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

<u>Section</u>	<u>Title</u>	<u>Revision</u>
TOC	Table of Contents	3
B 2.0	<b>SAFETY LIMITS BASES</b>	
	Page TS / B 2.0-1	1
	Pages TS / B 2.0-2 and TS / B 2.0-3	2
	Page TS / B 2.0-4	3
	Page TS / B 2.0-5	1
	Pages B 2.0-6 through B 2.0-8	0
B 3.0	<b>LCO AND SR APPLICABILITY BASES</b>	
	Pages B 3.0-1 through B 3.0-7	0
	Pages TS / B 3.0-8 and TS / B 3.0-9	1
	Pages B 3.0-10 through B 3.0-12	0
	Pages TS / B 3.0-13 through TS / B 3.0-15	1
B 3.1	<b>REACTIVITY CONTROL BASES</b>	
	Pages B 3.1-1 through B 3.1-5	0
	Pages TS / B 3.1-6 and TS / B 3.1-7	1
	Pages B 3.1-8 through B 3.1-27	0
	Page TS / B 3.1-28	1
	Pages B 3.1-29 through B 3.1-36	0
	Page TS / B 3.1-37	1
	Pages B 3.1-38 through B 3.1-51	0
B 3.2	<b>POWER DISTRIBUTION LIMITS BASES</b>	
	Pages TS / B 3.2-1 through TS / B 3.2-4	1
	Pages TS / B 3.2-5 and TS / B 3.2-6	2
	Page TS / B 3.2-7	1
	Pages TS / B 3.2-8 and TS / B 3.2-9	2
	Pages TS / B 3.2-10 through TS / B 3.2-19	1
B 3.3	<b>INSTRUMENTATION</b>	
	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 3.3-30	2
	Page TS / B 3.3-31	1
	Pages TS / B 3.3-32 and TS / B 3.3-33	2
	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	4
	Page TS / B 3.3-67	3

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

<u>Section</u>	<u>Title</u>	<u>Revision</u>
	Page TS / B 3.3-68	4
	Pages TS / B 3.3-69 and TS / B 3.3-70	3
	Pages TS / B 3.3-71 through TS / B 3.3-75	2
	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 3.3-91	0
	Pages TS / B 3.3-92 through TS / B 3.3-103	1
	Page TS / B 3.3-104	2
	Pages TS / B 3.3-105 and TS / B 3.3-106	1
	Page TS / B 3.3-107	2
	Page TS / B 3.3-108	1
	Page TS / B 3.3-109	2
	Pages TS / B 3.3-110 through TS / B 3.3-115	1
	Pages TS / B 3.3-116 through TS / B 3.3-118	2
	Pages TS / B 3.3-119 through TS / B 3.3-120	1
	Pages TS / B 3.3-121 and TS / B 3.3-122	2
	Page TS / B 3.3-123	1
	Page TS / B 3.3-124	2
	Page TS / B 3.3-124a	0
	Pages TS / B 3.3-125 and TS / B 3.3-126	1
	Page TS / B 3.3-127	2
	Pages TS / B 3.3-128 through TS / B 3.3-131	1
	Page TS / B 3.3-132	2
	Pages TS / B 3.3-133 and TS / B 3.3-134	1
	Pages B 3.3-135 through B 3.3-137	0
	Page TS / B 3.3-138	1
	Pages B 3.3-139 through B 3.3-149	0
	Pages TS / B 3.3-150 through TS / B 3.3-162	1
	Page TS / B 3.3-163	2
	Pages TS / B 3.3-164 through TS / B 3.3-177	1
	Pages TS / B 3.3-178 and TS / B 3.3-179	2
	Page TS / B 3.3-179a	1
	Pages TS / B 3.3-180 through TS / B 3.3-191	1
	Pages B 3.3-192 through B 3.3-205	0
	Page TS / B 3.3-206	1
	Pages B 3.3-207 through B 3.3-220	0
<b>B 3.4</b>	<b>REACTOR COOLANT SYSTEM BASES</b>	
	Pages TS / B 3.4-1 and TS / B 3.4-2	1
	Pages TS / B 3.4-3 through TS / B 3.4-6	2
	Page TS / B 3.4-7	1
	Pages TS / B 3.4-8 and TS / B 3.4-9	2
	Pages B 3.4-10 through B 3.4-14	0

