufficient reason to require a reactor shutdown.

During movement of irradiated fuel assemblies in the primary or secondary containment, during CORE ALTERATIONS, or during OPDRVs, if the inoperable Emergency Filtration ~~train~~ division cannot be restored to OPERABLE status within the required Completion Time, the OPERABLE Emergency Filtration ~~train~~ division may be placed in the ~~isolation~~ filtration mode. This action ensures that the remaining ~~train~~ division is OPERABLE, that no failures that would prevent automatic actuation will occur, and that any active failure will be readily detected.

An alternative to Required Action C.1 is to immediately suspend activities that present a potential for releasing radioactivity that might require ~~isolation~~ initiation of the ~~control room~~ Emergency Filtration System. This places the unit in a condition that minimizes risk.

If applicable, CORE ALTERATIONS and movement of irradiated fuel assemblies in the primary and secondary containment must be suspended immediately. Suspension of these activities shall not preclude completion of movement of a component to a safe position. Also, if applicable, actions must be initiated immediately to suspend OPDRVs to minimize the probability of a vessel draindown and subsequent potential for fission product release. Actions must continue until the OPDRVs are suspended.

(continued)

BASES

ACTIONS

D.1 (continued)

divisions

If both Emergency Filtration ~~trains~~ are inoperable in MODE 1, 2, or 3, the Emergency Filtration ~~sub~~system may not be capable of performing the intended function and the unit is in a condition outside of the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

E.1, E.2, and E.3

The Required Actions of Condition E are modified by a Note indicating that LCO 3.0.3 does not apply. If moving irradiated fuel assemblies while in MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Therefore, inability to suspend movement of irradiated fuel assemblies is not sufficient reason to require a reactor shutdown.

divisions

During movement of irradiated fuel assemblies in the primary or secondary containment, during CORE ALTERATIONS, or during OPDRVs, with two Emergency Filtration ~~trains~~ inoperable, action must be taken immediately to suspend activities that present a potential for releasing radioactivity that might require ~~isolation~~ initiation of the ~~control room~~ Emergency Filtration System. This places the unit in a condition that minimizes risk.

If applicable, CORE ALTERATIONS and movement of irradiated fuel assemblies in the primary and secondary containment must be suspended immediately. Suspension of these activities shall not preclude completion of movement of a component to a safe position. If applicable, actions must be initiated immediately to suspend OPDRVs to minimize the probability of a vessel draindown and subsequent potential for fission product release. Actions must continue until the OPDRVs are suspended.

SURVEILLANCE REQUIREMENTS

SR 3.7.~~3~~4.1

This SR verifies that a ~~train~~ division in a standby mode starts on demand and continues to operate. Standby systems should be checked periodically to ensure that they start and function properly. As the environmental and normal operating conditions of this ~~sub~~system are not severe, testing each

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.~~3~~4.1 (continued)

division ~~train~~ once every month provides an adequate check on this ~~sub~~system. Monthly heater operation dries out any moisture accumulated in the charcoal from humidity in the ambient air. Systems with heaters must be operated for ≥ 10 continuous hours with the heaters energized. Furthermore, the 31 day Frequency is based on the known reliability of the equipment and the two ~~subsystem~~ division redundancy available.

SR 3.7.~~3~~4.2

~~B 3.7.4-5~~ stet

This SR verifies that the required Emergency Filtration testing is performed in accordance with the Ventilation Filter Testing Program (VFTP). The Emergency Filtration filter tests are in accordance with Regulatory Guide 1.52 (Ref. ~~5~~). The VFTP includes testing HEPA filter performance, charcoal adsorber efficiency, minimum system flow rate, and the physical properties of the activated charcoal (general use and following specific operations). Specific test frequencies and additional information are discussed in detail in the VFTP.

SR 3.7.~~3~~4.3

4

This SR verifies that each Emergency Filtration division ~~train subsystem~~ starts and operates on an actual or simulated initiation signal. The LOGIC SYSTEM FUNCTIONAL TEST in SR 3.3.7.1.~~5~~ overlaps this SR to provide complete testing of the safety function. The 18 month Frequency is specified in Reference ~~5~~.

~~B 3.7.4-5~~ stet

SR 3.7.~~3~~4.4

This SR verifies the integrity of the MCAE ~~control room enclosure~~ and the assumed inleakage rates of potentially contaminated air. The control room positive pressure, with respect to potentially contaminated adjacent areas, is periodically tested to verify proper function of the Emergency Filtration ~~sub~~system. During the emergency mode of operation, the Emergency Filtration ~~sub~~system is designed to slightly pressurize the control room to 3.17 to 12.68 Kg/m^{2}g (.125 to .5 inches water gauge) positive pressure with respect to

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.~~3~~4.4 (continued)

~~adjacent areas~~ the atmosphere to prevent unfiltered inleakage. The Emergency Filtration ~~sub~~system is designed to maintain this positive pressure at a flow rate of [ ] cfm 360 m³/h 212 to the ~~control room~~ MCAE in the ~~isolation~~ emergency filtration mode. The Frequency of 18 months on a STAGGERED TEST BASIS is consistent with industry practice and other filtration system SRs.

REFERENCES

~~B3.7.4~~ stet

1. ABWR SSAR, Section 6.4.1.
2. ABWR SSAR, Section 9.4.1.
3. ABWR SSAR, Chapter 6.
4. ABWR SSAR, Chapter 15.
5. Regulatory Guide 1.52, Revision 2, March 1978.

B 3.7 PLANT SYSTEMS

B 3.7.~~4~~ 5 Control Room Habitability Area (CRHA) HVAC System - Control Room Air Conditioning (~~AC~~) ~~sub~~system

STET

BASES

BACKGROUND

The ~~Control Room~~ CRHA AC ~~sub~~system provides temperature control for the ~~control room following isolation of the control room.~~ main control area envelope (MCAE) at all times the MCAE is occupied.

The ~~Control Room~~ CRHA AC ~~sub~~system consists of two independent, redundant ~~trains~~ divisions that provide cooling and heating of recirculated control room air. Each ~~train~~ division consists of heating coils, cooling coils, fans, chillers, compressors, ductwork, dampers, and instrumentation and controls to provide for ~~control room~~ MCAE temperature control.

The ~~Control Room~~ CRHA AC subsystem is designed to provide a controlled environment under both normal and accident conditions. A single ~~train~~ division provides the required temperature control to maintain ~~a suitable control room~~ the required MCAE environment for a sustained occupancy of 12 persons. The design conditions for the control room environment are ~~23.3°C (72°F)~~ 21°C (70°F) to 26°C (79°F) and ~~50%~~ 20% to 60% relative humidity. The ~~Control Room~~ CRHA AC ~~sub~~system operation in maintaining the ~~control room~~ MCAE temperature is discussed in the SSAR, Sections 6.4 and 9.4.1 (Refs. ~~1~~ and ~~2~~, respectively).

~~B3.7.4-1~~ ~~B3.7.4-2~~ stet

APPLICABLE SAFETY ANALYSES

The design basis of the ~~Control Room~~ CRHA AC ~~sub~~system is to maintain the ~~control room~~ MCAE temperature range for a 30 day continuous occupancy.

The ~~Control Room~~ CRHA AC ~~sub~~system components are arranged in redundant safety related ~~trains~~ divisions. During emergency operation, the ~~Control Room~~ CRHA AC ~~sub~~system maintains a habitable environment and ensures the OPERABILITY of components in the ~~control room~~ MCAE. A single active failure of a component of the ~~Control Room~~ CRHA AC ~~sub~~system, assuming a loss of offsite power, does not impair the ability of the system to perform its design function. Redundant ~~detectors~~ temperature elements and controls are provided for ~~control room~~ MCAE temperature control. The ~~Control Room~~ CRHA AC ~~sub~~system is designed in accordance with Seismic Category I requirements. The ~~Control Room~~ CRHA AC ~~sub~~system is capable of removing sensible

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

and latent heat loads from the MCAE ~~control room~~, including consideration of equipment heat loads and personnel occupancy requirements to ensure equipment OPERABILITY.

The CRHA ~~Control Room~~ AC ~~sub~~system satisfies Criterion 3 of the NRC Policy Statement.

LCO

Two independent and redundant divisions ~~trains~~ of the CRHA ~~Control Room~~ AC ~~sub~~system are required to be OPERABLE to ensure that at least one is available, assuming a single failure disables the other division ~~train~~. Total system failure could result in the equipment operating temperature exceeding equipment qualification limits.

The CRHA ~~Control Room~~ AC ~~sub~~system is considered OPERABLE when the individual components necessary to maintain the MCAE ~~control room~~ temperature are OPERABLE in both divisions ~~trains~~. These components include the cooling coils, fans, chillers, compressors, ductwork, dampers, and associated instrumentation and controls.

APPLICABILITY

In MODE 1, 2, or 3, the CRHA ~~Control Room~~ AC ~~sub~~system must be OPERABLE to ensure that the MCAE ~~control room~~ temperature will not exceed equipment OPERABILITY limits following control room isolation.

In MODES 4 and 5, the probability and consequences of a Design Basis Accident are reduced due to the pressure and temperature limitations in these MODES. Therefore, maintaining the CRHA ~~Control Room~~ AC ~~sub~~system OPERABLE is not required in MODE 4 or 5, except for the following situations under which significant radioactive releases can be postulated:

a. During operations with a potential for draining the reactor vessel (OPDRVs);

b. During CORE ALTERATIONS; and

c. During movement of irradiated fuel assemblies in the primary or secondary containment.

(continued)

BASES (continued)

ACTIONS

A.1

With one ~~control room~~ CRHA AC ~~train~~ division inoperable, the inoperable ~~control room~~ CRHA AC ~~train~~ division must be restored to OPERABLE status within 30 days. With the unit in this condition, the remaining OPERABLE ~~control room~~ CRHA AC ~~train~~ division is adequate to perform the ~~control room~~ MCAE air conditioning function. However, the overall reliability is reduced because a single failure in the OPERABLE ~~train~~ division could result in loss of the ~~control room~~ MCAE air conditioning function. The 30 day Completion Time is based on the low probability of an event occurring requiring ~~control room~~ MCAE isolation, the consideration that the remaining ~~train~~ division can provide the required protection, and the availability of alternate cooling methods.

B.1 and B.2

In MODE 1, 2, or 3, if the inoperable ~~control room~~ CRHA AC ~~train~~ division cannot be restored to OPERABLE status within the associated Completion Time, the unit must be placed in a MODE that minimizes risk. To achieve this status the unit must be placed in at least MODE 3 within 12 hours and in MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

C.1, C.2.1, C.2.2, and C.2.3

The Required Actions of Condition C are modified by a Note indicating that LCO 3.0.3 does not apply.

If moving irradiated fuel assemblies while in MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Therefore, inability to suspend movement of irradiated fuel assemblies is not sufficient reason to require a reactor shutdown.

During movement of irradiated fuel assemblies in the primary or secondary containment, during CORE ALTERATIONS, or during OPDRVs, if Required Action A.1 cannot be completed within the required Completion Time, the OPERABLE ~~control room~~ CRHA AC ~~train~~ division may be placed immediately in operation.

(continued)

BASES

ACTIONS

C.1, C.2.1, C.2.2, and C.2.3 (continued)

division

This action ensures that the remaining ~~train~~ is OPERABLE, that no failures that would prevent actuation will occur, and that any active failure will be readily detected.

