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Page 1 of 1

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BASES UNIT 1

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# TSB

## APPROVED AMENDMENT TO THE UNIT 1 TECHNICAL SPECIFICATIONS BASES MANUAL REVISION 38

Replace the following pages of the Technical Specifications Bases Manual with the enclosed pages. The revised pages are identified by Revision Number and contain vertical lines indicating the area of change.

REMOVE PAGES	INSERT PAGES	REV. #
TS / B LOES 1 through TS / B LOES 4	TS / B LOES 1 through TS / B LOES 5	38
TOC pages iii through v	TS / B TOC-1 through TS / B TOC-3	1
TS / B 3.7-1 through TS / B 3 7-6	TS / B 3.7-1 through TS / B 3 7-6	2
TS / B 3.7-6a	TS / B 3.7-6a	2
_____	TS / B 3.7-6b and TS / B 3.7-6c	0
B 3.7-7 through B 3 7-11	TS / B 3.7-7 through TS / B 3.7-11	1

**SUSQUEHANNA STEAM ELECTRIC STATION**  
**LIST OF EFFECTIVE SECTIONS (TECHNICAL SPECIFICATIONS BASES)**

<u>Section</u>	<u>Title</u>	<u>Revision</u>
TOC	Table of Contents	1
B 2.0	SAFETY LIMITS BASES	
	Page B 2.0-1	0
	Page TS/B 2.0-2	1
	Pages TS/B 2.0-3 through TSB 2.0-5	1
		corrected
	Page TS/B 2.0-6	1
	Pages B 2.0-7 through B 2.0-9	0
B 3.0	LCO AND SR APPLICABILITY BASES	
	Pages B 3.0-1 through B 3.0-12	0
	Pages TS / B 3.0-13 through TS / B 3.0-15	1
B 3.1	REACTIVITY CONTROL BASES	
	Pages B 3.1-1 through B 3.1-51	0
B 3.2	POWER DISTRIBUTION LIMITS BASES	
	Page B 3.2-1	0
	Page TS/B 3.2-2	1
	Page B 3.2-3	0
	Pages TS/B 3.2-4 through TS/B 3.2-6	1
	Pages B 3.2-7 and B 3.2-8	0
	Page TS/B 3.2-9	1
	Page B 3.2-10	0
	Page TS/B 3.2-11	1
	Page B 3.2-12	0
	Page TS/B 3.2-13	1
	Pages B 3.2-14 and B 3.2-15	0
	Page TS/B 3.2-16	1
	Pages B 3.2-17 and 3.2-18	0
	Page TS/B 3.2-19	1
B 3.3	INSTRUMENTATION	
	Pages TS / B 3.3-1 through TS / B 3.3-10	1
	Page TS / B 3.3-11	2
	Pages TS / B 3.3-12 through TS / B 3.3-27	1
	Pages TS / B 3.3-28 through TS / B 3.3-31	2
	Pages TS / B 3.3-32 and TS / B 3.3-33	3
	Pages TS / B 3.3-34 through TS / B 3.3-54	1
	Pages B 3.3-55 through B 3.3-63	0
	Pages TS / B 3.3-64 and TS / B 3.3-65	2
	Page TS / B 3.3-66	3
	Page TS / B 3.3-67	2
	Page TS / B 3.3-68	3
		Corrected
	Pages TS / B 3.3-69 through TS / B 3.3-75	2

SUSQUEHANNA STEAM ELECTRIC STATION  
**LIST OF EFFECTIVE SECTIONS (TECHNICAL SPECIFICATIONS BASES)**

<u>Section</u>	<u>Title</u>	<u>Revision</u>
	Page TS / B 3.3-75a	4
	Pages TS / B 3.3-75b through TS / B 3.3-75c	3
	Pages B 3.3-76 through B 3.3-103	0
	Page TS / B 3.3-104	1
	Pages B 3.3-105 and B 3.3-106	0
	Page TS / B 3.3-107	1
	Page B 3.3-108	0
	Page TS / B 3.3-109	1
	Pages B 3.3-110 and B 3.3-111	0
	Pages TS/B 3.3-112 and TS/B 3.3-112a	1
	Pages B 3.3-113 and B 3.3-114	0
	Page TS / B 3.3-115	1
	Page TS / B 3.3-116	2
	Page TS / B 3.3-117	1
	Pages B 3.3-118 through B 3.3-122	0
	Pages TS / B 3.3-123 through TS / B 3.3-124	1
	Page TS / B 3.3-124a	0
	Pages B 3.3-125 and B 3.3-126	0
	Page TS / B 3.3-127	1
	Pages B 3.3-128 through B 3.3-130	0
	Page TS / B 3.3-131	1
	Pages B 3.3-132 through B 3.3-137	0
	Page TS / B 3.3-138	1
	Pages B 3.3-139 through B 3.3-162	0
	Page TS / B 3.3-163	1
	Pages B 3.3-164 through B 3.3-177	0
	Pages B 3.3-178 and B 3.3-179	1
	Page B 3.3-179a	0
	Pages TS / B 3.3-180 through TS / B 3.3-191	1
	Pages B 3.3-192 through B 3.3-219	0
B 3.4	REACTOR COOLANT SYSTEM BASES	
	Pages B 3.4-1 and B 3.4-2	0
	Pages TS/B 3.4-3 and TS/B 3.4-4	1
	Pages B 3.4-5 through B 3.4-14	0
	Page TS / B 3.4-15	1
	Pages TS / B 3.4-16 and TS / B 3.4-17	2
	Page TS / B 3.4-18	1
	Pages B 3.4-19 through B 3.4-28	0
	Page TS / B 3.4-29	1
	Pages B 3.4-30 through B 3.4-48	0
	Page TS / B 3.4-49	2
	Page TS / B 3.4-50	1
	Page TS / B 3.4-51	2
	Pages TS / B 3.4-52 and TS / B 3.4-53	1
	Page TS / B 3.4-54	2
	Page TS / B 3.4-55	2