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

<u>Section</u>	<u>Title</u>	<u>Revision</u>
	Page TS / B 3.4-15	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 3.3-30 through B 3.3-48	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
	Pages TS / B 3.4-54 and TS / B 3.4-55	2
	Pages TS / B 3.4-56 through TS / B 3.4-60	1
<b>B 3.5</b>	<b>ECCS AND RCIC BASES</b>	
	Pages TS / B 3.5-1 and TS / B 3.5-2	1
	Page TS / B 3.5-3	2
	Pages TS / B 3.5-4 through TS / B 3.5-10	1
	Page TS / B 3.5-11	2
	Pages TS / B 3.5-12 through TS / B 3.5-14	1
	Pages TS / B 3.5-15 through TS / B 3.5-17	2
	Page TS / B 3.18	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>B 3.6</b>	<b>CONTAINMENT SYSTEMS BASES</b>	
	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	3
	Pages TS / B 3.6-15a and TS / B 3.6-15b	0
	Page TS / B 3.6-16	1
	Page TS / B 3.6-17	2
	Page TS / B 3.6-17a	0
	Pages TS / B 3.6-18 and TS / B 3.6-19	1
	Page TS / B 3.6-20	2
	Page TS / B 3.6-21	3
	Pages TS / B 3.6-21a and TS / B 3.6-21b	0
	Pages TS / B 3.6-22 and TS / B 3.6-23	2

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

<u>Section</u>	<u>Title</u>	<u>Revision</u>
	Pages TS / B 3.6-24 through TS / B 3.6-26	1
	Page TS / B 3.6-27	3
	Page TS / B 3.6-28	6
	Page TS / B 3.6-29	3
	Page TS / B 3.6-29a	0
	Page TS / B 3.6-30	2
	Page TS / B 3.6-31	3
	Pages TS / B 3.6-32 through TS / B 3.6-34	1
	Pages TS / B 3.6-35 through TS / B 3.6-37	2
	Page TS / B 3.6-38	1
	Page TS / B 3.6-39	4
	Pages B 3.6-40 through B 3.6-42	0
	Pages TS / B 3.6-43 through TS / B 3.6-50	1
	Page TS / B 3.6-51	2
	Pages B 3.6-52 through B 3.6-62	0
	Page TS / B 3.6-63	1
	Pages B 3.6-64 through B 3.6-82	0
	Page TS / B 3.6-83	2
	Pages TS / B 3.6-84 through TS / B 3.6-87	1
	Page TS / B 3.6-87a	1
	Page TS / B 3.6-88	2
	Pages TS / B 3.6-89 through TS / B 3.6-99	1
	Pages B 3.6-100 through B 3.6-106	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 and TS / B 3.7-8	1
	Pages B 3.7-9 through B 3.7-11	0
	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 3.7-26	1
	Pages B 3.7-24 through B 3.7-26	0
	Pages TS / 3.7-27 through TS / B 3.7-29	1
	Pages B 3.7-30 through B 3.7-33	0
<b>B 3.8</b>	<b>ELECTRICAL POWER SYSTEMS BASES</b>	
	Pages B 3.8-1 through B 3.8-4	0
	Page TS / B 3.8-5	1
	Pages B 3.8-6 through B 3.8-8	0
	Pages TS / B 3.8-9 through TS / B 3.8-11	1