An alternative to Required Action C.1 is to immediately suspend activities that present a potential for releasing radioactivity that might require isolation of the ~~control room~~ MCAE. This places the unit in a condition that minimizes risk.

If applicable, CORE ALTERATIONS and movement of irradiated fuel assemblies in the primary and secondary containment must be suspended immediately. Suspension of these activities shall not preclude completion of movement of a component to a safe position. Also, if applicable, actions must be initiated immediately to suspend OPDRVs to minimize the probability of a vessel draindown and subsequent potential for fission product release. Actions must continue until the OPDRVs are suspended.

D.1

CRHA divisions

If both ~~control room~~ AC ~~trains~~ are inoperable in MODE 1, 2, or 3, the ~~Control Room~~ AC ~~sub~~system may not be capable of performing the intended function. Therefore, LCO 3.0.3 must be entered immediately.

E.1, E.2, and E.3

The Required Actions of Condition E.1 are modified by a Note indicating that LCO 3.0.3 does not apply. If moving irradiated fuel assemblies while in MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Therefore, inability to suspend movement of irradiated fuel assemblies is not sufficient reason to require a reactor shutdown.

During movement of irradiated fuel assemblies in the primary or secondary containment, during CORE ALTERATIONS, or during OPDRVs with two ~~control room~~ AC ~~trains~~ inoperable, action must be taken to immediately suspend activities that present

CRHA divisions

(continued)

BASES

ACTIONS

E.1, E.2, and E.3 (continued)

a potential for releasing radioactivity that might require isolation of the control room. This places the unit in a condition that minimizes risk.

If applicable, CORE ALTERATIONS and handling of irradiated fuel in the primary or secondary containment must be suspended immediately. Suspension of these activities shall not preclude completion of movement of a component to a safe position. Also, if applicable, actions must be initiated immediately to suspend OPDRVs to minimize the probability of a vessel draindown and subsequent potential for fission product release. Actions must continue until the OPDRVs are suspended.

SURVEILLANCE REQUIREMENTS

SR 3.7.~~4~~5.1

This SR verifies that the heat removal capability of the system is sufficient to remove the assumed heat load in the MCAE ~~control room~~. The SR consists of a combination of testing and calculation. The 18 month Frequency is appropriate since significant degradation of the CRHA ~~Control Room~~ AC subsystem is not expected over this time period.

REFERENCES B3.7.4

1. ABWR SSAR, Section 6.4.
2. ABWR SSAR, Section 9.4.1.

Stet

B 3.7 PLANT SYSTEMS

B 3.7.6 Main Turbine Bypass System

BASES

BACKGROUND

The Main Turbine Bypass System is designed to control steam pressure when reactor steam generation exceeds turbine requirements during unit startup, sudden load reduction, and cooldown. It allows excess steam flow from the reactor to the condenser without going through the turbine. The bypass capacity of the system is 33% of the Nuclear Steam Supply System rated steam flow. Sudden load reductions within the capacity of the steam bypass can be accommodated without reactor scram. The Main Turbine Bypass System consists of a three valve chest connected to the main steam lines between the main steam isolation valves and the turbine stop valves. Each of these valves is sequentially operated by hydraulic cylinders. The bypass valves are controlled by the pressure regulation function of the Steam Bypass and Pressure Control System, as discussed in the SSAR, Section 7.7.1.8 (Ref. 1). ~~B3.7.6-1~~ The bypass valves are normally closed, and the pressure regulator controls the turbine control valves, directing all steam flow to the turbine. If the speed governor or the load limiter restricts steam flow to the turbine, the ~~B3.7.6-2~~ Stet pressure regulator controls the system pressure by opening the bypass valves. Additionally, for the turbine trip and load rejection events only (Ref. 2) there is a Fast Opening Mode of turbine bypass operation. In the Fast Opening Mode, the turbine bypass will open rapidly in response to a signal generated by the turbine trip or load rejection, independent of steam pressure. When the bypass valves open, the steam flows from the bypass chest, through connecting piping, to the pressure breakdown assemblies, where a series of orifices are used to further reduce the steam pressure before the steam enters the condenser.

APPLICABLE SAFETY ANALYSES

~~B3.7.6-2~~ Stet

The Main Turbine Bypass System is assumed to function during the design basis feedwater controller failure, maximum demand event, described in the SSAR, Section 15.1.2 (Ref. 2). Opening the bypass valves during the pressurization event mitigates the increase in reactor vessel pressure, which affects the MCPR during the event. An inoperable Main Turbine Bypass System may result in an MCPR penalty.

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

The Main Turbine Bypass System satisfies Criterion 3 of the NRC Policy Statement.

LCO

The Main Turbine Bypass System is required to be OPERABLE to limit peak pressure in the main steam lines and maintain reactor pressure within acceptable limits during events that cause rapid pressurization, such that the Safety Limit MCPR is not exceeded. With the Main Turbine Bypass System inoperable, modifications to the MCPR limits (LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)") may be applied to allow continued operation. ~~B3.7.6-2~~ stet

An OPERABLE Main Turbine Bypass System requires the bypass valves to open in response to increasing main steam line pressure or in the Fast Opening Mode, as applicable. This response is within the assumptions of the applicable analysis (Ref. 2). The MCPR limit for the inoperable Main Turbine Bypass System is specified in the COLR.

APPLICABILITY

The Main Turbine Bypass System is required to be OPERABLE at ≥ 40% RTP to ensure that the fuel cladding integrity Safety Limit and the cladding 1% plastic strain limit are not violated during the feedwater controller failure, maximum demand event. As discussed in the Bases for LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)," and LCO 3.2.2, sufficient margin to these limits exists at a power level < 40% RTP. Therefore, these requirements are only necessary when operating at or above this power level.

ACTIONS

A.1

If the Main Turbine Bypass System is inoperable (one or more bypass valves inoperable), or the MCPR limits for an inoperable Main Turbine Bypass System, as specified in the COLR, are not applied, the assumptions of the design basis transient analysis may not be met. Under such circumstances, prompt action should be taken to restore the Main Turbine Bypass System to OPERABLE status or adjust the MCPR limits accordingly. The 2 hour Completion Time is

---

(continued)

BASES

ACTIONS

A.1 (continued)

reasonable, based on the time to complete the Required Action and the low probability of an event occurring during this period requiring the Main Turbine Bypass System.

B.1

If the Main Turbine Bypass System cannot be restored to OPERABLE status or the MCPR limits for an inoperable Main Turbine Bypass System are not applied, THERMAL POWER must be reduced to < 40% RTP. As discussed in the Applicability section, operation at < 40% RTP results in sufficient margin to the required limits, and the Main Turbine Bypass System is not required to protect fuel integrity during the feedwater controller failure, maximum demand event. The 4 hour Completion Time is reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.7.~~5~~6.1

Opening ~~Cycling~~ each main turbine bypass valve to its 10% position (approximately) ~~through one complete cycle of full travel~~ demonstrates that the valves are mechanically OPERABLE and will function when required. The 31 day Frequency is based on ~~engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions. Therefore, the Frequency is acceptable from a reliability standpoint.~~ a reliability analysis.

SR 3.7.~~5~~6.2

The Main Turbine Bypass System is required to actuate automatically to perform its design function. This SR demonstrates that, with the required system initiation signals, the valves will actuate to their required position. The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and because of the potential for an unplanned transient if the Surveillance were performed with the

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.~~5~~6.2 (continued)

reactor at power. Operating experience has shown the 18 month Frequency, which is based on the refueling cycle,is acceptable from a reliability standpoint.

SR 3.7.~~5~~6.3

This SR ensures that the TURBINE BYPASS SYSTEM RESPONSE TIME is in compliance with the assumptions of the appropriate safety analysis. The response time limits are specified in [unit specific documentation]. The [18] month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and because of the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown the [18] month Frequency, which is based on the refueling cycle, is acceptable from a reliability standpoint.

REFERENCES

~~B3.7.6~~-1. ABWR SSAR, Section 7.7.1.8.

Stet -2. ABWR SSAR, Chapter 15.

B 3.7 PLANT SYSTEMS

B 3.7.7 Fuel Pool Water Level

BASES

BACKGROUND	The minimum water level in the spent fuel storage pool meets the assumptions of iodine decontamination factors following a fuel handling accident. A general description of the spent fuel storage pool design is found in the SSAR, Section 9.1.2 (Ref. 1). The assumptions of the fuel handling accident are found in the SSAR, Section 15.7.4 (Ref. 2).
APPLICABLE SAFETY ANALYSES	The water level above the irradiated fuel assemblies is an explicit assumption of the fuel handling accident. A fuel handling accident is evaluated to ensure that the radiological consequences (calculated whole body and thyroid doses at the exclusion area and low population zone boundaries) are ≤ 25% (NUREG-0800, Section 15.7.4, Ref. 3) of the 10 CFR 100 (Ref. 4) exposure guidelines. A fuel handling accident could release a fraction of the fission product inventory by breaching the fuel rod cladding as discussed in the Regulatory Guide 1.25 (Ref. 5). The fuel handling accident is evaluated for the dropping of an irradiated fuel assembly onto the reactor core which bounds the consequences of dropping an irradiated fuel assembly onto stored fuel bundles. The consequences of a fuel handling accident inside the reactor building are documented in Reference 2. The water level in the spent fuel storage pool provides for absorption of water soluble fission product gases and transport delays of soluble and insoluble gases that must pass through the water before being released to the reactor building atmosphere. This absorption and transport delay reduces the potential radioactivity of the release during a fuel handling accident. The fuel pool water level satisfies Criterion 2 of the NRC Policy Statement.

(continued)

BASES (continued)

~~B3.7.7-2~~ stet

LCO

The specified water level preserves the assumption of the fuel handling accident analysis (Ref. 3). As such, it is the minimum required for fuel movement within the spent fuel storage pool.

APPLICABILITY

This LCO applies whenever movement of irradiated fuel assemblies occurs in the associated fuel storage racks since the potential for a release of fission products exists.

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply. If moving irradiated fuel assemblies while in MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Therefore, inability to suspend movement of irradiated fuel assemblies is not a sufficient reason to require a reactor shutdown.

When the initial conditions for an accident cannot be met, steps should be taken to preclude the accident from occurring. With either fuel pool level less than required, the movement of irradiated fuel assemblies in the associated storage pool is suspended immediately. Suspension of this activity shall not preclude completion of movement of an irradiated fuel assembly to a safe position. This effectively precludes a spent fuel handling accident from occurring.

SURVEILLANCE REQUIREMENTS

7

SR 3.7.~~6~~.1

This SR verifies that sufficient water is available in the event of a fuel handling accident. The water level in the spent fuel storage pool must be checked periodically. The 7 day Frequency is acceptable, based on operating experience, considering that the water volume in the pool is normally stable and water level changes are controlled by unit procedures.

(continued)

BASES (continued)

REFERENCES

1. ABWR SSAR, Section 9.1.2.
2. ABWR SSAR, Section 15.7.4.
3. NUREG-0800, Section 15.7.4, Revision 1, July 1981.
4. 10 CFR 100.
5. Regulatory Guide 1.25, March 1972.