**SUSQUEHANNA STEAM ELECTRIC STATION**  
**LIST OF EFFECTIVE SECTIONS (TECHNICAL SPECIFICATIONS BASES)**

<u>Section</u>	<u>Title</u>	<u>Revision</u>
	Page TS / B 3.4-56	1
	Page TS / B 3.4-57	2
	Pages TS / B 3.4-58 through TS / B 3.4-60	1
B 3.5	ECCS AND RCIC BASES	
	Pages B 3.5-1 and B 3.5-2	0
	Page TS / B 3.5-3	2
	Pages B 3.5-4 through B 3.5-10	0
	Page TS / B 3.5-11	1
	Pages B 3.5-12 through B 3.5-15	0
	Pages TS / B 3.5-16 through TS / B 3.5-18	1
	Pages B 3.5-19 through B 3.5-24	0
	Page TS / B 3.5-25	1
	Pages B 3.5-26 through B 3.5-31	0
B 3.6	CONTAINMENT SYSTEMS BASES	
	Page TS / B 3.6-1	2
	Page TS / B 3.6-1a	3
	Pages TS / B 3.6-2 through TS / B 3.6-5	2
	Page TS / B 3.6-6	3
	Pages TS / B 3.6-6a and TS / B 3.6-6b	2
	Page TS / B 3.6-6c	0
	Pages B 3.6-7 through B 3.6-14	0
	Page TS / B 3.6-15	2
	Pages TS / B 3.6-15a and TS / B 3.6-15b	0
	Page B 3.6-16	0
	Page TS / B 3.6-17	1
	Page TS / B 3.6-17a	0
	Pages TS / B 3.6-18 and TS / B 3.6-19	0
	Page TS / B 3.6-20	1
	Page TS / B 3.6-21	2
	Page TS / B 3.6-22	1
	Page TS / B 3.6-22a	0
	Page TS / B 3.6-23	1
	Pages TS / B 3.6-24 through TS / B 3.6-25	0
	Page TS / B 3.6-26	0
		Corrected
	Page TS / B 3.6-27	2
	Page TS / B 3.6-28	4
	Page TS / B 3.6-29	1
	Page TS/B 3.6-30	1
	Page TS / B 3.6-31	3
	Pages B 3.6-32 through B 3.6-35	0
	Page TS / B 3.6-36	1
	Page B 3.6-37	0
	Page TS/B 3.6-38	1
	Page B 3.6-39	0

**SUSQUEHANNA STEAM ELECTRIC STATION**  
**LIST OF EFFECTIVE SECTIONS (TECHNICAL SPECIFICATIONS BASES)**

<u>Section</u>	<u>Title</u>	<u>Revision</u>
	Page TS / B 3.6-40	2
	Pages B 3.6-41 through B 3.6-43	0
	Pages TS / B 3.6-44 through TS / B 3.6-51	1
	Page TS / B 3.6-52	2
	Pages B 3.6-53 through B 3.6-83	0
	Pages TS / B 3.6-84	2
	Pages TS / B 3.6-85 through TS / B 3.6-88	1
	Page TS / B 3.6-88a	1
	Pages TS / B 3.6-89 through TS / B 3.6-100	1
	Pages B 3.6-101 through B 3.6-107	0
<b>B 3.7</b>	<b>PLANT SYSTEMS BASES</b>	
	Pages TS / B 3.7-1 through TS / B 3.7-6	2
	Page TS / B 3.7-6a	2
	Pages TS / B 3.7-6b and TS / B 3.7-6c	0
	Pages TS / B 3.7-7 through TS / B 3.7-11	1
	Pages TS / B 3.7-12 and TS / B 3.7-13	1
	Pages TS / B 3.7-14 through TS / B 3.7-18	2
	Page TS / B 3.7-18a	0
	Pages TS / B 3.7-19 through TS / B 3.7-23	1
	Pages B 3.7-24 through B 3.7-26	0
	Pages TS / B 3.7-27 through TS / B 3.7-29	2
	Page TS / B 3.7-30	1
	Pages B 3.7-31 through B 3.7-33	0
<b>B 3.8</b>	<b>ELECTRICAL POWER SYSTEMS BASES</b>	
	Pages TS / B 3.8-1 through TS / B 3.8-4	2
	Page TS / B 3.8-5	3
	Pages TS / B 3.8-6 through TS/B 3.8-17	2
	Page TS / B 3.8-18	3
	Pages TS / B 3.8-19 through TS / B 3.8-21	2
	Pages TS / B 3.8-22 and TS / B 3.8-23	3
	Pages TS / B 3.8-24 through TS / B 3.8-37	2
	Pages B 3.8-38 through B 3.8-53	0
	Pages TS / B 3.8-54 through TS / B 3.8-61	1
	Page TS / B 3.8-62	2
	Page TS / B 3.8-63	2
	Page TS / B 3.8-64	1
	Page TS / B 3.8-65	2
	Pages TS/B 3.8-66 through B 3.8-90	0
<b>B 3.9</b>	<b>REFUELING OPERATIONS BASES</b>	
	Pages TS / B 3.9-1 and TS / B 3.9-1a	1
	Pages TS / B 3.9-2 through TS / B 3.9-4	1
	Pages B 3.9-5 through B 3.9-30	0