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

<u>Section</u>	<u>Title</u>	<u>Revision</u>
	Pages B 3.8-12 through B 3.8-18	0
	Page TS / B 3.8-19	1
	Pages B 3.8-20 through B 3.8-22	0
	Page TS / B 3.8-23	1
	Page B 3.8-24	0
	Pages TS / B 3.8-25 and TS / B 3.8-26	1
	Pages B 3.8-27 through B 3.8-37	0
	Page TS / B 3.8-38	1
	Pages TS / B 3.8-39 through TS / B 3.8-55	0
	Pages TS / B 3.8-56 through TS / B 3.8-64	1
	Page TS / B 3.8-65	2
	Page TS / B 3.8-66	2
	Pages TS / B 3.8-67 through TS / B 3.8-68	1
	Page TS / B 3.8-69	2
	Pages B 3.8-70 through B 3.8-99	0
<b>B 3.9</b>	<b>REFUELING OPERATIONS BASES</b>	
	Pages TS / B 3.9-1 and TS / B 3.9-2	1
	Page TS / B 3.9-2a	1
	Pages TS / B 3.9-3 and TS / B 3.9-4	1
	Pages B 3.9-5 through B 3.9-30	0
<b>B 3.10</b>	<b>SPECIAL OPERATIONS BASES</b>	
	Page TS / B 3.10-1	1
	Pages B 3.10-2 through B 3.10-32	0
	Page TS / B 3.10-33	1
	Pages B 3.10-34 through B 3.10-38	0
	Page TS / B 3.10-39	1

TSB2 text LOES  
9/1/04

TABLE OF CONTENTS (TECHNICAL SPECIFICATIONS BASES)

B2.0	SAFETY LIMITS (SLs).....	TS/B2.0-1
B2.1.1	Reactor Core SLs.....	TS/B2.0-1
B2.1.2	Reactor Coolant System (RCS) Pressure SL.....	B2.0-6
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.....	TS/B3.2-1
B3.2.1	Average Planar Linear Heat Generation Rate (APLHGR).....	TS/B3.2-1
B3.2.2	Minimum Critical Power Ratio (MCPR).....	TS/B3.2-5
B3.2.3	Linear Heat Generation Rate (LHGR).....	TS/B3.2-10
B3.2.4	Average Power Range Monitor (APRM) Gain and Setpoints.....	TS/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.....	TS/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.....	TS/B3.3-206
B3.3.8.2	Reactor Protection System (RPS) Electric Power Monitoring.....	B3.3-214
B3.4	REACTOR COOLANT SYSTEM (RCS) .....	TS/B3.4-1
B3.4.1	Recirculation Loops Operating.....	TS/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 .....	TS/B3.5-1
B3.5.1	ECCS – Operating.....	TS/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.....	B3.6-40
B3.6.1.5	Drywell Air Temperature.....	TS/B3.6-43
B3.6.1.6	Suppression Chamber-to-Drywell Vacuum Breakers.....	TS/B3.6-46
B3.6.2.1	Suppression Pool Average Temperature .....	B3.6-52
B3.6.2.2	Suppression Pool Water Level.....	B3.6-58
B3.6.2.3	Residual Heat Removal (RHR) Suppression Pool Cooling .....	B3.6-61
B3.6.2.4	Residual Heat Removal (RHR) Suppression Pool Spray .....	B3.6-65
B3.6.3.1	Primary Containment Hydrogen Recombiners.....	B3.6-69
B3.6.3.2	Drywell Air Flow System.....	B3.6-75
B3.6.3.3	Primary Containment Oxygen Concentration.....	B3.6-80
B3.6.4.1	Secondary Containment.....	TS/B3.6-83
B3.6.4.2	Secondary Containment Isolation Valves (SCIVs).....	TS/B3.6-90
B3.6.4.3	Standby Gas Treatment (SGT) System .....	B3.6-100

(continued)

**TABLE OF CONTENTS (TECHNICAL SPECIFICATIONS BASES)**

B3.7	<b>PLANT SYSTEMS.....</b>	<b>TS/B3.7-1</b>
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	<b>ELECTRICAL POWER SYSTEM .....</b>	<b>B3.8-1</b>
B3.8.1	AC Sources – Operating .....	B3.8-1
B3.8.2	AC Sources – Shutdown.....	B3.8-39
B3.8.3	Diesel Fuel Oil, Lube Oil, and Starting Air.....	B3.8-47
B3.8.4	DC Sources – Operating.....	TS/B3.8-56
B3.8.5	DC Sources – Shutdown .....	B3.8-70
B3.8.6	Battery Cell Parameters.....	B3.8-77
B3.8.7	Distribution Systems – Operating .....	B3.8-84
B3.8.8	Distribution Systems – Shutdown .....	B3.8-94
B3.9	<b>REFUELING OPERATIONS .....</b>	<b>TS/B3.9-1</b>
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	<b>SPECIAL OPERATIONS.....</b>	<b>TS/B3.10-1</b>
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 .....	B3.10-30
B3.10.8	SHUTDOWN MARGIN (SDM) Test – Refueling .....	B3.10-34