GE Nuclear Energy

May 19, 1993

Docket No. STN 52-001

Chet Poslusny, Senior Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of the Nuclear Reactor Regulation

Subject: Submittal Supporting Accelerated ABWR Review Schedule - **Revised LCO 3.7.5**

Dear Chet:

Enclosed is a SSAR markup of the revised LCO 3.7.5, Main Turbine Bypass System.

Please provide a copy of this transmittal to George Thomas.

Sincerely,

Jack Fox

Jack Fox
Advanced Reactor Programs

cc: Norman Fletcher (DOE)
Cal Tang (GE)

JF93-163

3.7 PLANT SYSTEMS

3.7.~~6~~ 5 Main Turbine Bypass System

LCO 3.7.~~6~~ 5 The Main Turbine Bypass System shall be OPERABLE.

[OR

LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)," limits for an inoperable Main Turbine Bypass System, as specified in the [COLR], are made applicable.]

APPLICABILITY: THERMAL POWER ≥ ~~25%~~ 40 RTP.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. [Requirements of the LCO not met or Main Turbine Bypass System inoperable.]	A.1 [Satisfy the requirements of the LCO or restore Main Turbine Bypass System to OPERABLE status.]	2 hours
B. Required Action and associated Completion Time not met.	B.1 Reduce THERMAL POWER to < ~~25%~~ 40 RTP.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.~~6~~ 5.1	~~Verify one complete cycle of each main turbine bypass valve.~~ perform bypass valve opening test to approximately 10% position for each turbine bypass valve.	31 days

(continued)

← indicates change

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.7.~~6~~5.2	Perform a system functional test.	[18] months
SR 3.7.~~6~~5.3	Verify the TURBINE BYPASS SYSTEM RESPONSE TIME is within limits.	[18] months

REFUELING INTERVAL

BASES

ACTIONS (continued)

B.1

If the Main Turbine Bypass System cannot be restored to OPERABLE status or the MCPR limits for an inoperable Main Turbine Bypass System are not applied, THERMAL POWER must be reduced to < ~~25~~ 40% RTP. As discussed in the Applicability section, operation at < ~~25~~ 40% RTP results in sufficient margin to the required limits, and the Main Turbine Bypass System is not required to protect fuel integrity during the feedwater controller failure, maximum demand event. The 4 hour Completion Time is reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.7.~~6~~5.1

~~Cycling~~ Opening each main turbine bypass valve ~~through one complete cycle of full travel~~ to its 10% position (approximately) demonstrates that the valves are mechanically OPERABLE and will function when required. The 31 day Frequency is based on ~~engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions. Therefore, the Frequency is acceptable from a reliability standpoint.~~ a reliability analysis (Ref 3).

SR 3.7.~~6~~5.2

The Main Turbine Bypass System is required to actuate automatically to perform its design function. This SR demonstrates that, with the required system initiation signals, the valves will actuate to their required position. The ~~[18] month~~ REFUELING INTERVAL Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and because of the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown the ~~[18] month~~ REFUELING INTERVAL Frequency, which is based on the refueling cycle, is acceptable from a reliability standpoint.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.~~6~~5.3

This SR ensures that the TURBINE BYPASS SYSTEM RESPONSE TIME is in compliance with the assumptions of the appropriate safety analysis. The response time limits are specified in [unit specific documentation]. The ~~[18] month~~ REFUELING INTERVAL Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and because of the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown the ~~[18] month~~ REFUELING INTERVAL Frequency, which is based on the refueling cycle, is acceptable from a reliability standpoint and is also based upon the reliability analysis of Ref. 3.

REFERENCES

1. ABWR ~~F~~SSAR, Section [7.7.1.~~5~~8].
2. ABWR ~~F~~SSAR, ~~Section [15.1.2]~~ Chapter 15.
3. [ ]

be more specific

ABWR Main Turbine Bypass Valve Failure Rate

The ABWR has three main turbine bypass valves (BPVs) with the capacity to dump 33% of reactor steam directly to the main condenser. In event of a turbine trip at modest power, less than 33%, the BPVs will open quickly to dump steam before a reactor scram can occur because of high reactor pressure.

If a turbine trip occurs at high power, even fast action of the bypass valves will not avoid reactor scram. However, the proper BPV function will limit the pressure rise in the reactor. The hydraulic fluid loop showing the fast acting solenoid valve (FASV) and its connection to the BPV is shown in Figure 1. The FASV is the key to fast opening of BPVs.

The number of safety related demands on the bypass valves and the FASV will depend on the number of turbine trips for which operability of the BPVs is assumed. That analysis included only one transient in which it was assumed that the BPVs would function properly. The transient is described in SSAR Section 15.1.2, Feedwater Controller Failure -- Maximum Demand; and the estimated frequency is less than once in 10,000 years. However, the event is analyzed as a moderate frequency event (once in 20 years), which overestimates its importance by a factor of 500.

Bypass valves of current BWRs in the U.S. are tested monthly in a test that includes slow stroking for 90% of valve travel followed by rapid stroke for the final 10% of travel. This monthly test frequency has no technical basis and was established on the basis of other turbine valve testing. Because of the 11% power capability of a single bypass valve in the ABWR plant, it is desirable to test the full stroke and fast travel of bypass valves only during plant shutdown, approximately every two years, to minimize disturbance to the electrical grid and to minimize potential challenges to the plant safety systems. At shutdown the total valve stroke time can be measured. The valves can be stroked slowly during plant operation over partial travel (such as 10%) to assure that they are not bound and will open on demand. Such a test will have little impact on operation.

The circuit to cause fast opening of the BPV is attached as Figure 2. The fault tolerant, solid state digital controller components are checked frequently by the self-check circuits. They are also combined in 2-out-of-3 logic so there will be a very low probability of failures of the controller that lead to inadvertent opening of the fast acting solenoid valves (FASVs). Because of the high reliability of this circuit, the main contributor to failure of the FASV to perform its desired function will be the FASV itself.

The referenced IEEE Standard gives failure rates for much nuclear plant equipment, including solenoid valves. The "all modes" failure rate for solenoid valves is 1.32E-6/h, but this is primarily for "catastrophic" (spurious open or spurious close) failures, 0.95E-6/h. The failure rate for "degraded" performance is 0.37E-6/h. A demand failure rate of 1.08E-6/d is also given in IEEE 500-1984.

The demand failure rate for solenoid valves is very low, and demand failure rates are generally not time dependent. Therefore, it will be assumed to be independent of test frequency. It is pessimistic to assume that the time dependent failure rate is dominant, in which case the failure rate will be proportional to the test interval. For such a pessimistic approach, the average failure probability during a time interval T is given as

$$\bar{\lambda} = \lambda T/2 = 0.37E\text{-}6 \times T/2 =$$

$$0.185E\text{-}6 \times T \text{ (hours)} = 1.35E\text{-}4 \times T \text{ (months)}$$

Test Interval T (months) =	1	3	6	12	24
Failure Probability	= 1.35E-4	4E-4	8.1E-4	1.6E-3	3.2E-3
Valve failures/year During FWC Maximum Demand Failure	= 2.0E-5	6.1E-5	1.2E-4	2.4E-4	4.9E-4

The valve failures per year are based on three valves in the plant and on the assumed 0.05 safety related turbine trips per year. To summarize the table, at a current test frequency of monthly for the FASV, less than one bypass valve failure in 50,000 years would be expected during failure of the feedwater controller resulting in maximum FW demand. (This failure could result in reactor overpressure, if bypass capability with the other valves were lower than power level.) If the test frequency were once per six months, one failure per 16,000 years could be expected. A 24-month interval between tests would result in the expectation of one failure per 2,000 years.

The determination of test frequency for turbine bypass valve testing should be based on the acceptable frequency of valve failure during the transient caused by FWC failure and leading to maximum flow demand. If one turbine trip causing reactor overpressure in 2,000 years is acceptable, a 24-month test interval can be justified.

Consideration was given to the probability that accumulator failure would preclude rapid BPV action when needed. The accumulators are precharged with nitrogen to 900 psig with the hydraulic system pump off. When the pump operates, system pressure climbs to 1600 psig. This pressure is maintained by the operating pump, and a standby pump will automatically start if system pressure drops to a preset value, indicating failure of the operating pump. If the accumulator leaks nitrogen, without being detected, and subsequently the operating pump fails and the standby pump fails to start, or starts and fails to run, the plant would be vulnerable to the FWC maximum demand event, with its assumed 0.05/year probability.

The probabilities of the above sequence are as follows:

- Accumulator leaks in 2 years: $1.7E-5/h \times 8760 \times 2\ h = 0.30$

- Operating pump fails to run 3 months (assume that pump switches to standby after 3 months):

$$7.4E-6/h \times 8760\ h/4 = 1.63E-2$$

- Standby pump fails to start or starts & fails to run for one month (failed pump could be repaired in one month):

$$1.3E-3 + 7.4E-6 \times 8760 / 12 = (1.3 + 5.4)\ E-3 = 6.7E-3$$

- Demand for BPV operation, FWC maximum demand: 0.05/year

- Total event probability:

$$0.30 \times 1.63E-2 \times 6.7E-3 \times 0.05 = 1.6E-6/year$$

The probability of this sequence of events is so low, even when the event frequency is overestimated by a factor of 500, it need not be considered. It will have no impact on the frequency of BPV testing.

Reference: IEEE Std. 500-1984, "IEEE Guide to the Collection and Presentation of Electrical, Electronic, and Sensing Component Reliability Data for Nuclear Power Generating Stations", Dec 13, 1983

