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TSB1 - TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL
REMOVE MANUAL TABLE OF CONTENTS DATE: 12/05/2017
ADD MANUAL TABLE OF CONTENTS DATE: 12/14/2017
CATEGORY: DOCUMENTS TYPE: TSB1
ID: TEXT 3.8.3
ADD: REV: 6
REMOVE: REV:5

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NRR

CATEGORY: DOCUMENTS TYPE: TSB1
ID: TEXT LOES
ADD: REV: 129

REMOVE: REV:128

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SSES MANUAL

Manual Name: TSB1

Manual Title: TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

Table Of Contents

Issue Date: 12/14/2017

<u>Procedure Name</u>	<u>Rev</u>	<u>Issue Date</u>	<u>Change ID</u>	<u>Change Number</u>
TEXT LOES	129	12/14/2017		
Title: LIST OF EFFECTIVE SECTIONS				
TEXT TOC	23	07/02/2014		
Title: TABLE OF CONTENTS				
TEXT 2.1.1	6	01/22/2015		
Title: SAFETY LIMITS (SLS) REACTOR CORE SLS				
TEXT 2.1.2	1	10/04/2007		
Title: SAFETY LIMITS (SLS) REACTOR COOLANT SYSTEM (RCS) PRESSURE S				
TEXT 3.0	3	08/20/2009		
Title: LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY				
TEXT 3.1.1	1	04/18/2006		
Title: REACTIVITY CONTROL SYSTEMS SHUTDOWN MARGIN (SDM)				
TEXT 3.1.2	0	11/15/2002		
Title: REACTIVITY CONTROL SYSTEMS REACTIVITY ANOMALIES				
TEXT 3.1.3	3	11/16/2016		
Title: REACTIVITY CONTROL SYSTEMS CONTROL ROD OPERABILITY				
TEXT 3.1.4	5	11/16/2016		
Title: REACTIVITY CONTROL SYSTEMS CONTROL ROD SCRAM TIMES				
TEXT 3.1.5	2	11/16/2016		
Title: REACTIVITY CONTROL SYSTEMS CONTROL ROD SCRAM ACCUMULATORS				
TEXT 3.1.6	4	11/16/2016		
Title: REACTIVITY CONTROL SYSTEMS ROD PATTERN CONTROL				

SSES MANUAL

Manual Name: TSB1

Manual Title: TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

TEXT 3.1.7 4 11/16/2016
Title: REACTIVITY CONTROL SYSTEMS STANDBY LIQUID CONTROL (SLC) SYSTEM

TEXT 3.1.8 4 11/16/2016
Title: REACTIVITY CONTROL SYSTEMS SCRAM DISCHARGE VOLUME (SDV) VENT AND DRAIN VALVES

TEXT 3.2.1 3 11/16/2016
Title: POWER DISTRIBUTION LIMITS AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)

TEXT 3.2.2 4 11/16/2016
Title: POWER DISTRIBUTION LIMITS MINIMUM CRITICAL POWER RATIO (MCPR)

TEXT 3.2.3 3 11/16/2016
Title: POWER DISTRIBUTION LIMITS LINEAR HEAT GENERATION RATE (LHGR)

TEXT 3.3.1.1 7 11/16/2016
Title: INSTRUMENTATION REACTOR PROTECTION SYSTEM (RPS) INSTRUMENTATION

TEXT 3.3.1.2 3 11/16/2016
Title: INSTRUMENTATION SOURCE RANGE MONITOR (SRM) INSTRUMENTATION

TEXT 3.3.2.1 5 11/16/2016
Title: INSTRUMENTATION CONTROL ROD BLOCK INSTRUMENTATION

TEXT 3.3.2.2 3 11/16/2016
Title: INSTRUMENTATION FEEDWATER MAIN TURBINE HIGH WATER LEVEL TRIP INSTRUMENTATION

TEXT 3.3.3.1 10 11/16/2016
Title: INSTRUMENTATION POST ACCIDENT MONITORING (PAM) INSTRUMENTATION

TEXT 3.3.3.2 2 11/16/2016
Title: INSTRUMENTATION REMOTE SHUTDOWN SYSTEM

TEXT 3.3.4.1 3 11/16/2016
Title: INSTRUMENTATION END OF CYCLE RECIRCULATION PUMP TRIP (EOC-RPT) INSTRUMENTATION

SSSES MANUAL

Manual Name: TSB1

Manual Title: TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

TEXT 3.3.4.2 1 11/16/2016
Title: INSTRUMENTATION ANTICIPATED TRANSIENT WITHOUT SCRAM RECIRCULATION PUMP TRIP (ATWS-RPT) INSTRUMENTATION