TSB2 TOC.doc  
7/29/04

**B 3.3 INSTRUMENTATION**

**B 3.3.8.1 Loss of Power (LOP) Instrumentation**

**BASES**

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**BACKGROUND** Successful operation of the required safety functions of the Emergency Core Cooling Systems (ECCS) is dependent upon the availability of adequate power sources for energizing the various components such as pump motors, motor operated valves, and the associated control components. The LOP instrumentation monitors the 4.16 kV emergency buses. Offsite power is the preferred source of power for the 4.16 kV emergency buses. If the monitors determine that insufficient power is available, the buses are disconnected from the offsite power sources and connected to the onsite diesel generator (DG) power sources.

Each 4.16 kV emergency bus has its own independent LOP instrumentation and associated trip logic. The voltage for each bus is monitored at three levels, which can be considered as three different undervoltage Functions: Loss of Voltage (< 20%), 4.16 kV Emergency Bus Undervoltage Degraded Voltage LOCA (< 93%), and 4.16 kV Emergency Bus Undervoltage Low Setting (Degraded Voltage) (< 65%). Each Function, with the exception of the Loss of Voltage relays is monitored by two undervoltage relays for each emergency bus, whose outputs are arranged in a two-out-of-two logic configuration. The Loss of Voltage Function is monitored by one undervoltage relay for each emergency bus, whose output is arranged in a one-out-of-one logic configuration. When voltage degrades below the setpoint, the channel output relay actuates, which then outputs a LOP trip signal to the trip logic.

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**APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY** The LOP instrumentation is required for Engineered Safety Features to function in any accident with a loss of offsite power. The Unit 1 LOP instrumentation is required to be operable for Unit 2 when the associated Unit 1 4.16 kV emergency buses are required to be operable per Unit 2 T.S. 3.8.7 and 3.8.8. The required channels of LOP instrumentation ensure that the ECCS and other assumed systems powered from the DGs, provide plant protection in the event of any of the Reference 1 and 2 analyzed accidents in which a loss of offsite power is assumed. The initiation of the DGs on loss of offsite power, and subsequent initiation of the ECCS, ensure that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

(continued)

**BASES**

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**APPLICABLE  
SAFETY  
ANALYSES,  
LCO, and  
APPLICABILITY  
(continued)**

Accident analyses credit the loading of the DG based on the loss of offsite power during a loss of coolant accident. The diesel starting and loading times have been included in the delay time associated with each safety system component requiring DG supplied power following a loss of offsite power.

The LOP instrumentation satisfies Criterion 3 of the NRC Policy Statement. (Ref. 3)

The OPERABILITY of the LOP instrumentation is dependent upon the OPERABILITY of the individual instrumentation channel Functions specified in Table 3.3.8.1-1. Each Function must have a required number of OPERABLE channels per 4.16 kV emergency bus, with their setpoints within the specified Allowable Values. A channel is inoperable if its actual trip setpoint is not within its required Allowable Value. The actual setpoint is calibrated consistent with applicable setpoint methodology assumptions.

The Allowable Values are specified for each Function in the Table. Trip setpoints are specified in the system calculations. The setpoints are selected to ensure that the setpoints do not exceed the Allowable Value. Operation with a trip setpoint less conservative than the nominal trip setpoint, but within the Allowable Value, is acceptable. Trip setpoints are those predetermined values of output at which an action should take place. The setpoints are compared to the actual process parameter (e.g., degraded voltage), and when the measured output value of the process parameter reaches the setpoint, the associated device changes state. The Allowable Values are derived from the limiting values of the process parameters obtained from the safety analysis. The trip setpoints are then derived based on engineering judgement.

The specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below on a Function by Function basis.

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(continued)

**BASES**

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**APPLICABLE  
SAFETY  
ANALYSES,  
LCO, and  
APPLICABILITY  
(continued)**

**1. 4.16 kV Emergency Bus Undervoltage (Loss of Voltage < 20%)**

Loss of voltage on a 4.16 kV emergency bus indicates that offsite power may be completely lost to the respective emergency bus and is unable to supply sufficient power for proper operation of the applicable equipment. Therefore, the power supply to the bus is transferred from offsite power to DG power when the voltage on the bus drops below the Loss of Voltage Function Allowable Values (loss of voltage with a short time delay). This ensures that adequate power will be available to the required equipment.

The Bus Undervoltage Allowable Values are low enough to prevent inadvertent power supply transfer, but high enough to ensure that power is available to the required equipment. The Time Delay Allowable Values are long enough to provide time for the offsite power supply to recover to normal voltages, but short enough to ensure that power is available to the required equipment.

One channel of 4.16 kV Emergency Bus Undervoltage (Loss of Voltage) Function per associated emergency bus is required to be OPERABLE when the associated DG is required to be OPERABLE to ensure that no single instrument failure can preclude the DG function. 4.16 kV Emergency Bus Undervoltage (Loss of Voltage) relay controls and provides a permissive to allow closure of the associated alternate source breaker and the associated DG breaker. (one channel input to each of the four DGs.) Refer to LCO 3.8.1, "AC Sources—Operating," and 3.8.2, "AC Sources—Shutdown," for Applicability Bases for the DGs.

**2., 3. 4.16 kV Emergency Bus Undervoltage (Degraded Voltage)**

A reduced voltage condition on a 4 kV emergency bus indicates that, while offsite power may not be completely lost to the respective emergency bus, available power may be insufficient for starting large ECCS motors without risking damage to the motors that could disable the ECCS function. Therefore, power supply to the bus is transferred from offsite power to onsite DG power when there is no offsite power or a degraded power supply to the bus. This transfer will occur only if the voltage of the primary and alternate power sources drop below the Degraded Voltage Function

(continued)

**BASES**

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**APPLICABLE  
SAFETY  
ANALYSES,  
LCO, and  
APPLICABILITY**

**2., 3. 4.16 kV Emergency Bus Undervoltage (Degraded Voltage)**  
(continued)

Allowable Values (degraded voltage with a time delay) and the source breakers trip which causes the DG to start. This ensures that adequate power will be available to the required equipment.

Two Functions are provided to monitor degraded voltage at two different levels. These Functions are the Degraded Voltage LOCA (< 93%) and Degraded Voltage Low Setting (< 65%). These relays respond to degraded voltage as follows: 93% for approximately 5 minutes (when no LOCA signal is present) and approximately 10 seconds (with a LOCA signal present), and 65% (Degraded Voltage Low Setting). The Degraded Voltage LOCA Function preserves the assumptions of the LOCA analysis and the Degraded Voltage Low Setting Function preserves the assumptions of the accident sequence analysis in the FSAR. The circuitry is designed such that with the LOCA signal present, the non-LOCA time delay is physically bypassed.

The Bus Undervoltage Allowable Values are low enough to prevent inadvertent power supply transfer, but high enough to ensure that sufficient power is available to the required equipment. The Time Delay Allowable Values are long enough to provide time for the offsite power supply to recover to normal voltages, but short enough to ensure that sufficient power is available to the required equipment.

Two channels of 4.16 kV Emergency Bus Undervoltage (Degraded Voltage) per Function (Functions 2 and 3) per associated bus are required to be OPERABLE when the associated DG is required to be OPERABLE. This ensures no single instrument failure can preclude the start of DGs (each logic inputs to each of the four DGs). Refer to LCO 3.8.1 and LCO 3.8.2 for Applicability Bases for the DGs.