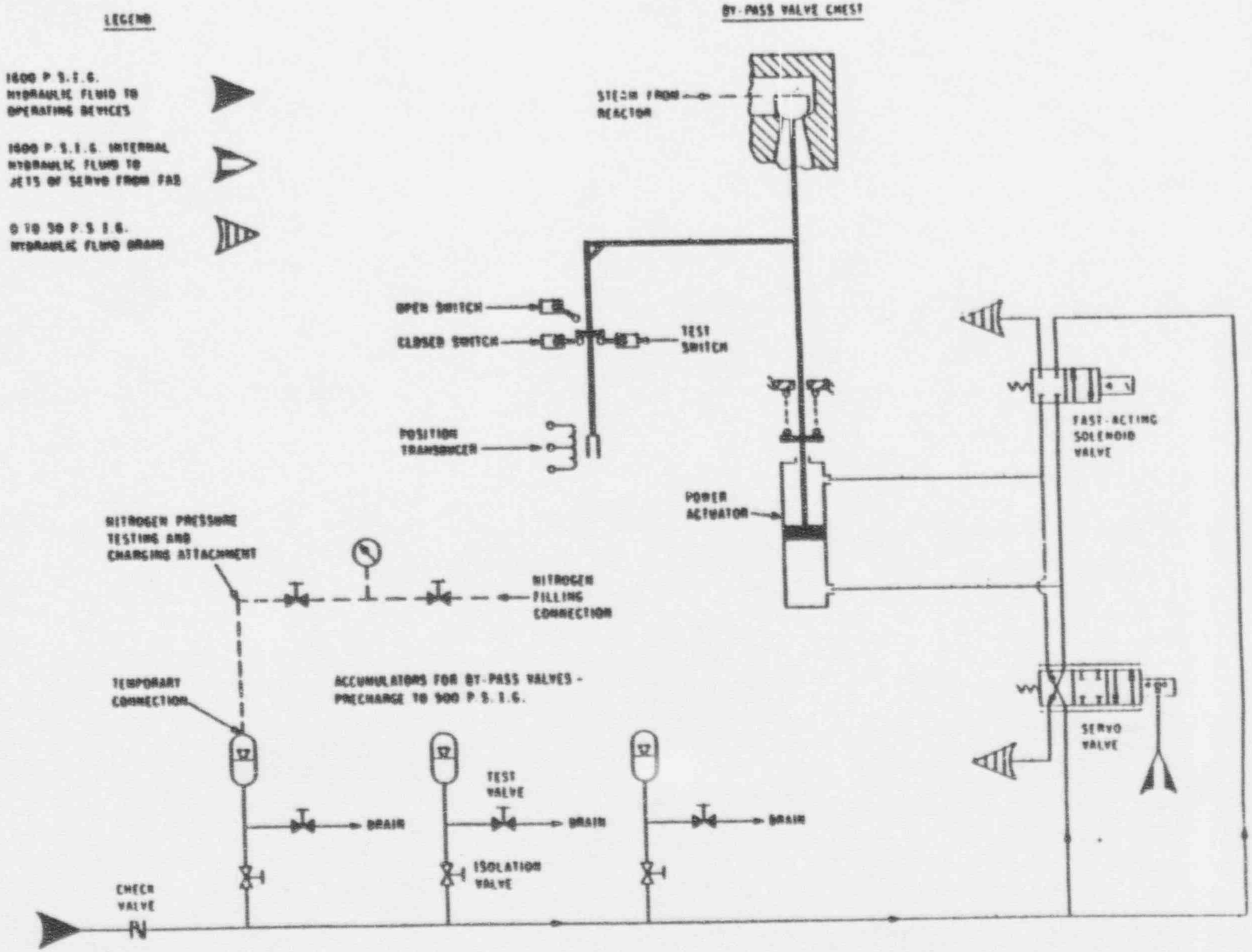

Figure 1. Turbine Bypass Valve Hydraulic Fluid Control Loop

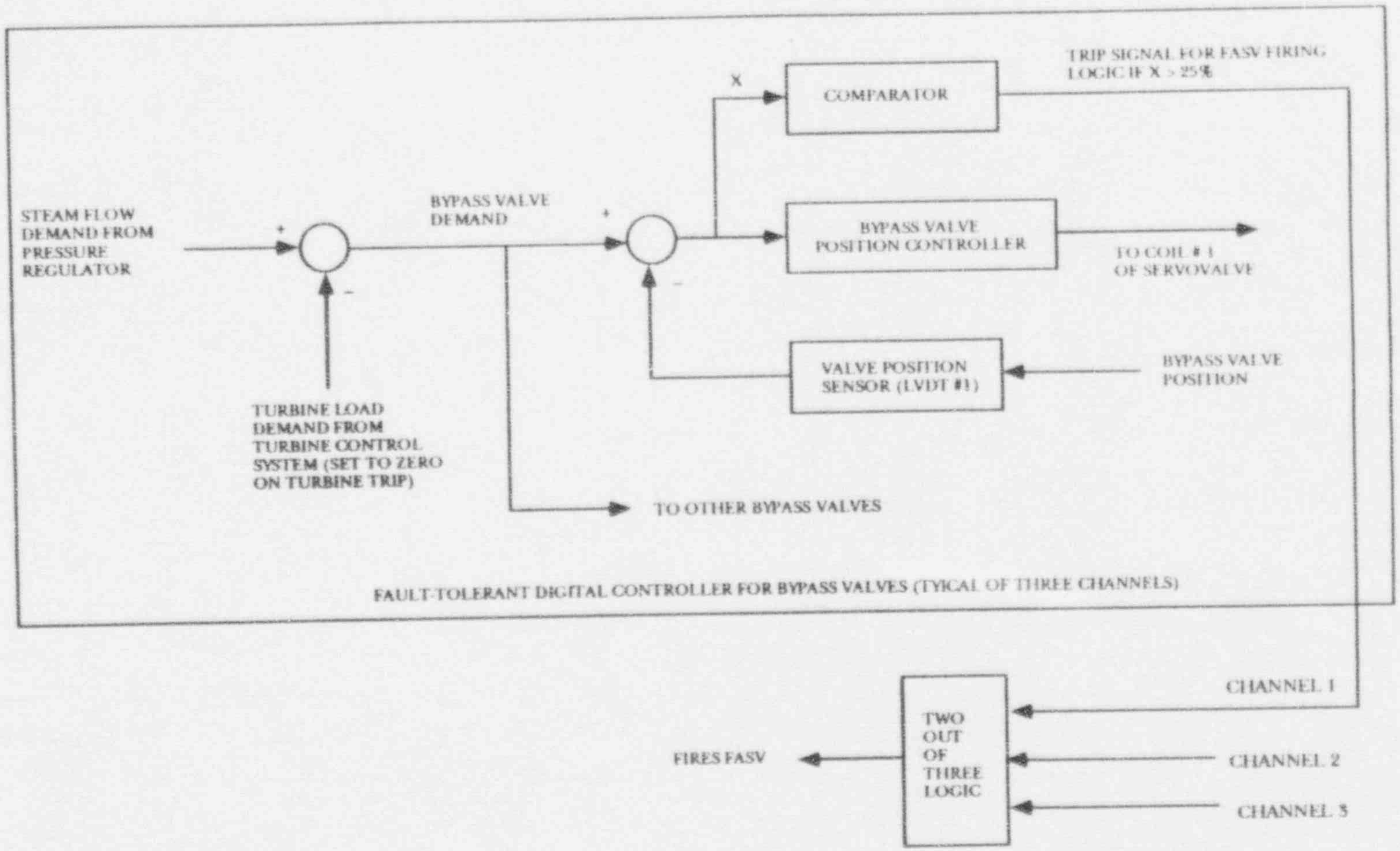

FIGURE 2. TURBINE BYPASS VALVE FAST ACTING SOLENOID VALVE CONTROL CIRCUIT

GE Nuclear Energy

General Electric Company
175 Curtner Avenue, San Jose, CA 95125

September 16, 1993

Docket No. STN 52-001

Chet Poslusny, Senior Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of the Nuclear Reactor Regulation

Subject: Submittal Supporting Accelerated ABWR Schedule - **P&R Version of Technical Specification LCOs 3.5.1 and 3.7.1 and Bases**

Dear Chet:

Enclosed are revised LCOs 3.5.1 and 3.7.1 and associated bases. These are intended to replace LCOs 3.5.1 and 3.7.1 issued for P&R dated 7/22/93 and 7/30/93, respectively, in their entirety.

Please provide a copy of this transmittal to Mark Reinhart.

Sincerely,

Jack Fox

Jack Fox
Advanced Reactor Programs

cc: Alan Beard (GE)
Norman Fletcher (DOE)
Cal Tang (GE)

JF93-259

3.7 PLANT SYSTEMS

3.7.1 Reactor Building Cooling (RCW) System, Reactor Service Water (RSW) System and Ultimate Heat Sink (UHS)-Operating

LCO 3.7.1 Divisions A, B and C of the RCW/RSW System and the UHS shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One RCW pump and/or one RSW pump and/or one RCW/RSW heat exchanger inoperable in a single division.	A.1 Restore pump(s) and/or heat exchanger to OPERABLE status.	30 days
B. One RCW/RSW division inoperable for reasons other than Condition A.	B.1 Declare associated supported required feature(s) inoperable and enter applicable Conditions and Required Actions of the LCOs for the inoperable required feature(s).	Immediately
	<u>AND</u>	
	B.2 Initiate action to restore RCW/RSW division to OPERABLE status.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Condition A exists in two or more RCW/RSW divisions.	C.1 Restore one inoperable RCW/RSW division to OPERABLE status. AND C.2 Restore two inoperable RCW/RSW divisions to OPERABLE status.	7 days 14 days
D. Required Action and associated Completion Time of Condition A, B or C not met. OR Two or more RCW/RSW divisions inoperable for reasons other than Condition C. OR UHS inoperable.	D.1 Be in MODE 3. AND D.2 Be in MODE 4.	12 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.1.1	Verify the water level of each UHS [spray pond] is ≥ [ ] ft.	24 hours
SR 3.7.1.2	Verify the water level in each RSW pump well of the intake structure is ≥ [ ] ft.	24 hours
SR 3.7.1.3	Verify the average water temperature of UHS is ≤ 35°C (95°F).	24 hours
SR 3.7.1.4	-------------------NOTE------------------- Isolation of flow to individual components does not render RCW/RSW System inoperable. -- Verify each RCW/RSW division manual, power operated, and automatic valve in the flow path servicing safety related systems or components, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.7.1.5	Verify each RCW/RSW division actuates on an actual or simulated initiation signal.	18 months

B 3.7 PLANT SYSTEMS

B 3.7.1 Reactor Building Cooling Water (RCW) System, Reactor Service Water (RSW) System, and Ultimate Heat Sink (UHS)-Operating

BASES

BACKGROUND

The RCW and RSW Systems are designed to provide cooling water for the removal of heat from unit auxiliaries, such as Residual Heat Removal (RHR) System heat exchangers, standby diesel generators (DGs), and room coolers for Emergency Core Cooling System equipment required for a safe reactor shutdown following a Design Basis Accident (DBA) or transient. The RCW/RSW System also provides cooling to unit components, as required, during normal shutdown and reactor isolation modes. During a DBA, most, but not all, equipment required for normal operation only is isolated from the RCW/RSW System, and cooling is directed to selected non-essential equipment such as control rod drive (CRD) pump oil coolers, instrument and service air compressor coolers, reactor water cleanup (RWCU) pump coolers, drywell coolers and reactor internal pump (RIP) MG set coolers and to safety related equipment. All non-essential equipment can be manually isolated if required. During all plant operating modes, all RCW/RSW divisions have at least one pump operating and, therefore, if a LOCA occurs the RCW/RSW systems will already be in operation.

The combined RCW/RSW system includes three separate divisions (A, B and C). Each division consists of the ultimate heat sink (UHS), an independent cooling water header, an independent service water loop, and the associated pumps, heat exchangers, piping, valves and instrumentation. Each division includes two RCW pumps, two RSW pumps and three RCW to RSW heat exchangers. Each division is sized to provide sufficient cooling capacity to support the required safety-related systems in its respective division during safe shutdown of the unit following a loss-of-coolant accident (LOCA).

The UHS is [a spray pond with four spray networks, and their supply piping, suspended above the pond surface on reinforced concrete columns]. The [spray pond] is sized such that sufficient water inventory is available for all RCW/RSW System post LOCA cooling requirements for a 30 day period

(continued)

BASES

BACKGROUND (continued)

with no external makeup water source available (Regulatory Guide 1.27, Ref. 1). Normal makeup for the [spray pond] is provided automatically by the [power cycle heat sink makeup line].

Cooling water is pumped from the [spray pond] by the RSW pump(s) to the RCW/RSW heat exchangers through the three main redundant supply headers (divisions A, B and C). In a separate closed loop cooling water is circulated by the pump(s) in each RCW division through the essential components to be cooled and back through the RCW/RSW heat exchangers. Thus, the heat removed from the components by the RCW is transferred to the RSW, and then ultimately rejected to the UHS.