SUSQUEHANNA STEAM ELECTRIC STATION  
***LIST OF EFFECTIVE SECTIONS*** (TECHNICAL SPECIFICATIONS BASES)

---

<u>Section</u>	<u>Title</u>	<u>Revision</u>
B 3.10	SPECIAL OPERATIONS BASES	
	Page TS / B 3.10-1	1
	Pages B 3.10-2 through B 3.10-38	0

# TABLE OF CONTENTS (TECHNICAL SPECIFICATIONS BASES)

B2.0	SAFETY LIMITS (SLs) .....	B2.0-1
B2.1.1	Reactor Core SLs .....	B2.0-1
B2.1.2	Reactor Coolant System (RCS) Pressure SL .....	B2.0-7
B3.0	LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY .....	B3.0-1
B3.0	SURVEILLANCE REQUIREMENT (SR) APPLICABILITY .....	B3.0-10
B3.1	REACTIVITY CONTROL SYSTEMS .....	B3.1-1
B3.1.1	Shutdown Margin (SDM) .....	B3.1-1
B3.1.2	Reactivity Anomalies .....	B3.1-8
B3.1.3	Control Rod OPERABILITY .....	B3.1-13
B3.1.4	Control Rod Scram Times .....	B3.1-22
B3.1.5	Control Rod Scram Accumulators .....	B3.1-29
B3.1.6	Rod Pattern Control .....	B3.1-34
B3.1.7	Standby Liquid Control (SLC) System .....	B3.1-39
B3.1.8	Scram Discharge Volume (SDV) Vent and Drain Valves .....	B3.1-47
B3.2	POWER DISTRIBUTION LIMITS .....	B3.2-1
B3.2.1	Average Planar Linear Heat Generation Rate (APLHGR) .....	B3.2-1
B3.2.2	Minimum Critical Power Ratio (MCPR) .....	TS/B3.2-5
B3.2.3	Linear Heat Generation Rate (LHGR) .....	B3.2-10
B3.2.4	Average Power Range Monitor (APRM) Gain and Setpoints .....	B3.2-14
B3.3	INSTRUMENTATION .....	TS/B3.3-1
B3.3.1.1	Reactor Protection System (RPS) Instrumentation .....	TS/B3.3-1
B3.3.1.2	Source Range Monitor (SRM) Instrumentation .....	TS/B3.3-35
B3.3.2.1	Control Rod Block Instrumentation .....	TS/B3.3-44
B3.3.2.2	Feedwater – Main Turbine High Water Level Trip Instrumentation .....	B3.3-55
B3.3.3.1	Post Accident Monitoring (PAM) Instrumentation .....	TS/B3.3-64
B3.3.3.2	Remote Shutdown System .....	B3.3-76
B3.3.4.1	End of Cycle Recirculation Pump Trip (EOC-RPT) Instrumentation .....	B3.3-81
B3.3.4.2	Anticipated Transient Without Scram Recirculation Pump Trip (ATWS-RPT) Instrumentation .....	B3.3-92
B3.3.5.1	Emergency Core Cooling System (ECCS) Instrumentation .....	B3.3-101
B3.3.5.2	Reactor Core Isolation Cooling (RCIC) System Instrumentation .....	B3.3-135
B3.3.6.1	Primary Containment Isolation Instrumentation .....	B3.3-147
B3.3.6.2	Secondary Containment Isolation Instrumentation .....	TS/B3.3-180
B3.3.7.1	Control Room Emergency Outside Air Supply (CREOAS) System Instrumentation .....	B3.3-192

(continued)