TEXT 3.3.5.1 4 11/16/2016
Title: INSTRUMENTATION EMERGENCY CORE COOLING SYSTEM (ECCS) INSTRUMENTATION

TEXT 3.3.5.2 1 11/16/2016
Title: INSTRUMENTATION REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM INSTRUMENTATION

TEXT 3.3.6.1 8 11/16/2016
Title: INSTRUMENTATION PRIMARY CONTAINMENT ISOLATION INSTRUMENTATION

TEXT 3.3.6.2 5 11/16/2016
Title: INSTRUMENTATION SECONDARY CONTAINMENT ISOLATION INSTRUMENTATION

TEXT 3.3.7.1 3 11/16/2016
Title: INSTRUMENTATION CONTROL ROOM EMERGENCY OUTSIDE AIR SUPPLY (CREOAS) SYSTEM INSTRUMENTATION

TEXT 3.3.8.1 3 11/16/2016
Title: INSTRUMENTATION LOSS OF POWER (LOP) INSTRUMENTATION

TEXT 3.3.8.2 1 11/16/2016
Title: INSTRUMENTATION REACTOR PROTECTION SYSTEM (RPS) ELECTRIC POWER MONITORING

TEXT 3.4.1 5 11/16/2016
Title: REACTOR COOLANT SYSTEM (RCS) RECIRCULATION LOOPS OPERATING

TEXT 3.4.2 4 11/16/2016
Title: REACTOR COOLANT SYSTEM (RCS) JET PUMPS

TEXT 3.4.3 3 01/13/2012
Title: REACTOR COOLANT SYSTEM RCS SAFETY RELIEF VALVES S/RVS

TEXT 3.4.4 1 11/16/2016
Title: REACTOR COOLANT SYSTEM (RCS) RCS OPERATIONAL LEAKAGE

SSES MANUAL

Manual Name: TSB1

Manual Title: TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

TEXT 3.4.5	2	04/13/2016	Title: REACTOR COOLANT SYSTEM (RCS) RCS PRESSURE ISOLATION VALVE (PIV) LEAKAGE
TEXT 3.4.6	5	11/16/2016	Title: REACTOR COOLANT SYSTEM (RCS) RCS LEAKAGE DETECTION INSTRUMENTATION
TEXT 3.4.7	3	11/16/2016	Title: REACTOR COOLANT SYSTEM (RCS) RCS SPECIFIC ACTIVITY
TEXT 3.4.8	3	11/16/2016	Title: REACTOR COOLANT SYSTEM (RCS) RESIDUAL HEAT REMOVAL (RHR) SHUTDOWN COOLING SYSTEM - HOT SHUTDOWN
TEXT 3.4.9	2	11/16/2016	Title: REACTOR COOLANT SYSTEM (RCS) RESIDUAL HEAT REMOVAL (RHR) SHUTDOWN COOLING SYSTEM - COLD SHUTDOWN
TEXT 3.4.10	5	11/16/2016	Title: REACTOR COOLANT SYSTEM (RCS) RCS PRESSURE AND TEMPERATURE (P/T) LIMITS
TEXT 3.4.11	1	11/16/2016	Title: REACTOR COOLANT SYSTEM (RCS) REACTOR STEAM DOME PRESSURE
TEXT 3.5.1	5	11/16/2016	Title: EMERGENCY CORE COOLING SYSTEMS (ECCS) AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM ECCS - OPERATING
TEXT 3.5.2	1	11/16/2016	Title: EMERGENCY CORE COOLING SYSTEMS (ECCS) AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM ECCS - SHUTDOWN
TEXT 3.5.3	5	05/31/2017	Title: EMERGENCY CORE COOLING SYSTEMS (ECCS) AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM RCIC SYSTEM
TEXT 3.6.1.1	6	11/16/2016	Title: PRIMARY CONTAINMENT
TEXT 3.6.1.2	2	11/16/2016	Title: CONTAINMENT SYSTEMS PRIMARY CONTAINMENT AIR LOCK