Divisions A, B and C supply cooling water to redundant equipment required for a safe reactor shutdown. Additional information on the design and operation of the RCW/RSW System and UHS along with the specific equipment for which the RCW/RSW System supplies cooling water is provided in the ABWR SSAR, Sections 9.2.11 and 9.2.15 and the SSAR, Table 9.2-4C (Refs. 2 and 3, respectively). The combined three division RCW/RSW System is designed to withstand a single active or passive failure coincident with a loss of offsite power, without losing the capability to supply adequate cooling water to equipment required for safe reactor shutdown.

Following a DBA or transient, the RCW/RSW System will operate automatically without operator action. Manual initiation of supported systems is, however, performed for some cooling operations (e.g., shutdown cooling).

APPLICABLE SAFETY ANALYSES

The volume of water incorporated in the UHS is sized so that sufficient water inventory is available for all RCW/RSW System post LOCA cooling requirements for a 30 day period with no additional makeup water source available (Ref. 1). The ability of the RCW/RSW System to support long term cooling of the reactor or containment is assumed in evaluations of the equipment required for safe reactor shutdown presented in the SSAR, Sections 9.2.11, 9.2.15, 6.2.1.1.3.3.1.4, and Chapter 15, (Refs. 2, 4, and 5, respectively). These analyses include the evaluation of the

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

long term primary containment response after a design basis LOCA. The RCW/RSW System provides cooling water for the RHR suppression pool cooling mode to limit suppression pool temperature and primary containment pressure following a LOCA. This ensures that the primary containment can perform its intended function of limiting the release of radioactive materials to the environment following a LOCA. The RCW/RSW System also provides cooling to other components assumed to function during a LOCA (e.g., RHR). Also, the ability to provide onsite emergency AC power is dependent on the ability of the RCW/RSW System to cool the DGs.

The safety analyses for long term containment cooling were performed, as discussed in the SSAR, Sections 6.2.1.1.3.3.1.4 and 6.2.2.3 (Refs. 4 and 6, respectively), for a LOCA, concurrent with a loss of offsite power, and minimum available DG power. The worst case single failure affecting the performance of the RCW/RSW System is the failure of one of the three standby DGs, which would in turn affect one of the three RCW/RSW divisions and cause failure of a RHR heat exchanger as assumed in the SSAR analysis. Reference 2 discusses RCW/RSW System performance during these conditions.

The combined RCW/RSW System, together with the UHS, satisfy Criterion 3 of the NRC Policy Statement.

LCO

The OPERABILITY of Divisions A, B and C of the RCW/RSW System is required to ensure the effective operation of the RHR System in removing heat from the reactor, and the effective operation of other safety related equipment during a DBA or transient. Requiring all three divisions to be OPERABLE ensures that two divisions will be available to provide adequate capability to meet cooling requirements of the equipment required for safe shutdown in the event of a single failure.

A division is considered OPERABLE when:

a. All four associated RCW/RSW pumps are OPERABLE;

b. All three RCW/RSW heat exchangers are OPERABLE;

(continued)

BASES

LCO (continued)

c. The associated UHS is OPERABLE; and

d. The associated piping, valves, instrumentation, and controls required to perform the safety related function are OPERABLE.

OPERABILITY of the UHS is based on a maximum water temperature of 35°C (95°F) with OPERABILITY of each division requiring a minimum water level at or above elevation [mean sea level (equivalent to an indicated level of ≥ [ ]) and four OPERABLE spray networks].

The isolation of the RCW/RSW System to components or systems may render those components or systems inoperable, but does not affect the OPERABILITY of the RCW/RSW System.

APPLICABILITY

In MODES 1, 2, and 3, the RCW/RSW System and UHS are required to be OPERABLE to support OPERABILITY of the equipment serviced by the RCW/RSW System and UHS, and are required to be OPERABLE in these MODES.

In MODES 4 and 5, the OPERABILITY requirements of the RCW/RSW System and UHS are specified in LCOs 3.7.2, "RCW/RSW and UHS-Shutdown" and 3.7.3, "RCW/RSW and UHS-Refueling".

ACTIONS

A.1

If one RCW pump and/or one RSW pump and/or one RCW/RSW heat exchanger in the same division is inoperable (i.e., if only the minimum complement of one RCW pump, one RSW pump and two RCW/RSW heat exchangers are OPERABLE) in one division, action must be taken to restore the inoperable component(s), and thus the division affected, to OPERABLE status within 30 days. In this condition sufficient redundant equipment is still available to provide cooling water to the required safety related components and sufficient heat removal capacity is still available to adequately cool safety related loads, even assuming the worst case single failure. However, in the degraded mode of this Condition, overall reliability is reduced and a division may not be capable of

(continued)

BASES

ACTIONS

A.1 (continued)

removing heat from the respective RHR heat exchanger at a rate consistent with design basis assumptions and modeling in the analysis for long term containment cooling (depending on other factors such as actual UHS temperature).

With a minimum complement of one RCW pump, one RSW pump and two RCW/RSW heat exchangers, a division is capable of performing its safety related cooling function, consistent with design basis assumptions, for all required modes with the exception of containment cooling. However, beyond design basis calculations performed to support PRA success criteria (Ref. 7) demonstrate that successful operation of only one of three RHR divisions (in the suppression pool cooling mode) is needed to prevent conditions inside the containment from exceeding its ultimate capacity (see B 3.6.2.3). Thus, should a DBA occur while in this slightly degraded Condition, even considering a coincident worst case single failure, the combined RCW/RSW and RHR system would retain the capability to ultimately protect containment integrity.

The 30-day Completion Time is reasonable, based on the low probability of an accident occurring during the 30 days that a component is inoperable in one or more divisions, the number of available redundant divisions, the substantial cooling capability still remaining in a division(s) in this Condition, and the expected high division availability afforded by a system where most of the equipment, including the minimum required for most functions, is normally operating.

B.1 and B.2

If one RCW/RSW division is inoperable for reasons other than Condition A, then, immediately, those required feature(s) supported by the inoperable RCW/RSW division must be declared inoperable (e.g., Emergency Diesel Generator, RHR heat exchanger, drywell coolers, RIP coolers, etc.) and the applicable Conditions and Required Actions of the appropriate LCOs for the inoperable required feature(s) must be entered. For example, applicable Conditions of LCO 3.8.1, "AC Sources-Operating," LCO 3.4.7, "Residual Heat Removal (RHR) Shutdown Cooling System-Hot Shutdown," LCO

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

3.4.1, "Reactor Internal Pumps (RIP) Operating," and LCO 3.6.1.5, "Drywell Air Temperature" be entered and the Required Actions taken if the inoperable RCW/RSW division results in an inoperable DG, RHR shutdown cooling, RIPS or drywell coolers, respectively. This is in accordance with LCO 3.0.6 and ensures the proper actions are taken for these components.

Additionally, immediate action must be taken to restore the inoperable RCW/RSW division to OPERABLE status. This is consistent with the Required Actions of the applicable LCOs for those support feature(s) declared inoperable as a result of the inoperable RCW/RSW division.

C.1 and C.2

If one RCW pump and/or one RSW pump and/or one RCW/RSW heat exchanger in the same division is inoperable in two or more separate divisions, one RCW/RSW division must be restored to OPERABLE status within 7 days and two RCW/RSW divsions must be restored to OPERABLE status in 14 days. In this condition sufficient redundant equipment is still available to provide cooling water to the required safety related components and sufficient heat removal capacity is still available to adequately cool safety related loads. However, a division may not be capable of removing heat from the respective RHR heat exchanger at a rate consistent with design basis assumptions and modeling in the analysis for long term containment cooling. Nonetheless, with a minimum complement of one RCW pump, one RSW pump and two RCW/RSW heat exchangers, a division is still capable of performing its safety related cooling function, consistent with design basis assumptions, for all other modes. Furthermore, beyond design basis calculations performed to support PRA success criteria (Ref. 7) demonstrate that only one of three RHR divisions (in the suppression pool cooling mode) is needed to ultimately protect containment integrity (see B 3.6.2.3). Therefore, continued operation for a limited time is justified. However, in the degraded mode of this Condition, overall reliability and heat removal capability is reduced from that of Condition A, and thus a more restrictive Completion Time is imposed.

(continued)

BASES

ACTIONS

C.1 and C.2 (continued)

The 7 and 14 day Completion Times are reasonable, based on the low probability of an accident occurring during the period that one or more redundant components are inoperable in one or more divisions, the number of available redundant divisions, the substantial cooling capability still remaining in divisions in this Condition, and the expected high division availability afforded by a system where most of the equipment, including the minimum required for most functions, is normally operating.

D.1, D.2, D.3 and D.4

If the RCW/RSW division cannot be restored to OPERABLE status within the associated Completion Time, or two or more RCW/RSW divisions are inoperable for reasons other than Condition C, or the UHS is determined inoperable, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 12 hours and in MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.7.1.1

This SR ensures adequate long term (30 days) cooling can be maintained. With the UHS water source below the minimum level, the affected RCW/RSW division must be declared inoperable. The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.1.2

This SR verifies the water level in each RSW pump well of the intake structure to be sufficient for the proper operation of the RSW pumps (net positive suction head and pump vortexing are considered in determining this limit). The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

SR 3.7.1.3

Verification of the UHS temperature ensures that the heat removal capability of the RCW/RSW System is within the assumptions of the DBA analysis. The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

SR 3.7.1.4

Verifying the correct alignment for each manual, power operated, and automatic valve in each RCW/RSW division flow path provides assurance that the proper flow paths will exist for RCW/RSW operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing. A valve is also allowed to be in the nonaccident position and yet considered in the correct position, provided it can be automatically realigned to its accident position. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of potentially being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

This SR is modified by a Note indicating that isolation of the RCW/RSW System to components or systems may render those components or systems inoperable, but does not affect the OPERABILITY of the RCW/RSW System. As such, when all RCW/RSW pumps, valves, and piping are OPERABLE but a branch connection off of the main header is isolated, the RCW/RSW System is still OPERABLE.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.1.4 (continued)

The 31 day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

SR 3.7.1.5

This SR verifies the automatic isolation valves of the RCW/RSW System will automatically switch to the safety or emergency position to provide cooling water exclusively to the safety related equipment, and limited non-safety related equipment, during an accident event. This is demonstrated by use of an actual or simulated initiation signal. This SR also verifies the automatic start capability of the RCW/RSW pumps that are in standby and automatic valving in each of the standby RCW/RSW heat exchangers in each division. The LOGIC SYSTEM FUNCTIONAL TEST in SR 3.3.5.1.4 overlaps this SR to provide complete testing of the safety function.

Operating experience has shown that these components usually pass the SR when performed on the 18 month Frequency. Therefore, this Frequency is concluded to be acceptable from a reliability standpoint.

REFERENCES

1. Regulatory Guide 1.27, Revision 2, January 1976.
2. ABWR SSAR, Sections 9.2.11 and 9.2.15.
3. ABWR SSAR, Table 9.2-4C.
4. ABWR SSAR, Chapter 6.2.1.1.3.3.1.4.
5. ABWR SSAR, Chapter 15.
6. ABWR SSAR, Section 6.2.2.3.
7. [later].