# TABLE OF CONTENTS (TECHNICAL SPECIFICATIONS BASES)

B3.3	INSTRUMENTATION (continued)	
B3.3.8.1	Loss of Power (LOP) Instrumentation .....	B3.3-205
B3.3.8.2	Reactor Protection System (RPS) Electric Power Monitoring .....	B3.3-213
B3.4	REACTOR COOLANT SYSTEM (RCS).....	B3.4-1
B3.4.1	Recirculation Loops Operating .....	B3.4-1
B3.4.2	Jet Pumps .....	B3.4-10
B3.4.3	Safety/Relief Valves (S/RVs).....	TS/B3.4-15
B3.4.4	RCS Operational LEAKAGE .....	B3.4-19
B3.4.5	RCS Pressure Isolation Valve (PIV) Leakage .....	B3.4-24
B3.4.6	RCS Leakage Detection Instrumentation .....	B3.4-30
B3.4.7	RCS Specific Activity.....	B3.4-35
B3.4.8	Residual Heat Removal (RHR) Shutdown Cooling System – Hot Shutdown.....	B3.4-39
B3.4.9	Residual Heat Removal (RHR) Shutdown Cooling System – Cold Shutdown .....	B3.4-44
B3.4.10	RCS Pressure and Temperature (P/T) Limits	TS/B3.4-49
B3.4.11	Reactor Steam Dome Pressure .....	TS/B3.4-58
B3.5	EMERGENCY CORE COOLING SYSTEMS (ECCS) AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM.....	B3.5-1
B3.5.1	ECCS – Operating .....	B3.5-1
B3.5.2	ECCS – Shutdown .....	B3.5-19
B3.5.3	RCIC System .....	TS/B3.5-25
B3.6	CONTAINMENT SYSTEMS.....	TS/B3.6-1
B3.6.1.1	Primary Containment .....	TS/B3.6-1
B3.6.1.2	Primary Containment Air Lock.....	B3.6-7
B3.6.1.3	Primary Containment Isolation Valves (PCIVs) .....	TS/B3.6-15
B3.6.1.4	Containment Pressure .....	B3.6-41
B3.6.1.5	Drywell Air Temperature .....	TS/B3.6-44
B3.6.1.6	Suppression Chamber-to-Drywell Vacuum Breakers	TS/B3.6-47
B3.6.2.1	Suppression Pool Average Temperature.....	B3.6-53
B3.6.2.2	Suppression Pool Water Level .....	B3.6-59
B3.6.2.3	Residual Heat Removal (RHR) Suppression Pool Cooling.....	B3.6-62
B3.6.2.4	Residual Heat Removal (RHR) Suppression Pool Spray.....	B3.6-66
B3.6.3.1	Primary Containment Hydrogen Recombiners .....	B3.6-70
B3.6.3.2	Drywell Air Flow System .....	B3.6-76
B3.6.3.3	Primary Containment Oxygen Concentration .....	B3.6-81
B3.6.4.1	Secondary Containment.....	TS/B3.6-84
B3.6.4.2	Secondary Containment Isolation Valves (SCIVs)	TS/B3.6-91
B3.6.4.3	Standby Gas Treatment (SGT) System.....	B3.6-101

(continued)

# TABLE OF CONTENTS (TECHNICAL SPECIFICATIONS BASES)

B3.7	PLANT SYSTEMS .....	TS/B3.7-1
B3.7.1	Residual Heat Removal Service Water (RHRSW) System and the Ultimate Heat Sink (UHS) .....	TS/B3.7-1
B3.7.2	Emergency Service Water (ESW) System .....	TS/B3.7-7
B3.7.3	Control Room Emergency Outside Air Supply (CREOAS) System .....	TS/B3.7-12
B3.7.4	Control Room Floor Cooling System .....	TS/B3.7-19
B3.7.5	Main Condenser Offgas .....	B3.7-24
B3.7.6	Main Turbine Bypass System .....	TS/B3.7-27
B3.7.7	Spent Fuel Storage Pool Water Level .....	B3.7-31
B3.8	ELECTRICAL POWER SYSTEM .....	TS/B3.8-1
B3.8.1	AC Sources – Operating .....	TS/B3.8-1
B3.8.2	AC Sources – Shutdown .....	B3.8-38
B3.8.3	Diesel Fuel Oil, Lube Oil, and Starting Air .....	B3.8-45
B3.8.4	DC Sources – Operating .....	TS/B3.8-54
B3.8.5	DC Sources – Shutdown .....	B3.8-66
B3.8.6	Battery Cell Parameters .....	B3.8-71
B3.8.7	Distribution Systems – Operating .....	B3.8-78
B3.8.8	Distribution Systems – Shutdown .....	B3.8-86
B3.9	REFUELING OPERATIONS .....	TS/B3.9-1
B3.9.1	Refueling Equipment Interlocks .....	TS/B3.9-1
B3.9.2	Refuel Position One-Rod-Out Interlock .....	B3.9-5
B3.9.3	Control Rod Position .....	B3.9-9
B3.9.4	Control Rod Position Indication .....	B3.9-12
B3.9.5	Control Rod OPERABILITY – Refueling .....	B3.9-16
B3.9.6	Reactor Pressure Vessel (RPV) Water Level .....	B3.9-19
B3.9.7	Residual Heat Removal (RHR) – High Water Level .....	B3.9-22
B3.9.8	Residual Heat Removal (RHR) – Low Water Level .....	B3.9-26
B3.10	SPECIAL OPERATIONS .....	TS/B3.10-1
B3.10.1	Inservice Leak and Hydrostatic Testing Operation .....	TS/B3.10-1
B3.10.2	Reactor Mode Switch Interlock Testing .....	B3.10-6
B3.10.3	Single Control Rod Withdrawal – Hot Shutdown .....	B3.10-11
B3.10.4	Single Control Rod Withdrawal – Cold Shutdown .....	B3.10-16
B3.10.5	Single Control Rod Drive (CRD) Removal – Refueling .....	B3.10-21
B3.10.6	Multiple Control Rod Withdrawal – Refueling .....	B3.10-26
B3.10.7	Control Rod Testing – Operating .....	B3.10-29
B3.10.8	SHUTDOWN MARGIN (SDM) Test – Refueling .....	B3.10-33

(continued)

B 3.7 PLANT SYSTEMS

B 3.7.1 Residual Heat Removal Service Water (RHRSW) System and the Ultimate Heat Sink (UHS)

BASES

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BACKGROUND

The RHRSW System is designed to provide cooling water for the Residual Heat Removal (RHR) System heat exchangers, required for a safe reactor shutdown following a Design Basis Accident (DBA) or transient. The RHRSW System is operated whenever the RHR heat exchangers are required to operate in the shutdown cooling mode or in the suppression pool cooling or spray mode of the RHR System.