SSES MANUAL

Manual Name: TSB1

Manual Title: TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

TEXT 3.6.1.3	13	11/16/2016		
Title: CONTAINMENT SYSTEMS PRIMARY CONTAINMENT ISOLATION VALVES (PCIVS)				
TEXT 3.6.1.4	2	11/16/2016		
Title: CONTAINMENT SYSTEMS CONTAINMENT PRESSURE				
TEXT 3.6.1.5	2	11/16/2016		
Title: CONTAINMENT SYSTEMS DRYWELL AIR TEMPERATURE				
TEXT 3.6.1.6	1	11/16/2016		
Title: CONTAINMENT SYSTEMS SUPPRESSION CHAMBER-TO-DRYWELL VACUUM BREAKERS				
TEXT 3.6.2.1	3	11/16/2016		
Title: CONTAINMENT SYSTEMS SUPPRESSION POOL AVERAGE TEMPERATURE				
TEXT 3.6.2.2	1	11/16/2016		
Title: CONTAINMENT SYSTEMS SUPPRESSION POOL WATER LEVEL				
TEXT 3.6.2.3	2	11/16/2016		
Title: CONTAINMENT SYSTEMS RESIDUAL HEAT REMOVAL (RHR) SUPPRESSION POOL COOLING				
TEXT 3.6.2.4	1	11/16/2016		
Title: CONTAINMENT SYSTEMS RESIDUAL HEAT REMOVAL (RHR) SUPPRESSION POOL SPRAY				
TEXT 3.6.3.1	2	06/13/2006		
Title: CONTAINMENT SYSTEMS PRIMARY CONTAINMENT HYDROGEN RECOMBINERS				
TEXT 3.6.3.2	3	09/29/2017		
Title: CONTAINMENT SYSTEMS DRYWELL AIR FLOW SYSTEM				
			LDCN	5296
TEXT 3.6.3.3	3	09/29/2017		
Title: CONTAINMENT SYSTEMS PRIMARY CONTAINMENT OXYGEN CONCENTRATION				
TEXT 3.6.4.1	13	04/19/2017		
Title: CONTAINMENT SYSTEMS SECONDARY CONTAINMENT				

SSES MANUAL

Manual Name: TSB1

Manual Title: TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

TEXT 3.6.4.2	12	04/19/2017	Title: CONTAINMENT SYSTEMS SECONDARY CONTAINMENT ISOLATION VALVES (SCIVS)
TEXT 3.6.4.3	6	09/15/2017	Title: CONTAINMENT SYSTEMS STANDBY GAS TREATMENT (SGT) SYSTEM
TEXT 3.7.1	5	11/16/2016	Title: PLANT SYSTEMS RESIDUAL HEAT REMOVAL SERVICE WATER (RHRSW) SYSTEM AND THE ULTIMATE HEAT SINK (UHS)
TEXT 3.7.2	3	11/16/2016	Title: PLANT SYSTEMS EMERGENCY SERVICE WATER (ESW) SYSTEM
TEXT 3.7.3	3	09/15/2017	Title: PLANT SYSTEMS CONTROL ROOM EMERGENCY OUTSIDE AIR SUPPLY (CREOAS) SYSTEM
TEXT 3.7.4	1	11/16/2016	Title: PLANT SYSTEMS CONTROL ROOM FLOOR COOLING SYSTEM
TEXT 3.7.5	2	11/16/2016	Title: PLANT SYSTEMS MAIN CONDENSER OFFGAS
TEXT 3.7.6	3	11/16/2016	Title: PLANT SYSTEMS MAIN TURBINE BYPASS SYSTEM
TEXT 3.7.7	2	11/16/2016	Title: PLANT SYSTEMS SPENT FUEL STORAGE POOL WATER LEVEL
TEXT 3.7.8	1	11/16/2016	Title: PLANT SYSTEMS
TEXT 3.8.1	8	11/16/2016	Title: ELECTRICAL POWER SYSTEMS AC SOURCES - OPERATING
TEXT 3.8.2	0	11/15/2002	Title: ELECTRICAL POWER SYSTEMS AC SOURCES - SHUTDOWN