GE Nuclear Energy

May 19, 1993

Docket No. STN 52-001

Chet Poslusny, Senior Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of the Nuclear Reactor Regulation

Subject: Submittal Supporting Accelerated ABWR Review Schedule - **Revised LCO 3.7.5**

Dear Chet:

Enclosed is a SSAR markup of the revised LCO 3.7.5, Main Turbine Bypass System.

Please provide a copy of this transmittal to George Thomas.

Sincerely,

Jack Fox

Jack Fox
Advanced Reactor Programs

cc: Norman Fletcher (DOE)
Cal Tang (GE)

JF93-163

3.7 PLANT SYSTEMS

3.7.~~6~~ 5 Main Turbine Bypass System

LCO 3.7.~~6~~ 5 The Main Turbine Bypass System shall be OPERABLE.

[OR

LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)," limits for an inoperable Main Turbine Bypass System, as specified in the [COLR], are made applicable.]

APPLICABILITY: THERMAL POWER ≥ ~~25%~~ 40 RTP.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. [Requirements of the LCO not met or Main Turbine Bypass System inoperable.]	A.1 [Satisfy the requirements of the LCO or restore Main Turbine Bypass System to OPERABLE status.]	2 hours
B. Required Action and associated Completion Time not met.	B.1 Reduce THERMAL POWER to < ~~25%~~ 40 RTP.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.~~6~~ 5.1	~~Verify one complete cycle of each main turbine bypass valve.~~ Perform bypass valve opening test to approximately 10% position for each turbine bypass valve.	31 days

indicates change

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.7.~~6~~5.2	Perform a system functional test.	~~[18] months~~
SR 3.7.~~6~~5.3	Verify the TURBINE BYPASS SYSTEM RESPONSE TIME is within limits.	~~[18] months~~

REFUELING INTERVAL

BASES

ACTIONS (continued)

B.1

If the Main Turbine Bypass System cannot be restored to OPERABLE status or the MCPR limits for an inoperable Main Turbine Bypass System are not applied, THERMAL POWER must be reduced to < ~~25~~ 40% RTP. As discussed in the Applicability section, operation at < ~~25~~ 40% RTP results in sufficient margin to the required limits, and the Main Turbine Bypass System is not required to protect fuel integrity during the feedwater controller failure, maximum demand event. The 4 hour Completion Time is reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.7.~~6~~5.1

~~Cycling~~ Opening each main turbine bypass valve ~~through one complete cycle of full travel~~ to its 10% position (approximately) demonstrates that the valves are mechanically OPERABLE and will function when required. The 31 day Frequency is based on ~~engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions. Therefore, the Frequency is acceptable from a reliability standpoint.~~ a reliability analysis (Ref 3).

SR 3.7.~~6~~5.2

The Main Turbine Bypass System is required to actuate automatically to perform its design function. This SR demonstrates that, with the required system initiation signals, the valves will actuate to their required position. The ~~[18] month~~ REFUELING INTERVAL Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and because of the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown the ~~[18] month~~ REFUELING INTERVAL Frequency, which is based on the refueling cycle, is acceptable from a reliability standpoint.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.~~6~~5.3

This SR ensures that the TURBINE BYPASS SYSTEM RESPONSE TIME is in compliance with the assumptions of the appropriate safety analysis. The response time limits are specified in [unit specific documentation]. The ~~[18] month~~ REFUELING INTERVAL Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and because of the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown the ~~[18] month~~ REFUELING INTERVAL Frequency, which is based on the refueling cycle, is acceptable from a reliability standpoint and is also based upon the reliability analysis of Ref. 3.

REFERENCES

1. ABWR ~~F~~SSAR, Section 7.7.1.8.
2. ABWR ~~F~~SSAR, ~~Section [15.1.2]~~ Chapter 15.
3. [ ]

be more specific

ABWR Main Turbine Bypass Valve Failure Rate

The ABWR has three main turbine bypass valves (BPVs) with the capacity to dump 33% of reactor steam directly to the main condenser. In event of a turbine trip at modest power, less than 33%, the BPVs will open quickly to dump steam before a reactor scram can occur because of high reactor pressure.

If a turbine trip occurs at high power, even fast action of the bypass valves will not avoid reactor scram. However, the proper BPV function will limit the pressure rise in the reactor. The hydraulic fluid loop showing the fast acting solenoid valve (FASV) and its connection to the BPV is shown in Figure 1. The FASV is the key to fast opening of BPVs.

The number of safety related demands on the bypass valves and the FASV will depend on the number of turbine trips for which operability of the BPVs is assumed. That analysis included only one transient in which it was assumed that the BPVs would function properly. The transient is described in SSAR Section 15.1.2, Feedwater Controller Failure -- Maximum Demand; and the estimated frequency is less than once in 10,000 years. However, the event is analyzed as a moderate frequency event (once in 20 years), which overestimates its importance by a factor of 500.

Bypass valves of current BWRs in the U.S. are tested monthly in a test that includes slow stroking for 90% of valve travel followed by rapid stroke for the final 10% of travel. This monthly test frequency has no technical basis and was established on the basis of other turbine valve testing. Because of the 11% power capability of a single bypass valve in the ABWR plant, it is desirable to test the full stroke and fast travel of bypass valves only during plant shutdown, approximately every two years, to minimize disturbance to the electrical grid and to minimize potential challenges to the plant safety systems. At shutdown the total valve stroke time can be measured. The valves can be stroked slowly during plant operation over partial travel (such as 10%) to assure that they are not bound and will open on demand. Such a test will have little impact on operation.

The circuit to cause fast opening of the BPV is attached as Figure 2. The fault tolerant, solid state digital controller components are checked frequently by the self-check circuits. They are also combined in 2-out-of-3 logic so there will be a very low probability of failures of the controller that lead to inadvertent opening of the fast acting solenoid valves (FASVs). Because of the high reliability of this circuit, the main contributor to failure of the FASV to perform its desired function will be the FASV itself.

The referenced IEEE Standard gives failure rates for much nuclear plant equipment, including solenoid valves. The "all modes" failure rate for solenoid valves is 1.32E-6/h, but this is primarily for "catastrophic" (spurious open or spurious close) failures, 0.95E-6/h. The failure rate for "degraded" performance is 0.37E-6/h. A demand failure rate of 1.08E-6/d is also given in IEEE 500-1984.

The demand failure rate for solenoid valves is very low, and demand failure rates are generally not time dependent. Therefore, it will be assumed to be independent of test frequency. It is pessimistic to assume that the time dependent failure rate is dominant, in which case the failure rate will be proportional to the test interval. For such a pessimistic approach, the average failure probability during a time interval T is given as

$$\bar{\lambda} = \lambda T/2 = 0.37\text{E-}6 \times T/2 =$$

$$0.185\text{E-}6 \times T \text{ (hours)} = 1.35\text{E-}4 \times T \text{ (months)}$$

Test Interval T (months) =	1	3	6	12	24
Failure Probability =	1.35E-4	4E-4	8.1E-4	1.6E-3	3.2E-3
Valve failures/year During FWC Maximum Demand Failure =	2.0E-5	6.1E-5	1.2E-4	2.4E-4	4.9E-4

The valve failures per year are based on three valves in the plant and on the assumed 0.05 safety related turbine trips per year. To summarize the table, at a current test frequency of monthly for the FASV, less than one bypass valve failure in 50,000 years would be expected during failure of the feedwater controller resulting in maximum FW demand. (This failure could result in reactor overpressure, if bypass capability with the other valves were lower than power level.) If the test frequency were once per six months, one failure per 16,000 years could be expected. A 24-month interval between tests would result in the expectation of one failure per 2,000 years.

The determination of test frequency for turbine bypass valve testing should be based on the acceptable frequency of valve failure during the transient caused by FWC failure and leading to maximum flow demand. If one turbine trip causing reactor overpressure in 2,000 years is acceptable, a 24-month test interval can be justified.

Consideration was given to the probability that accumulator failure would preclude rapid BPV action when needed. The accumulators are precharged with nitrogen to 900 psig with the hydraulic system pump off. When the pump operates, system pressure climbs to 1600 psig. This pressure is maintained by the operating pump, and a standby pump will automatically start if system pressure drops to a preset value, indicating failure of the operating pump. If the accumulator leaks nitrogen, without being detected, and subsequently the operating pump fails and the standby pump fails to start, or starts and fails to run, the plant would be vulnerable to the FWC maximum demand event, with its assumed 0.05/year probability.

The probabilities of the above sequence are as follows:

- Accumulator leaks in 2 years: 1.7E-5/h x 8760 x 2 h = 0.30

- Operating pump fails to run 3 months (assume that pump switches to standby after 3 months):

  7.4E-6/h x 8760 h/4 = 1.63E-2

- Standby pump fails to start or starts & fails to run for one month (failed pump could be repaired in one month):

  1.3E-3 + 7.4E-6 x 8760 / 12 = (1.3 + 5.4) E-3 = 6.7E-3

- Demand for BPV operation, FWC maximum demand: 0.05/year

- Total event probability:

  0.30 x 1.63E-2 x 6.7E-3 x 0.05 = 1.6E-6/year

The probability of this sequence of events is so low, even when the event frequency is overestimated by a factor of 500, it need not be considered. It will have no impact on the frequency of BPV testing.

Reference: IEEE Std. 500-1984, "IEEE Guide to the Collection and Presentation of Electrical, Electronic, and Sensing Component Reliability Data for Nuclear Power Generating Stations", Dec 13, 1983