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**ACTIONS**

A Note has been provided to modify the ACTIONS related to LOP instrumentation channels. Section 1.3, Completion Times, specifies that once a Condition has been entered, subsequent divisions, subsystems, components, or variables expressed in the Condition, discovered to be inoperable or not within limits, will not result in separate entry into

(continued)

**BASES**

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**ACTIONS**  
(continued)

the Condition. Section 1.3 also specifies that Required Actions of the Condition continue to apply for each additional failure, with Completion Times based on initial entry into the Condition. However, the Required Actions for inoperable LOP instrumentation channels provide appropriate compensatory measures for separate inoperable channels. As such, a Note has been provided that allows separate Condition entry for each inoperable LOP instrumentation channel.

A.1

Required Action A.1 directs entry into the appropriate Condition referenced in Table 3.3.8.1-1. The applicable Condition specified in the Table is Function dependent. Each time a channel is discovered inoperable, Condition A is entered for that channel and provides for transfer to the appropriate subsequent Condition.

B.1

With one or more channels of a Function inoperable, the Function is not capable of performing the intended function. Therefore, only 1 hour is allowed to restore the inoperable channel to OPERABLE status. If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the channel must be placed in the tripped condition per Required Action B.1. Placing the inoperable channel in trip would conservatively compensate for the inoperability, restore capability to accommodate a single failure (within the LOP instrumentation), and allow operation to continue. Alternately, if it is not desired to place the channel in trip (e.g., as in the case where placing the channel in trip would result in a DG initiation), Condition D must be entered and its Required Action taken.

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The 1 hour Completion Time is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

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(continued)

**BASES**

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**ACTIONS**  
(continued)

C.1

With one channel of the Function inoperable, the Function is not capable of performing the intended function. Therefore, only 1 hour is allowed to restore the inoperable channel to OPERABLE status. If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, Condition D must be entered and its Required Action taken.

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The 1 hour Completion Time is acceptable because it minimizes risk while allowing time for restoration of channels.

D.1

If the Required Action and associated Completion Times of Conditions B or C are not met, the associated Function is not capable of performing the intended function. Therefore, the associated DG(s) is declared inoperable immediately. This requires entry into applicable Conditions and Required Actions of LCO 3.8.1 and LCO 3.8.2, which provide appropriate actions for the inoperable DG(s).

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**SURVEILLANCE**  
**REQUIREMENTS**

As noted at the beginning of the SRs, the SRs for each LOP instrumentation Function are located in the SRs column of Table 3.3.8.1-1.

The Surveillances are modified by a Note to indicate that when a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours provided the associated Function maintains DG initiation capability. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to OPERABLE status or the applicable Condition entered and Required Actions taken.

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(continued)

**BASES**

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**SURVEILLANCE  
REQUIREMENTS  
(continued)**

**SR 3.3.8.1.1**

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria which are determined by the plant staff based on an investigation of a combination of the channel instrument uncertainties may be used to support this parameter comparison and include indication and readability. If a channel is outside the criteria, it may be an indication that the instrument has drifted outside its limit.

The Frequency is based upon operating experience that demonstrates channel failure is rare. The CHANNEL CHECK supplements less formal checks of channels during normal operational use of the displays associated with channels required by the LCO.

**SR 3.3.8.1.2**

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function.

The Frequency of 31 days is based on operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function in any 31 day interval is a rare event.

**SR 3.3.8.1.3**

A CHANNEL CALIBRATION verifies that the channel responds to the measured parameter within the necessary range and

(continued)

**BASES**

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**SURVEILLANCE  
REQUIREMENTS**

SR 3.3.8.1.3 (continued)

accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology.

Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology.

The Frequency is based upon the assumption of an 24 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

SR 3.3.8.1.4

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required actuation logic for a specific channel. The system functional testing performed in LCO 3.8.1 and LCO 3.8.2 overlaps this Surveillance to provide complete testing of the assumed safety functions.

The 24 month Frequency is based on the need to perform portions of this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at the 24 month Frequency.

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**REFERENCES**

1. FSAR, Section 6.3.
  2. FSAR, Chapter 15.
  3. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 32193)
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