SSES MANUAL

Manual Name: TSBI

Manual Title: TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

TEXT 3.8.3 6 12/14/2017
Title: ELECTRICAL POWER SYSTEMS DIESEL FUEL OIL, LUBE OIL, AND STARTING AIR

TEXT 3.8.4 4 11/16/2016
Title: ELECTRICAL POWER SYSTEMS DC SOURCES - OPERATING

TEXT 3.8.5 1 12/14/2006
Title: ELECTRICAL POWER SYSTEMS DC SOURCES - SHUTDOWN

TEXT 3.8.6 2 11/16/2016
Title: ELECTRICAL POWER SYSTEMS BATTERY CELL PARAMETERS

TEXT 3.8.7 2 11/16/2016
Title: ELECTRICAL POWER SYSTEMS DISTRIBUTION SYSTEMS - OPERATING

TEXT 3.8.8 1 11/16/2016
Title: ELECTRICAL POWER SYSTEMS DISTRIBUTION SYSTEMS - SHUTDOWN

TEXT 3.9.1 1 11/16/2016
Title: REFUELING OPERATIONS REFUELING EQUIPMENT INTERLOCKS

TEXT 3.9.2 2 11/16/2016
Title: REFUELING OPERATIONS REFUEL POSITION ONE-ROD-OUT INTERLOCK

TEXT 3.9.3 1 11/16/2016
Title: REFUELING OPERATIONS CONTROL ROD POSITION

TEXT 3.9.4 0 11/15/2002
Title: REFUELING OPERATIONS CONTROL ROD POSITION INDICATION

TEXT 3.9.5 1 11/16/2016
Title: REFUELING OPERATIONS CONTROL ROD OPERABILITY - REFUELING

TEXT 3.9.6 2 11/16/2016
Title: REFUELING OPERATIONS REACTOR PRESSURE VESSEL (RPV) WATER LEVEL

SSES MANUAL

Manual Name: TSBI

Manual Title: TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

TEXT 3.9.7 1 11/16/2016
Title: REFUELING OPERATIONS RESIDUAL HEAT REMOVAL (RHR) - HIGH WATER LEVEL

TEXT 3.9.8 1 11/16/2016
Title: REFUELING OPERATIONS RESIDUAL HEAT REMOVAL (RHR) - LOW WATER LEVEL

TEXT 3.10.1 1 01/23/2008
Title: SPECIAL OPERATIONS INSERVICE LEAK AND HYDROSTATIC TESTING OPERATION

TEXT 3.10.2 1 11/16/2016
Title: SPECIAL OPERATIONS REACTOR MODE SWITCH INTERLOCK TESTING

TEXT 3.10.3 1 11/16/2016
Title: SPECIAL OPERATIONS SINGLE CONTROL ROD WITHDRAWAL - HOT SHUTDOWN

TEXT 3.10.4 1 11/16/2016
Title: SPECIAL OPERATIONS SINGLE CONTROL ROD WITHDRAWAL - COLD SHUTDOWN

TEXT 3.10.5 1 11/16/2016
Title: SPECIAL OPERATIONS SINGLE CONTROL ROD DRIVE (CRD) REMOVAL - REFUELING

TEXT 3.10.6 1 11/16/2016
Title: SPECIAL OPERATIONS MULTIPLE CONTROL ROD WITHDRAWAL - REFUELING

TEXT 3.10.7 1 04/18/2006
Title: SPECIAL OPERATIONS CONTROL ROD TESTING - OPERATING

TEXT 3.10.8 2 11/16/2016
Title: SPECIAL OPERATIONS SHUTDOWN MARGIN (SDM) TEST - REFUELING

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

<u>Section</u>	<u>Title</u>	<u>Revision</u>
TOC	Table of Contents.....	23
B 2.0	SAFETY LIMITS BASES	
B2.1.1	Reactor Core SLs	6
B2.1.2	Reactor Coolant System (RCS) Pressure SL.....	1
B 3.0	LCO AND SR APPLICABILITY BASES	3
B 3.1	REACTIVITY CONTROL BASES	
B3.1.1	Shutdown Margin (SDM).....	2
B3.1.2	Reactivity Anomalies	1
B3.1.3	Control Rod OPERABILITY	3
B3.1.4	Control Rod Scram Times.....	5
B3.1.5	Control Rod Scram Accumulators.....	2
B3.1.6	Rod Pattern Control.....	4
B3.1.7	Standby Liquid Control (SLC) System.....	4
B3.1.8	Scram Discharge Volume (SDV) Vent and Drain Valves.....	4
B 3.2	POWER DISTRIBUTION LIMITS BASES	
B3.2.1	Average Planar Linear Heat Generation Rate (APLHGR)	3
B3.2.2	Minimum Critical Power Ratio (MCPR)	4
B3.2.3	Linear Heat Generation Rate (LHGR).....	3
B 3.3	INSTRUMENTATION	
B3.3.1.1	Reactor Protection System (RPS) Instrumentation	7
B3.3.1.2	Source Range Monitor (SRM) Instrumentation	3
B3.3.2.1	Control Rod Block Instrumentation	5
B3.3.2.2	Feedwater – Main Turbine High Water Level Trip Instrumentation.....	3
B3.3.3.1	Post Accident Monitoring (PAM) Instrumentation.....	10
B3.3.3.2	Remote Shutdown System	2
B3.3.4.1	End of Cycle Recirculation Pump Trip (EOC-RPT) Instrumentation	3
B3.3.4.2	Anticipated Transient Without Scram Recirculation Pump Trip (ATWS-RPT) Instrumentation.....	1
B3.3.5.1	Emergency Core Cooling System (ECCS) Instrumentation.....	4
B3.3.5.2	Reactor Core Isolation Cooling (RCIC) System Instrumentation	1
B3.3.6.1	Primary Containment Isolation Instrumentation.....	8
B3.3.6.2	Secondary Containment Isolation Instrumentation.....	5
B3.3.7.1	Control Room Emergency Outside Air Supply (CREOAS)	3
B3.3.8.1	Loss of Power (LOP) Instrumentation	3
B3.3.8.2	Reactor Protection System (RPS) Electric Power Monitoring.....	1