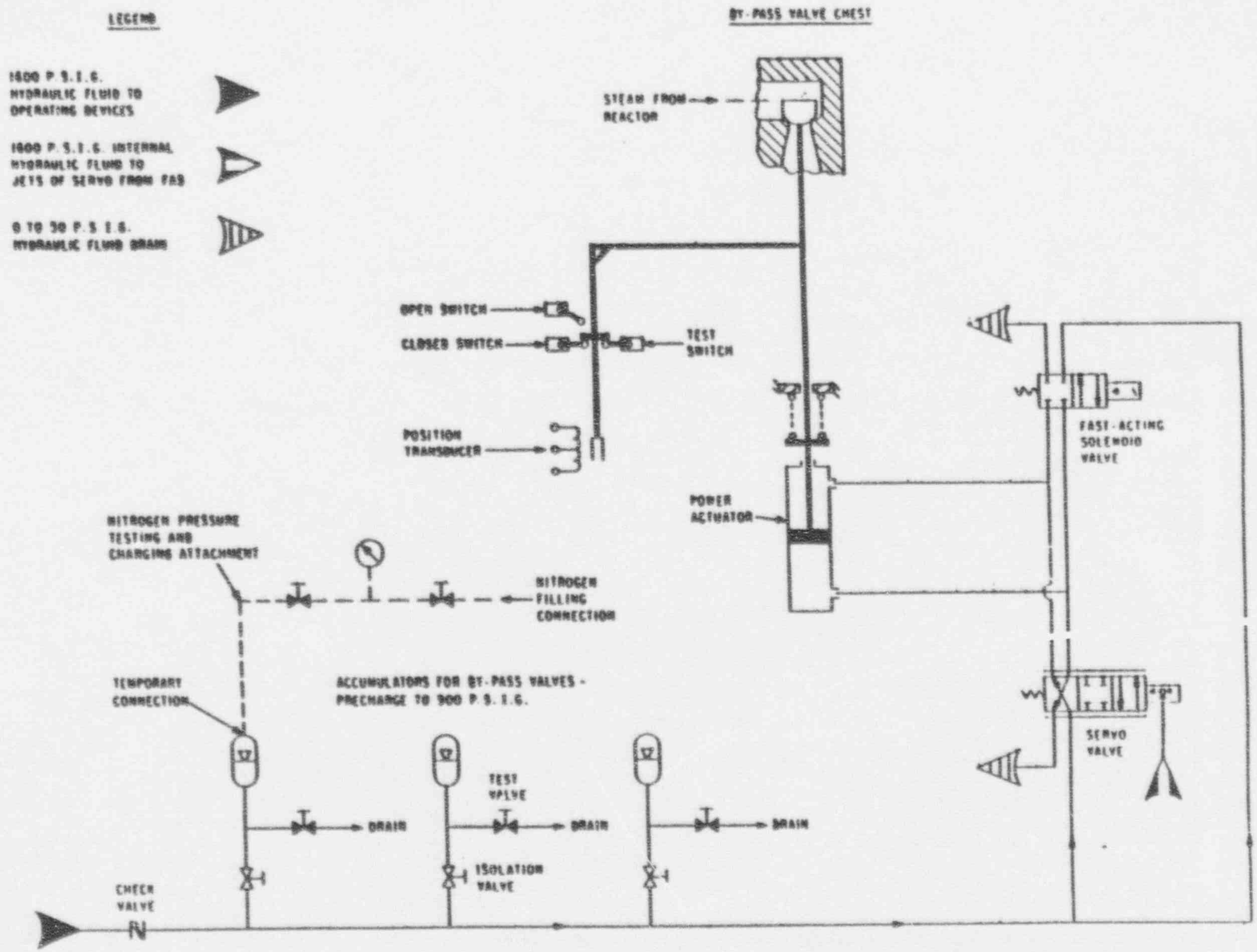

Figure 1. Turbine Bypass Valve Hydraulic Fluid Control Loop

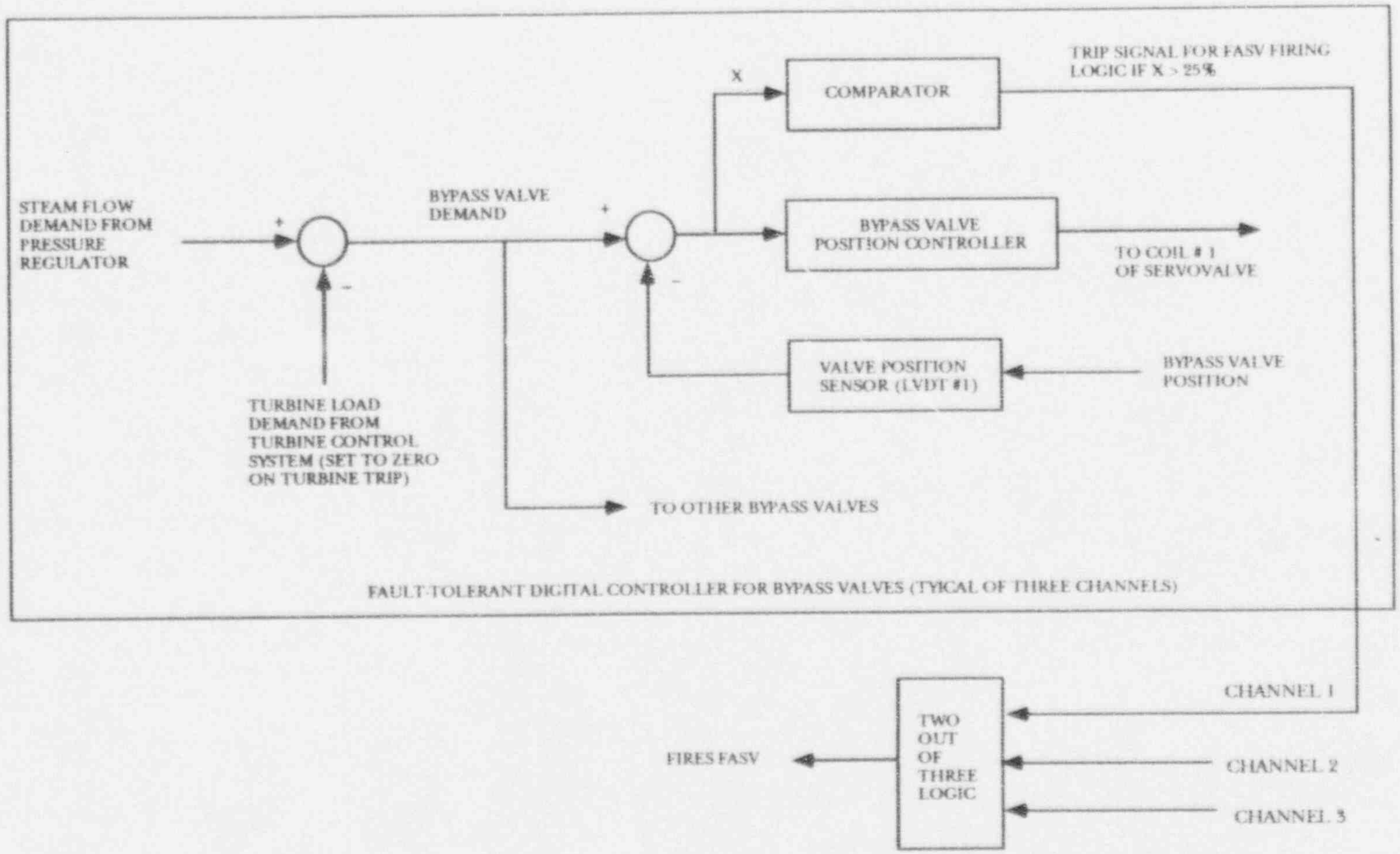

FIGURE 2. TURBINE BYPASS VALVE FAST ACTING SOLENOID VALVE CONTROL CIRCUIT

GE Nuclear Energy

General Electric Company
175 Curtner Avenue, San Jose, CA 95125

September 16, 1993

Docket No. STN 52-001

Chet Poslusny, Senior Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of the Nuclear Reactor Regulation

Subject: Submittal Supporting Accelerated ABWR Schedule - **P&R Version of Technical Specification LCOs 3.5.1 and 3.7.1 and Bases**

Dear Chet:

Enclosed are revised LCOs 3.5.1 and 3.7.1 and associated bases. These are intended to replace LCOs 3.5.1 and 3.7.1 issued for P&R dated 7/22/93 and 7/30/93, respectively, in their entirety.

Please provide a copy of this transmittal to Mark Reinhart.

Sincerely,

Jack Fox

Jack Fox
Advanced Reactor Programs

cc: Alan Beard (GE)
Norman Fletcher (DOE)
Cal Tang (GE)

JF93-259

3.7 PLANT SYSTEMS

3.7.1 Reactor Building Cooling (RCW) System, Reactor Service Water (RSW) System and Ultimate Heat Sink (UHS)-Operating

LCO 3.7.1 Divisions A, B and C of the RCW/RSW System and the UHS shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One RCW pump and/or one RSW pump and/or one RCW/RSW heat exchanger inoperable in a single division.	A.1 Restore pump(s) and/or heat exchanger to OPERABLE status.	30 days
B. One RCW/RSW division inoperable for reasons other than Condition A.	B.1 Declare associated supported required feature(s) inoperable and enter applicable Conditions and Required Actions of the LCOs for the inoperable required feature(s).	Immediately
	<u>AND</u>	
	B.2 Initiate action to restore RCW/RSW division to OPERABLE status.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Condition A exists in two or more RCW/RSW divisions.	C.1 Restore one inoperable RCW/RSW division to OPERABLE status. <u>AND</u> C.2 Restore two inoperable RCW/RSW divisions to OPERABLE status.	7 days 14 days
D. Required Action and associated Completion Time of Condition A, B or C not met. <u>OR</u> Two or more RCW/RSW divisions inoperable for reasons other than Condition C. <u>OR</u> UHS inoperable.	D.1 Be in MODE 3. <u>AND</u> D.2 Be in MODE 4.	12 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.1.1	Verify the water level of each UHS [spray pond] is ≥ [ ] ft.	24 hours
SR 3.7.1.2	Verify the water level in each RSW pump well of the intake structure is ≥ [ ] ft.	24 hours
SR 3.7.1.3	Verify the average water temperature of UHS is ≤ 35°C (95°F).	24 hours
SR 3.7.1.4	-------------------NOTE------------------- Isolation of flow to individual components does not render RCW/RSW System inoperable. -- Verify each RCW/RSW division manual, power operated, and automatic valve in the flow path servicing safety related systems or components, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.7.1.5	Verify each RCW/RSW division actuates on an actual or simulated initiation signal.	18 months

B 3.7 PLANT SYSTEMS

B 3.7.1 Reactor Building Cooling Water (RCW) System, Reactor Service Water (RSW) System, and Ultimate Heat Sink (UHS)-Operating

BASES

BACKGROUND

The RCW and RSW Systems are designed to provide cooling water for the removal of heat from unit auxiliaries, such as Residual Heat Removal (RHR) System heat exchangers, standby diesel generators (DGs), and room coolers for Emergency Core Cooling System equipment required for a safe reactor shutdown following a Design Basis Accident (DBA) or transient. The RCW/RSW System also provides cooling to unit components, as required, during normal shutdown and reactor isolation modes. During a DBA, most, but not all, equipment required for normal operation only is isolated from the RCW/RSW System, and cooling is directed to selected non-essential equipment such as control rod drive (CRD) pump oil coolers, instrument and service air compressor coolers, reactor water cleanup (RWCU) pump coolers, drywell coolers and reactor internal pump (RIP) MG set coolers and to safety related equipment. All non-essential equipment can be manually isolated if required. During all plant operating modes, all RCW/RSW divisions have at least one pump operating and, therefore, if a LOCA occurs the RCW/RSW systems will already be in operation.

The combined RCW/RSW system includes three separate divisions (A, B and C). Each division consists of the ultimate heat sink (UHS), an independent cooling water header, an independent service water loop, and the associated pumps, heat exchangers, piping, valves and instrumentation. Each division includes two RCW pumps, two RSW pumps and three RCW to RSW heat exchangers. Each division is sized to provide sufficient cooling capacity to support the required safety-related systems in its respective division during safe shutdown of the unit following a loss-of-coolant accident (LOCA).

The UHS is [a spray pond with four spray networks, and their supply piping, suspended above the pond surface on reinforced concrete columns]. The [spray pond] is sized such that sufficient water inventory is available for all RCW/RSW System post LOCA cooling requirements for a 30 day period

(continued)

BASES

BACKGROUND (continued)

with no external makeup water source available (Regulatory Guide 1.27, Ref. 1). Normal makeup for the [spray pond] is provided automatically by the [power cycle heat sink makeup line].

Cooling water is pumped from the [spray pond] by the RSW pump(s) to the RCW/RSW heat exchangers through the three main redundant supply headers (divisions A, B and C). In a separate closed loop cooling water is circulated by the pump(s) in each RCW division through the essential components to be cooled and back through the RCW/RSW heat exchangers. Thus, the heat removed from the components by the RCW is transferred to the RSW, and then ultimately rejected to the UHS.