The RHRSW System consists of two independent and redundant subsystems. Each subsystem is made up of a header, one pump, a suction source, valves, piping, heat exchanger, and associated instrumentation. Either of the two subsystems is capable of providing the required cooling capacity to maintain safe shutdown conditions. The two subsystems are separated so that failure of one subsystem will not affect the OPERABILITY of the other subsystem. One Unit 1 RHRSW subsystem and the associated (same division) Unit 2 RHRSW subsystem constitute a single RHRSW loop. The two RHRSW pumps in a loop can each, independently, be aligned to either Unit's heat exchanger. The RHRSW System is designed with sufficient redundancy so that no single active component failure can prevent it from achieving its design function. The RHRSW System is described in the FSAR, Section 9.2.6, Reference 1.

Cooling water is pumped by the RHRSW pumps from the UHS through the tube side of the RHR heat exchangers. After removing heat from the RHRSW heat exchanger, the water is discharged to the spray pond (UHS) by way of the UHS return loops. The UHS return loops direct the return flow to a network of sprays that dissipate the heat to the atmosphere or directly to the UHS via a bypass valve.

The system is initiated manually from the control room. The system can be started any time the LOCA signal is manually overridden or clears.

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(continued)

**BASES (continued)**

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**BACKGROUND  
(continued)**

The ultimate heat sink (UHS) system is composed of a 350,000 cubic foot spray pond and associated piping and spray risers. Each UHS return loop contains a bypass line, a large spray array and a small spray array. The purpose of the UHS is to provide both a suction source of water and a return path for the RHRSW and ESW systems. The function of the UHS is to provide water to the RHRSW and ESW systems at a temperature less than the 97°F design temperature of the RHRSW and ESW systems. UHS temperature is maintained less than the design temperature by introducing the hot return fluid from the RHRSW and ESW systems into the spray loops and relying on spray cooling to maintain temperature. The UHS is designed to supply the RHRSW and ESW systems with all the cooling capacity required during a combination LOCA/LOOP for thirty days without fluid addition. The UHS is described in the FSAR, Section 9.2.7 (Reference 1).

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**APPLICABLE  
SAFETY  
ANALYSES**

The RHRSW System removes heat from the suppression pool to limit the suppression pool temperature and primary containment pressure following a LOCA. This ensures that the primary containment can perform its function of limiting the release of radioactive materials to the environment following a LOCA. The ability of the RHRSW System to support long term cooling of the reactor or primary containment is discussed in the FSAR, Chapters 6 and 15 (Refs. 2 and 3, respectively). These analyses explicitly assume that the RHRSW System will provide adequate cooling support to the equipment required for safe shutdown. These analyses include the evaluation of the long term primary containment response after a design basis LOCA.

The safety analyses for long term cooling were performed for various combinations of RHR System failures. The worst case single failure that would affect the performance of the RHRSW System is any failure that would disable one UHS return loop. The failure of the spray array bypass valve to close results in the inability of one UHS return loop to perform its design function because failure of this valve to close results in inadequate spray nozzle pressures on the affected loop. As discussed in the FSAR, Section 6.2.2 (Ref. 2) for these analyses, manual initiation of the OPERABLE RHRSW subsystem and the associated RHR System is assumed to occur 30 minutes after a DBA. In this case, the maximum suppression chamber water temperature and pressure are analyzed to be below the design temperature of 220°F and maximum allowable pressure of 53 psig.

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(continued)

BASES (continued)

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APPLICABLE  
SAFETY  
ANALYSES  
(continued)

The failure of the large spray array valve to open on demand is of less consequence than the failure of the spray array bypass valve because the small spray array is still available. Two small spray arrays have the same capacity and can perform the same function as a single large spray array. Each small array can effectively discharge the output of one RHRSW subsystem and one ESW loop to the UHS. The small spray arrays do not meet the 10CFR50.36 criteria for inclusion into the Technical Specifications and are not included. As a result, no credit is taken for the existence of the small spray arrays.

The RHRSW System, together with the UHS, satisfy Criterion 3 of the NRC Policy Statement. (Ref. 4)

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LCO

Two RHRSW subsystems are required to be OPERABLE to provide the required redundancy to ensure that the system functions to remove post accident heat loads, assuming the worst case single active failure occurs coincident with the loss of offsite power.

An RHRSW subsystem is considered OPERABLE when:

- a. One pump is OPERABLE; and
- b. An OPERABLE flow path is capable of taking suction from the UHS and transferring the water to the RHR heat exchanger and returning it to the UHS at the assumed flow rate, and
- c. An OPERABLE UHS.

The OPERABILITY of the UHS is based on having a minimum water level at the overflow weir of 678 feet 1 inch above mean sea level and a maximum water temperature of 85°F; unless either unit is in MODE 3. If a unit enters MODE 3, the time of entrance into this condition determines the appropriate maximum ultimate heat sink fluid temperature. If the earliest unit to enter MODE 3 has been in that condition for less than twelve (12) hours, the peak temperature to maintain OPERABILITY of the ultimate heat sink remains at 85°F. If either unit has been in MODE 3 for more than twelve (12) hours but less than twenty-four (24) hours, the OPERABILITY temperature of the ultimate heat sink becomes 87°F. If either unit has been in MODE 3 for twenty-four (24) hours or more, the OPERABILITY temperature of the ultimate heat sink becomes 88°F.