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

<u>Section</u>	<u>Title</u>	<u>Revision</u>
B 3.4	REACTOR COOLANT SYSTEM BASES	
B3.4.1	Recirculation Loops Operating.....	5
B3.4.2	Jet Pumps	4
B3.4.3	Safety/Relief Valves (S/RVs)	3
B3.4.4	RCS Operational LEAKAGE	1
B3.4.5	RCS Pressure Isolation Valve (PIV) Leakage	2
B3.4.6	RCS Leakage Detection Instrumentation	5
B3.4.7	RCS Specific Activity	3
B3.4.8	Residual Heat Removal (RHR) Shutdown Cooling System – Hot Shutdown	3
B3.4.9	Residual Heat Removal (RHR) Shutdown Cooling System – Cold Shutdown.....	2
B3.4.10	RCS Pressure and Temperature (P/T) Limits.....	5
B3.4.11	Reactor Steam Dome Pressure	1
B3.5	ECCS AND RCIC BASES	
B3.5.1	ECCS – Operating.....	5
B3.5.2	ECCS – Shutdown.....	1
B3.5.3	RCIC System.....	5
B3.6	CONTAINMENT SYSTEMS BASES	
B3.6.1.1	Primary Containment.....	6
B3.6.1.2	Primary Containment Air Lock	2
B3.6.1.3	Primary Containment Isolation Valves (PCIVs)	13
B3.6.1.4	Containment Pressure	2
B3.6.1.5	Drywell Air Temperature	2
B3.6.1.6	Suppression Chamber-to-Drywell Vacuum Breakers	1
B3.6.2.1	Suppression Pool Average Temperature	3
B3.6.2.2	Suppression Pool Water Level.....	1
B3.6.2.3	Residual Heat Removal (RHR) Suppression Pool Cooling	2
B3.6.2.4	Residual Heat Removal (RHR) Suppression Pool Spray	1
B3.6.3.1	Not Used	2
B3.6.3.2	Drywell Air Flow System.....	3
B3.6.3.3	Primary Containment Oxygen Concentration.....	3
B3.6.4.1	Secondary Containment.....	13
B3.6.4.2	Secondary Containment Isolation Valves (SCIVs)	12
B3.6.4.3	Standby Gas Treatment (SGT) System	6

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

<u>Section</u>	<u>Title</u>	<u>Revision</u>
B3.7	PLANT SYSTEMS BASES	
B3.7.1	Residual Heat Removal Service Water (RHRSW) System and the Ultimate Heat Sink (UHS)	5
B3.7.2	Emergency Service Water (ESW) System	3
B3.7.3	Control Room Emergency Outside Air Supply (CREOAS) System	3
B3.7.4	Control Room Floor Cooling System.....	1
B3.7.5	Main Condenser Offgas.....	2
B3.7.6	Main Turbine Bypass System	3
B3.7.7	Spent Fuel Storage Pool Water Level.....	2
B3.7.8	Main Turbine Pressure Regulation System.....	1
B3.8	ELECTRICAL POWER SYSTEMS BASES	
B3.8.1	AC Sources – Operating.....	8
B3.8.2	AC Sources – Shutdown.....	0
B3.8.3	Diesel Fuel Oil, Lube Oil, and Starting Air.....	6
B3.8.4	DC Sources – Operating.....	4
B3.8.5	DC Sources – Shutdown.....	1
B3.8.6	Battery Cell Parameters.....	2
B3.8.7	Distribution Systems – Operating.....	2
B3.8.8	Distribution Systems – Shutdown	1
B3.9	REFUELING OPERATIONS BASES	
B3.9.1	Refueling Equipment Interlocks	1
B3.9.2	Refuel Position One-Rod-Out Interlock.....	1
B3.9.3	Control Rod Position.....	1
B3.9.4	Control Rod Position Indication.....	0
B3.9.5	Control Rod OPERABILITY – Refueling	1
B3.9.6	Reactor Pressure Vessel (RPV) Water Level.....	2
B3.9.7	Residual Heat Removal (RHR) – High Water Level	1
B3.9.8	Residual Heat Removal (RHR) – Low Water Level	1
B3.10	SPECIAL OPERATIONS BASES	
B3.10.1	Inservice Leak and Hydrostatic Testing Operation.....	1
B3.10.2	Reactor Mode Switch Interlock Testing.....	1
B3.10.3	Single Control Rod Withdrawal – Hot Shutdown	1
B3.10.4	Single Control Rod Withdrawal – Cold Shutdown	1
B3.10.5	Single Control Rod Drive (CRD) Removal – Refueling.....	1
B3.10.6	Multiple Control Rod Withdrawal – Refueling	1
B3.10.7	Control Rod Testing – Operating	1
B3.10.8	Shutdown Margin (SDM) Test – Refueling.....	2