Divisions A, B and C supply cooling water to redundant equipment required for a safe reactor shutdown. Additional information on the design and operation of the RCW/RSW System and UHS along with the specific equipment for which the RCW/RSW System supplies cooling water is provided in the ABWR SSAR, Sections 9.2.11 and 9.2.15 and the SSAR, Table 9.2-4C (Refs. 2 and 3, respectively). The combined three division RCW/RSW System is designed to withstand a single active or passive failure coincident with a loss of offsite power, without losing the capability to supply adequate cooling water to equipment required for safe reactor shutdown.

Following a DBA or transient, the RCW/RSW System will operate automatically without operator action. Manual initiation of supported systems is, however, performed for some cooling operations (e.g., shutdown cooling).

APPLICABLE SAFETY ANALYSES

The volume of water incorporated in the UHS is sized so that sufficient water inventory is available for all RCW/RSW System post LOCA cooling requirements for a 30 day period with no additional makeup water source available (Ref. 1). The ability of the RCW/RSW System to support long term cooling of the reactor or containment is assumed in evaluations of the equipment required for safe reactor shutdown presented in the SSAR, Sections 9.2.11, 9.2.15, 6.2.1.1.3.3.1.4, and Chapter 15, (Refs. 2, 4, and 5, respectively). These analyses include the evaluation of the

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)	long term primary containment response after a design basis LOCA. The RCW/RSW System provides cooling water for the RHR suppression pool cooling mode to limit suppression pool temperature and primary containment pressure following a LOCA. This ensures that the primary containment can perform its intended function of limiting the release of radioactive materials to the environment following a LOCA. The RCW/RSW System also provides cooling to other components assumed to function during a LOCA (e.g., RHR). Also, the ability to provide onsite emergency AC power is dependent on the ability of the RCW/RSW System to cool the DGs. The safety analyses for long term containment cooling were performed, as discussed in the SSAR, Sections 6.2.1.1.3.3.1.4 and 6.2.2.3 (Refs. 4 and 6, respectively), for a LOCA, concurrent with a loss of offsite power, and minimum available DG power. The worst case single failure affecting the performance of the RCW/RSW System is the failure of one of the three standby DGs, which would in turn affect one of the three RCW/RSW divisions and cause failure of a RHR heat exchanger as assumed in the SSAR analysis. Reference 2 discusses RCW/RSW System performance during these conditions. The combined RCW/RSW System, together with the UHS, satisfy Criterion 3 of the NRC Policy Statement.
LCO	The OPERABILITY of Divisions A, B and C of the RCW/RSW System is required to ensure the effective operation of the RHR System in removing heat from the reactor, and the effective operation of other safety related equipment during a DBA or transient. Requiring all three divisions to be OPERABLE ensures that two divisions will be available to provide adequate capability to meet cooling requirements of the equipment required for safe shutdown in the event of a single failure. A division is considered OPERABLE when: a. All four associated RCW/RSW pumps are OPERABLE; b. All three RCW/RSW heat exchangers are OPERABLE;

(continued)

BASES

LCO (continued)

c. The associated UHS is OPERABLE; and

d. The associated piping, valves, instrumentation, and controls required to perform the safety related function are OPERABLE.

OPERABILITY of the UHS is based on a maximum water temperature of 35°C (95°F) with OPERABILITY of each division requiring a minimum water level at or above elevation [mean sea level (equivalent to an indicated level of ≥ [ ]) and four OPERABLE spray networks].

The isolation of the RCW/RSW System to components or systems may render those components or systems inoperable, but does not affect the OPERABILITY of the RCW/RSW System.

APPLICABILITY

In MODES 1, 2, and 3, the RCW/RSW System and UHS are required to be OPERABLE to support OPERABILITY of the equipment serviced by the RCW/RSW System and UHS, and are required to be OPERABLE in these MODES.

In MODES 4 and 5, the OPERABILITY requirements of the RCW/RSW System and UHS are specified in LCOs 3.7.2, "RCW/RSW and UHS-Shutdown" and 3.7.3, "RCW/RSW and UHS-Refueling".

ACTIONS

A.1

If one RCW pump and/or one RSW pump and/or one RCW/RSW heat exchanger in the same division is inoperable (i.e., if only the minimum complement of one RCW pump, one RSW pump and two RCW/RSW heat exchangers are OPERABLE) in one division, action must be taken to restore the inoperable component(s), and thus the division affected, to OPERABLE status within 30 days. In this condition sufficient redundant equipment is still available to provide cooling water to the required safety related components and sufficient heat removal capacity is still available to adequately cool safety related loads, even assuming the worst case single failure. However, in the degraded mode of this Condition, overall reliability is reduced and a division may not be capable of

(continued)

BASES

ACTIONS

A.1 (continued)

removing heat from the respective RHR heat exchanger at a rate consistent with design basis assumptions and modeling in the analysis for long term containment cooling (depending on other factors such as actual UHS temperature).

With a minimum complement of one RCW pump, one RSW pump and two RCW/RSW heat exchangers, a division is capable of performing its safety related cooling function, consistent with design basis assumptions, for all required modes with the exception of containment cooling. However, beyond design basis calculations performed to support PRA success criteria (Ref. 7) demonstrate that successful operation of only one of three RHR divisions (in the suppression pool cooling mode) is needed to prevent conditions inside the containment from exceeding its ultimate capacity (see B 3.6.2.3). Thus, should a DBA occur while in this slightly degraded Condition, even considering a coincident worst case single failure, the combined RCW/RSW and RHR system would retain the capability to ultimately protect containment integrity.

The 30-day Completion Time is reasonable, based on the low probability of an accident occurring during the 30 days that a component is inoperable in one or more divisions, the number of available redundant divisions, the substantial cooling capability still remaining in a division(s) in this Condition, and the expected high division availability afforded by a system where most of the equipment, including the minimum required for most functions, is normally operating.

B.1 and B.2

If one RCW/RSW division is inoperable for reasons other than Condition A, then, immediately, those required feature(s) supported by the inoperable RCW/RSW division must be declared inoperable (e.g., Emergency Diesel Generator, RHR heat exchanger, drywell coolers, RIP coolers, etc.) and the applicable Conditions and Required Actions of the appropriate LCOs for the inoperable required feature(s) must be entered. For example, applicable Conditions of LCO 3.8.1, "AC Sources-Operating," LCO 3.4.7, "Residual Heat Removal (RHR) Shutdown Cooling System-Hot Shutdown," LCO

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

3.4.1, "Reactor Internal Pumps (RIP) Operating," and LCO 3.6.1.5, "Drywell Air Temperature" be entered and the Required Actions taken if the inoperable RCW/RSW division results in an inoperable DG, RHR shutdown cooling, RIPS or drywell coolers, respectively. This is in accordance with LCO 3.0.6 and ensures the proper actions are taken for these components.

Additionally, immediate action must be taken to restore the inoperable RCW/RSW division to OPERABLE status. This is consistent with the Required Actions of the applicable LCOs for those support feature(s) declared inoperable as a result of the inoperable RCW/RSW division.

C.1 and C.2

If one RCW pump and/or one RSW pump and/or one RCW/RSW heat exchanger in the same division is inoperable in two or more separate divisions, one RCW/RSW division must be restored to OPERABLE status within 7 days and two RCW/RSW divsions must be restored to OPERABLE status in 14 days. In this condition sufficient redundant equipment is still available to provide cooling water to the required safety related components and sufficient heat removal capacity is still available to adequately cool safety related loads. However, a division may not be capable of removing heat from the respective RHR heat exchanger at a rate consistent with design basis assumptions and modeling in the analysis for long term containment cooling. Nonetheless, with a minimum complement of one RCW pump, one RSW pump and two RCW/RSW heat exchangers, a division is still capable of performing its safety related cooling function, consistent with design basis assumptions, for all other modes. Furthermore, beyond design basis calculations performed to support PRA success criteria (Ref. 7) demonstrate that only one of three RHR divisions (in the suppression pool cooling mode) is needed to ultimately protect containment integrity (see B 3.6.2.3). Therefore, continued operation for a limited time is justified. However, in the degraded mode of this Condition, overall reliability and heat removal capability is reduced from that of Condition A, and thus a more restrictive Completion Time is imposed.

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BASES

ACTIONS

C.1 and C.2 (continued)

The 7 and 14 day Completion Times are reasonable, based on the low probability of an accident occurring during the period that one or more redundant components are inoperable in one or more divisions, the number of available redundant divisions, the substantial cooling capability still remaining in divisions in this Condition, and the expected high division availability afforded by a system where most of the equipment, including the minimum required for most functions, is normally operating.

D.1, D.2, D.3 and D.4

If the RCW/RSW division cannot be restored to OPERABLE status within the associated Completion Time, or two or more RCW/RSW divisions are inoperable for reasons other than Condition C, or the UHS is determined inoperable, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 12 hours and in MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.7.1.1

This SR ensures adequate long term (30 days) cooling can be maintained. With the UHS water source below the minimum level, the affected RCW/RSW division must be declared inoperable. The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.1.2

This SR verifies the water level in each RSW pump well of the intake structure to be sufficient for the proper operation of the RSW pumps (net positive suction head and pump vortexing are considered in determining this limit). The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

SR 3.7.1.3

Verification of the UHS temperature ensures that the heat removal capability of the RCW/RSW System is within the assumptions of the DBA analysis. The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

SR 3.7.1.4

Verifying the correct alignment for each manual, power operated, and automatic valve in each RCW/RSW division flow path provides assurance that the proper flow paths will exist for RCW/RSW operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing. A valve is also allowed to be in the nonaccident position and yet considered in the correct position, provided it can be automatically realigned to its accident position. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of potentially being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

This SR is modified by a Note indicating that isolation of the RCW/RSW System to components or systems may render those components or systems inoperable, but does not affect the OPERABILITY of the RCW/RSW System. As such, when all RCW/RSW pumps, valves, and piping are OPERABLE but a branch connection off of the main header is isolated, the RCW/RSW System is still OPERABLE.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.1.4 (continued)

The 31 day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

SR 3.7.1.5

This SR verifies the automatic isolation valves of the RCW/RSW System will automatically switch to the safety or emergency position to provide cooling water exclusively to the safety related equipment, and limited non-safety related equipment, during an accident event. This is demonstrated by use of an actual or simulated initiation signal. This SR also verifies the automatic start capability of the RCW/RSW pumps that are in standby and automatic valving in each of the standby RCW/RSW heat exchangers in each division. The LOGIC SYSTEM FUNCTIONAL TEST in SR 3.3.5.1.4 overlaps this SR to provide complete testing of the safety function.

Operating experience has shown that these components usually pass the SR when performed on the 18 month Frequency. Therefore, this Frequency is concluded to be acceptable from a reliability standpoint.

REFERENCES

1. Regulatory Guide 1.27, Revision 2, January 1976.
2. ABWR SSAR, Sections 9.2.11 and 9.2.15.
3. ABWR SSAR, Table 9.2-4C.
4. ABWR SSAR, Chapter 6.2.1.1.3.3.1.4.
5. ABWR SSAR, Chapter 15.
6. ABWR SSAR, Section 6.2.2.3.
7. [later].