(continued)

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BASES (continued)

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LCO  
(continued)

In addition, the OPERABILITY of the UHS is based on having sufficient spray capacity in the UHS return loops to effectively dissipate the heat picked up by the RHRSW and ESW systems. Sufficient spray capacity is defined as one large spray array available for heat dissipation.

This OPERABILITY definition is supported by analysis and evaluations performed in accordance with the guidance given in Regulatory Guide 1.27.

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APPLICABILITY

In MODES 1, 2, and 3, the RHRSW System and the UHS are required to be OPERABLE to support the OPERABILITY of the RHR System for primary containment cooling (LCO 3.6.2.3, "Residual Heat Removal (RHR) Suppression Pool Cooling," and LCO 3.6.2.4, "Residual Heat Removal (RHR) Suppression Pool Spray") and decay heat removal (LCO 3.4.8, "Residual Heat Removal (RHR) Shutdown Cooling System—Hot Shutdown"). The Applicability is therefore consistent with the requirements of these systems.

In MODES 4 and 5, the OPERABILITY requirements of the RHRSW System are determined by the RHR shutdown cooling subsystem(s) it supports (LCO 3.4.9, "Residual Heat Removal (RHR) Shutdown Cooling System - Cold Shutdown"; LCO 3.9.7, "Residual Heat Removal (RHR) - High Water Level"; and LCO 3.9.8, "Residual Heat Removal (RHR) - Low Water Level").

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

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ACTIONS

The ACTIONS are modified by a Note indicating that the applicable Conditions of LCO 3.4.8, be entered and Required Actions taken if the inoperable RHRSW subsystem results in inoperable RHR shutdown cooling (SDC) (i.e., both the Unit 1 and Unit 2 RHRSW pumps in a loop are inoperable resulting in the associated RHR SDC system being inoperable). This is an exception to LCO 3.0.6 because the Required Actions of LCO 3.7.1 do not adequately compensate for the loss of RHR SDC Function (LCO 3.4.8).

Condition A is modified by a separate note to allow separate Condition entry for each valve. This is acceptable since the Required Action for this Condition provides appropriate compensatory actions.

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(continued)

BASES (continued)

ACTIONS  
(continued)

A.1

With one spray array bypass valve inoperable (that is, not capable of being closed on demand), or with one large spray array valve not capable of being opened, the associated Unit 1 and Unit 2 RHRSW subsystems cannot use the spray cooling function of the affected UHS return loop. As a result, the associated RHRSW subsystems must be declared inoperable.

A.2

With one spray array bypass valve or one large spray array valve inoperable, only one large spray array is available for effective spray cooling. Failure of either the spray bypass valve or the large spray array valve in the unaffected loop would result in insufficient spray cooling capacity. The 72-hour completion time is based on the fact that, although adequate UHS spray loop capability exists during this time period, both units are affected and an additional single failure results in a system configuration that will not meet design basis accident requirements.

If an additional RHRSW subsystem on either Unit is inoperable, cooling capacity less than the minimum required for response to a design basis event would exist. Therefore, an 8-hour Completion Time is appropriate. The 8-hour Completion Time provides sufficient time to restore inoperable equipment and there is a low probability that a design basis event would occur during this period.

B.1

Required Action B.1 is intended to ensure that appropriate actions are taken if one Unit 1 RHRSW subsystem is inoperable. Although designated and operated as a unitized system, the associated Unit 2 subsystem is directly connected to a common header which can supply the associated RHR heat exchanger in either unit. The Unit 2 subsystems are considered capable of supporting Unit 1 RHRSW subsystem when the Unit 2 subsystem is OPERABLE and can provide the assumed flow to the Unit 1 heat exchanger. A Completion time of 72 hours, when one Unit 2 RHRSW subsystem is not capable of supporting the Unit 1 RHRSW subsystems, is allowed to restore the Unit 1 RHRSW subsystem to OPERABLE status. In this configuration, the remaining OPERABLE Unit 1 RHRSW subsystem is adequate to perform the RHRSW heat removal function. However, the overall reliability is reduced because a single failure in the OPERABLE RHRSW subsystem

(continued)

BASES (continued)

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ACTIONS  
(continued)

could result in loss of RHRSW function. The Completion Time is based on the redundant RHRSW capabilities afforded by the OPERABLE subsystem and the low probability of an event occurring requiring RHRSW during this period.

With one RHRSW subsystem inoperable, and both of the Unit 2 RHRSW subsystems capable of supporting their respective Unit 1 RHRSW subsystems, the design basis cooling capacity for both units can still be maintained even considering a single active failure. However, the configuration does reduce the overall reliability of the RHRSW System. Therefore, provided both of the Unit 2 subsystems remain capable of supporting their respective Unit 1 RHRSW subsystems, the inoperable RHRSW subsystem must be restored to OPERABLE status within 7 days. The 7-day Completion Time is based on the remaining RHRSW System heat removal capability.