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.3 Diesel Fuel Oil, Lube Oil, and Starting Air

BASES

BACKGROUND

Each diesel generator (DG) is provided with a storage tank having a fuel oil capacity sufficient to operate that DG for a period of 7 days while the DG is supplying its continuous rated capacity as discussed in FSAR, Section 9.5.4 (Ref. 1). The maximum load demand is calculated using the assumption that at least three DGs are available. This on-site fuel oil storage tank (FOST) capacity is sufficient to operate the DGs for longer than the time to replenish the onsite supply from outside sources.

Fuel oil is transferred from storage tank to day tank by a transfer pump associated with each storage tank. Independent pumps and piping preclude the failure of one pump, or the rupture of any pipe, valve, or tank to result in the loss of more than one DG. All outside tanks, pumps, and piping are located underground.

For proper operation of the standby DGs, it is necessary to ensure the proper quality of the fuel oil. Regulatory Guide 1.137 (Ref. 2) addresses the recommended fuel oil practices as supplemented by ANSI N195 (Ref. 3). The fuel oil properties governed by these SRs are the water and sediment content, the kinematic viscosity, specific gravity (or API gravity) and impurity level.

The DG lubrication system is designed to provide sufficient lubrication to permit proper operation of its associated DG under all loading conditions. The system is required to circulate the lube oil to the diesel engine working surfaces and to remove excess heat generated by friction during operation. Each engine oil sump contains an inventory capable of supporting a minimum of 7 days of operation. This supply is sufficient to allow the operator to replenish lube oil from outside sources.

Each DG has an air start system with two air receivers (DG E has four air receivers) and each DG air start system provides adequate capacity for five successive start cycles on the DG without recharging the air start receivers. Each bank of two air receivers for DG E has adequate capacity for a minimum of five successive start cycles.

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in FSAR, Chapter 6 (Ref. 4), and Chapter 15 (Ref. 5), assume Engineered Safety Feature (ESF) systems are OPERABLE. The DGs are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that fuel, Reactor Coolant System, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems.

Since diesel fuel oil, lube oil, and starting air subsystem support the operation of the standby AC power sources, they satisfy Criterion 3 of the NRC Policy Statement (Ref. 6).

LCO

Stored diesel fuel oil is required to have sufficient supply for 7 days of full load operation. It is also required to meet specific standards for quality. Additionally, sufficient lube oil supply must be available to ensure the capability to operate at full load for 7 days. This requirement, in conjunction with an ability to obtain replacement supplies within 7 days, supports the availability of DGs required to shut down the reactor and to maintain it in a safe condition for an anticipated operational occurrence (AOO) or a postulated DBA with loss of offsite power. DG day tank fuel oil requirements, as well as transfer capability from the storage tank to the day tank, are addressed in LCO 3.8.1, "AC Sources—Operating," and LCO 3.8.2, "AC Sources-Shutdown."

The starting air system is required to have a minimum capacity for five successive DG start attempts without recharging the air start receivers.

APPLICABILITY

The AC sources (LCO 3.8.1 and LCO 3.8.2) are required to ensure the availability of the required power to shut down the reactor and maintain it in a safe shutdown condition after an AOO or a postulated DBA. Because stored diesel fuel oil, lube oil, and starting air subsystem support LCO 3.8.1 and LCO 3.8.2, stored diesel fuel oil, lube oil,

(continued)

BASES

APPLICABILITY
(continued) and starting air are required to be within limits when the associated DG is required to be OPERABLE.