C.1

Required Action C.1 is intended to ensure that appropriate actions are taken if both Unit 1 RHRSW subsystems are inoperable. Although designated and operated as a unitized system, the associated Unit 2 subsystem is directly connected to a common header which can supply the associated RHR heat exchanger in either unit. With both Unit 1 RHRSW subsystems inoperable, the RHRSW system is still capable of performing its intended design function. However, the loss of an additional RHRSW subsystem on Unit 2 results in the cooling capacity to be less than the minimum required for response to a design basis event. Therefore, the 8-hour Completion Time is appropriate. The 8-hour Completion Time for restoring one RHRSW subsystem to OPERABLE status, is based on the Completion Times provided for the RHR suppression pool spray function.

With both Unit 1 RHRSW subsystems inoperable, and both of the Unit 2 RHRSW subsystems capable of supporting their respective Unit 1 RHRSW subsystem, if no additional failures occur which impact the RHRSW System, the remaining OPERABLE Unit 2 subsystems and flow paths provide adequate heat removal capacity following a design basis LOCA. However, capability for this alignment is not assumed in long term containment response analysis and an additional single failure in the RHRSW System could reduce the system capacity below that assumed in the safety analysis.

(continued)



BASES (continued)

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ACTIONS  
(continued)

Therefore, continued operation is permitted only for a limited time. One inoperable subsystem is required to be restored to OPERABLE status within 72 hours. The 72 hour Completion Time for restoring one inoperable RHRSW subsystem to OPERABLE status is based on the fact that the alternate loop is capable of providing the required cooling capability during this time period.

D.1 and D.2

If the RHRSW subsystems cannot be restored to OPERABLE status within the associated Completion Times, or the UHS is determined to be 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.

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SURVEILLANCE  
REQUIREMENTS

SR 3.7.1.1

This SR verifies the water level to be sufficient for the proper operation of the RHRSW pumps (net positive suction head and pump vortexing are considered in determining this limit). The 12 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, which is the arithmetical average of the UHS temperature near the surface, middle and bottom levels, ensures that the heat removal capability of the ESW and RHRSW Systems are 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.

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(continued)

BASES (continued)

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SURVEILLANCE  
REQUIREMENTS SR 3.7.1.3  
(continued)

Verifying the correct alignment for each manual, power operated, and automatic valve in each RHRSW subsystem flow path provides assurance that the proper flow paths will exist for RHRSW operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves are 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 realigned to its accident position. This is acceptable because the RHRSW System is a manually initiated system.

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.

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

SR 3.7.1.4

The UHS spray array bypass valves are required to actuate to the closed position for the UHS to perform its design function. These valves receive an automatic signal to open upon emergency service water (ESW) or residual heat removal service water (RHRSW) system pump start and are required to be operated from the control room or the remote shutdown panel. A spray bypass valve is considered to be inoperable when it cannot be closed on demand. Failure of the spray bypass valve to close on demand puts the UHS at risk to exceed its design temperature. The failure of the spray bypass valve to open on demand is not limiting and, therefore, would not cause the loop to be inoperable. This SR demonstrates that the valves will move to their required positions when required. The 92-day Test Frequency is based upon engineering judgement and operating/testing history that indicates this frequency gives adequate assurance that the valves will move to their required positions when required.

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BASES (continued)

SURVEILLANCE  
REQUIREMENTS SR 3.7.1.5  
(continued)

The return loop large spray array valves are required to open in order for the UHS to perform its design function. These valves are manually actuated from either the control room or the remote shutdown panel, under station operating procedure, when the RHRSW system is required to remove energy from the reactor vessel or suppression pool. A large spray array valve is considered inoperable if it cannot be opened on demand, because the valve must be opened to allow spray cooling to occur. This SR demonstrates that the valves will move to their required positions when required. The 92-day Test Frequency is based upon engineering judgement and operating/testing history that indicates this frequency gives adequate assurance that the valves will move to their required positions when required.

REFERENCES

1. FSAR, Section 9.2.6.
2. FSAR, Chapter 6.
3. FSAR, Chapter 15.
4. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 39132).

B 3.7 PLANT SYSTEMS

B 3.7.2 Emergency Service Water (ESW) System

BASES

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**BACKGROUND** The ESW System is designed to provide cooling water for the removal of heat from equipment, such as the diesel generators (DGs), residual heat removal (RHR) pump coolers, and room coolers for Emergency Core Cooling System equipment, required for a safe reactor shutdown following a Design Basis Accident (DBA) or transient. Upon receipt of a loss of offsite power or loss of coolant accident (LOCA) signal, ESW pumps are automatically started after a time delay.

The ESW System consists of two independent and redundant subsystems. Each of the two ESW subsystems is made up of a header, two pumps, a suction source, valves, piping and associated instrumentation. The two subsystems are separated from each other so an active single failure in one subsystem will not affect the OPERABILITY of the other subsystem.

Cooling water is pumped from the Ultimate Heat Sink (UHS) by the ESW pumps to the essential components through the two main headers. After removing heat from the components, the water is discharged to the spray pond (UHS) by way of a network of sprays that dissipate the heat to the atmosphere or directly to the UHS via a bypass valve.

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**APPLICABLE SAFETY ANALYSES** Sufficient water inventory is available for all ESW System post LOCA cooling requirements for a 30 day period with no additional makeup water source available. The ability of the ESW System to support long term cooling is assumed in evaluations of the equipment required for safe reactor shutdown presented in the FSAR, Chapters 4 and 6 (Refs. 1 and 2, respectively).

The ability of the ESW 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 ESW System to cool the DGs. The long term cooling capability of the RHR and core spray pumps is also dependent on the cooling provided by the ESW System.

The ESW System satisfies Criterion 3 of the NRC Policy Statement. (Ref. 3)

(continued)

BASES (continued)

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LCO

The ESW 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 ESW 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, two subsystems of ESW must be OPERABLE. At least one subsystem will operate, if the worst single active failure occurs coincident with the loss of offsite power.

A subsystem is considered OPERABLE when it has two OPERABLE pumps, and an OPERABLE flow path capable of taking suction from the UHS and transferring the water to the appropriate equipment and returning flow to the UHS. If individual loads are isolated, the affected components may be rendered inoperable, but it does not necessarily affect the OPERABILITY of the ESW System. Because each ESW subsystem supplies all four required DGs, an ESW subsystem is considered OPERABLE if it supplies at least three of the four DGs provided no single DG does not have an ESW subsystem capable of supplying flow.

An adequate suction source is not addressed in this LCO since the minimum net positive suction head of the ESW pumps is bounded by the Residual Heat Removal Service Water System requirements (LCO 3.7.1, "Residual Heat Removal System and Ultimate Heat Sink (UHS)").

The ESW return loop requirement, in terms of operable UHS return paths or UHS spray capacity, is also not addressed in this LCO. UHS operability, in terms of the return loop and spray capacity is addressed in the RHRSW/UHS Technical Specification (LCO 3.7.1, "Residual Heat Removal Service Water System and Ultimate Heat Sink (UHS)"). The design basis calculations for the UHS assume post-accident ESW return flow through the spray bypass valve on one return loop until a UHS temperature is reached whereby realignment of appropriate ESW heat loads to the spray loop is required. This realignment is manual and can be done several hours or more after accident initiation.

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(continued)

BASES (continued)

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**APPLICABILITY** In MODES 1, 2, and 3, the ESW System is required to be OPERABLE to support OPERABILITY of the equipment serviced by the ESW System. Therefore, the ESW System is required to be OPERABLE in these MODES.

In MODES 4 and 5, the OPERABILITY requirements of the ESW System is determined by the systems it supports.

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**ACTIONS** The ACTIONS are modified by a Note indicating that the applicable Conditions of LCO 3.8.1, be entered and Required Actions taken if the inoperable ESW subsystem results in inoperable DGs (i.e., the supply from both subsystems of ESW is secured to the same DG). This is an exception to LCO 3.0.6 because the Required Actions of LCO 3.7.2 do not adequately compensate for the loss of a DG (LCO 3.8.1) due to loss of ESW flow.

A.1

With one ESW pump inoperable in each subsystem, both inoperable pumps must be restored to OPERABLE status within 7 days. With the unit in this condition, the remaining OPERABLE ESW pumps are adequate to perform the ESW heat removal function; however, the overall reliability is reduced because a single failure could result in loss of ESW function. The 7 day Completion Time is based on the remaining ESW heat removal capability and the low probability of an event occurring during this time period.

B 1

With one or both ESW subsystems not capable of supplying ESW flow to two or more DGs, the capability to supply ESW to at least three DGs from each ESW subsystem must be restored within 7 days. With the units in this condition, the remaining ESW flow to DGs is adequate to maintain the full capability of all DGs; however, the overall reliability is reduced because a single failure could result in loss of the multiple DGs. The 7 day Completion Time is based on the fact that all DGs remain capable of responding to an event occurring during this time period.

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BASES (continued)

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ACTIONS

C.1

With one ESW subsystem inoperable for reasons other than Condition B, the ESW subsystem must be restored to OPERABLE status within 7 days. With the unit in this condition, the remaining OPERABLE ESW subsystem is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure in the OPERABLE ESW subsystem could result in loss of ESW function.

The 7 day Completion Time is based on the redundant ESW System capabilities afforded by the OPERABLE subsystem, the low probability of an accident occurring during this time period, and is consistent with the allowed Completion Time for restoring an inoperable Core Spray Loop, LPCI Pumps and Control Structure Chiller.

D.1 and D.2

If the ESW subsystem cannot be restored to OPERABLE status within the associated Completion Time, or both ESW subsystems are inoperable for reasons other than Condition A and B (i.e., three ESW pumps 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.

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SURVEILLANCE  
REQUIREMENTS

SR 3.7.2.1

Verifying the correct alignment for each manual, power operated, and automatic valve in each ESW subsystem flow path provides assurance that the proper flow paths will exist for ESW 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.

(continued)

BASES (continued)

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**SURVEILLANCE REQUIREMENTS**     SR 3.7.2.1 (continued)

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 ESW System to components or systems may render those components or systems inoperable, but does not necessarily affect the OPERABILITY of the ESW System. As such, when all ESW pumps, valves, and piping are OPERABLE, but a branch connection off the main header is isolated, the ESW 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 3.7.2.2

This SR verifies that the automatic valves of the ESW System 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 the use of an actual or simulated initiation signal. This SR also verifies the automatic start capability of the ESW pumps in each subsystem.

Operating experience has shown that these components usually pass the SR when performed at the 24 month Frequency. Therefore, this Frequency is concluded to be acceptable from a reliability standpoint.

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**REFERENCES**

1. FSAR, Chapter 4.
  2. FSAR, Chapter 6.
  3. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 39132)
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