ACTIONS

The ACTIONS Table is modified by a Note indicating that separate Condition entry is allowed for each DG. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory actions for each inoperable DG subsystem. Complying with the Required Actions for one inoperable DG subsystem may allow for continued operation, and subsequent inoperable DG subsystem(s) governed by separate Condition entry and application of associated Required Actions.

A.1

In this Condition, the 7 day fuel oil supply for a DG is not available. However, the Condition is restricted to fuel oil level reductions that maintain at least a 6 day supply. These circumstances may be caused by events such as:

- a. Full load operation required for an inadvertent start while at minimum required level; or
- b. Feed and bleed operations that may be necessitated by increasing particulate levels or any number of other oil quality degradations.

This restriction allows sufficient time for obtaining the requisite replacement volume and performing the analyses required prior to addition of the fuel oil to the tank. A period of 48 hours is considered sufficient to complete restoration of the required level prior to declaring the DG inoperable. This period is acceptable based on the remaining capacity (> 6 days), the fact that action will be initiated to obtain replenishment, the availability of fuel oil in the storage tank of the fifth diesel generator that is not required to be OPERABLE, and the low probability of an event during this brief period.

(continued)

BASES

ACTIONS
(continued)

B.1

With lube oil sump level not visible in the sight glass, sufficient lube oil to support 7 days of continuous DG operation at full load conditions may not be available. Therefore, the DG is declared inoperable immediately.

C.1

This Condition is entered as a result of a failure to meet the acceptance criterion for particulates. Normally, trending of particulate levels allows sufficient time to correct high particulate levels prior to reaching the limit of acceptability. Poor sample procedures (bottom sampling), contaminated sampling equipment, and errors in laboratory analysis can produce failures that do not follow a trend. Since the presence of particulates does not mean failure of the fuel oil to burn properly in the diesel engine, since particulate concentration is unlikely to change significantly between Surveillance Frequency intervals, and since proper engine performance has been recently demonstrated (within 31 days), it is prudent to allow a brief period prior to declaring the associated DG inoperable. The 7 day Completion Time allows for further evaluation, resampling, and re-analysis of the DG fuel oil.

D.1

With the new fuel oil properties defined in the Bases for SR 3.8.3.3 not within the required limits, a period of 30 days is allowed for restoring the stored fuel oil properties. This period provides sufficient time to test the stored fuel oil to determine that the new fuel oil, when mixed with previously stored fuel oil, remains acceptable, or to restore the stored fuel oil properties. This restoration may involve feed and bleed procedures, filtering, or combination of these procedures. Even if a DG start and load was required during this time interval and the fuel oil properties were outside limits, there is high likelihood that the DG would still be capable of performing its intended function.

(continued)

BASES

ACTIONS
(continued)

E.1

With starting air receiver pressure < 240 psig in one or more air receivers, sufficient capacity for five successive DG start attempts cannot be provided by the air start system. However, as long as all receiver pressures are > 180 psig, there is adequate capacity for at least one start attempt, and the DG can be considered OPERABLE while the air receiver pressure is restored to the required limit. A period of 48 hours is considered sufficient to complete restoration to the required pressure prior to declaring the DG inoperable. This period is acceptable based on the remaining air start capacity, the fact that most DG starts are accomplished on the first attempt, and the low probability of an event during this brief period. Entry into Condition E is not required when air receiver pressure is less than required limits following a successful start while the DG is operating.

F.1

With a Required Action and associated Completion Time of A through E not met, or the stored diesel fuel oil, lube oil, or starting air not within SR limits for reasons other than addressed by Conditions A, B, C, D or E, the associated DG may be incapable of performing its intended function and must be immediately declared inoperable.

SURVEILLANCE
REQUIREMENTS

SR 3.8.3.1

This SR provides verification that there is an adequate inventory of fuel oil in the storage tanks to support each DG's operation for 7 days at continuous rated capacity which is greater than the maximum post LOCA load demand. The 7 day period is sufficient time to place the unit in a safe shutdown condition and to bring in replenishment fuel from an offsite location.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.8.3.2

This Surveillance ensures that sufficient lubricating oil inventory is available to support at least 7 days of full load operation for each DG. The sump level requirement is based on the DG manufacturer's consumption values. The acceptance criteria of maintaining a visible level in the sight glass ensures adequate inventory for 7 days of full load operation without the level reaching the manufacturer's recommended minimum level.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.3.3

The tests listed below are a means of determining whether new fuel oil is of the appropriate grade and has not been contaminated with substances that would have an immediate detrimental impact on diesel engine combustion. If results from these tests are within acceptable limits, the fuel oil may be added to the storage tanks without concern for contaminating the entire volume of fuel oil in the storage tanks. These tests are to be conducted prior to adding the new fuel to the storage tank(s), but in no case is the time between receipt of new fuel and conducting the tests to exceed 31 days. The tests, limits, and applicable ASTM Standards are as follows:

- a. Sample the new fuel oil following the guidelines of ASTM D4057 (Ref. 7);
- b. Verify, following the guidelines of the tests specified in ASTM D975 (Ref. 7), that the sample has:
 - a Density at 15°C of ≥ 0.835 kg/L and ≤ 0.876 kg/L per ASTM D1298 (Ref. 7) or an API Gravity of ≥ 30 and ≤ 38 per ASTM D287 (Ref. 7)
 - a Kinematic Viscosity at 40°C of ≥ 1.9 centistokes and ≤ 4.1 centistokes
 - A Flash Point of $\geq 52^\circ\text{C}$

(continued)

BASES

SURVEILLANCE
REQUIREMENT

SR 3.8.3.3 (continued)

- c. Verify that the new fuel oil has a clear and bright appearance when tested following the guidelines of ASTM D4176 procedure (Ref. 7), or has $\leq 0.05\%$ (vol) water and sediment when tested following the guidelines of ASTM D1796 or ASTM D2709 (Ref. 7). Note that if dye is used in the diesel fuel oil, the water and sediment test must be performed.

Failure to meet any of the limits for key properties of new fuel oil prior to addition to the storage tank is cause for rejecting the new fuel oil, but does not represent a failure to meet the LCO concern since the fuel oil is not added to the storage tanks.

Within 31 days following the initial new fuel oil sample, the fuel oil is analyzed to establish that the other properties specified in Specification 5.5.9 and Reference 7 are met for new fuel oil when tested following the guidelines of ASTM D975 (Ref. 7). The 31 day period is acceptable because the fuel oil properties of interest, even if they were not within stated limits, would not have an immediate effect on DG operation. This Surveillance ensures the availability of high quality fuel oil for the DGs.

Fuel oil degradation during long term storage shows up as an increase in particulate, mostly due to oxidation. The presence of particulate does not mean that the fuel oil will not burn properly in a diesel engine. The particulate can cause fouling of filters and fuel oil injection equipment, however, which can cause engine failure.

Particulate concentrations should be determined following the guidelines of ASTM D6217 (Ref. 7). This method involves a filtration determination of total particulate concentration in the fuel oil. This limit is 10 mg/l. It is acceptable to obtain a field-sample for subsequent laboratory testing in lieu of field testing. The Frequency of this test takes into consideration fuel oil degradation trends that indicate that particulate concentration is unlikely to change significantly between Frequency intervals.

SR 3.8.3.4

This Surveillance ensures that, without the aid of the refill compressor, sufficient air start capacity for each DG is available. The system design requirements provide for a minimum of five engine start cycles without recharging.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.3.4 (continued)

The pressure specified in this SR is intended to reflect the lowest value at which the five starts can be accomplished. The air starting system capacity for each start cycle is calculated based on the following:

1. each cranking cycle duration should be approximately three seconds, or
2. consist of two to three engine revolutions, or
3. air start requirements per engine start provided by the engine manufacturer,

whichever air start requirement is larger.

The Surveillance is modified by a Note which does not require the SR to be met when the associated DG is running. This is acceptable because once the DG is started, the safety function of the air start system is performed.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.3.5

Microbiological fouling is a major cause of fuel oil degradation. There are numerous bacteria that can grow in fuel oil and cause fouling, but all must have a water environment in order to survive. Periodic removal of water from the fuel storage tanks eliminates the necessary environment for bacterial survival. This is the most effective means of controlling microbiological fouling. In addition, it eliminates the potential for water entrainment in the fuel oil during DG operation. Water may come from any of several sources, including condensation, ground water, rain water, contaminated fuel oil, and from breakdown of the fuel oil by bacteria. Frequent checking for and removal of accumulated water minimizes fouling and

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.3.5 (continued)

provides data regarding the watertight integrity of the fuel oil system. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. FSAR, Section 9.5.4.
 2. Regulatory Guide 1.137.
 3. ANSI N195, 1976.
 4. FSAR, Chapter 6.
 5. FSAR, Chapter 15.
 6. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 39132).
 7. ASTM Standard: D4057; D975; D4176; D1796; D1298; D287; D2709; and D6217.
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