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TSB1 - TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

REMOVE MANUAL TABLE OF CONTENTS    DATE: 07/19/2019

ADD        MANUAL TABLE OF CONTENTS    DATE: 08/07/2019

CATEGORY: DOCUMENTS    TYPE: TSB1

*ADD  
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ID: TEXT 3.8.3

ADD: REV: 7

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# SS&S MANUAL

Manual Name: TSB1

Manual Title: TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

## Table Of Contents

Issue Date: 08/07/2019

| <u>Procedure Name</u>  | <u>Rev</u> | <u>Issue Date</u> | <u>Change ID</u> | <u>Change Number</u> |
|--|------------|-------------------|------------------|----------------------|
| TEXT LOES<br>Title: LIST OF EFFECTIVE SECTIONS                                   | 134        | 01/03/2019        |                  |                      |
| TEXT TOC<br>Title: TABLE OF CONTENTS   | 25         | 03/05/2019        |                  |                      |
| TEXT 2.1.1<br>Title: SAFETY LIMITS (SLS) REACTOR CORE SLS                        | 6          | 01/22/2015        |                  |                      |
| TEXT 2.1.2<br>Title: SAFETY LIMITS (SLS) REACTOR COOLANT SYSTEM (RCS) PRESSURE S | 1          | 10/04/2007        |                  |                      |
| TEXT 3.0<br>Title: LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY          | 4          | 01/03/2019        |                  |                      |
| TEXT 3.1.1<br>Title: REACTIVITY CONTROL SYSTEMS SHUTDOWN MARGIN (SDM)            | 1          | 04/18/2006        |                  |                      |
| TEXT 3.1.2<br>Title: REACTIVITY CONTROL SYSTEMS REACTIVITY ANOMALIES             | 0          | 11/15/2002        |                  |                      |
| TEXT 3.1.3<br>Title: REACTIVITY CONTROL SYSTEMS CONTROL ROD OPERABILITY          | 3          | 11/16/2016        |                  |                      |
| TEXT 3.1.4<br>Title: REACTIVITY CONTROL SYSTEMS CONTROL ROD SCRAM TIMES          | 5          | 11/16/2016        |                  |                      |
| TEXT 3.1.5<br>Title: REACTIVITY CONTROL SYSTEMS CONTROL ROD SCRAM ACCUMULATORS   | 2          | 11/16/2016        |                  |                      |
| TEXT 3.1.6<br>Title: REACTIVITY CONTROL SYSTEMS ROD PATTERN CONTROL              | 4          | 11/16/2016        |                  |                      |

# 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 4 01/23/2018  
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

## SSES 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 5 03/05/2019  
Title: INSTRUMENTATION EMERGENCY CORE COOLING SYSTEM (ECCS) INSTRUMENTATION

TEXT 3.3.5.2 2 03/05/2019  
Title: REACTOR PRESSURE VESSEL (RPV) WATER INVENTORY CONTROL INSTRUMENTATION

TEXT 3.3.5.3 0 03/05/2019  
Title: INSTRUMENTATION REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM INSTRUMENTATION  
\*\*PREVIOUSLY TEXT 3.3.5.2 REV 1\*\*

TEXT 3.3.6.1 9 03/05/2019  
Title: INSTRUMENTATION PRIMARY CONTAINMENT ISOLATION INSTRUMENTATION

TEXT 3.3.6.2 6 03/05/2019  
Title: INSTRUMENTATION SECONDARY CONTAINMENT ISOLATION INSTRUMENTATION

TEXT 3.3.7.1 4 03/05/2019  
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

# SSES MANUAL

**Manual Name:** TSB1

**Manual Title:** TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

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

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 6 05/14/2019  
**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 6 03/05/2019  
**Title:** EMERGENCY CORE COOLING SYSTEMS (ECCS) REACTOR PRESSURE VESSEL (RPV) WATER  
INVENTORY CONTROL AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM ECCS  
OPERATING

TEXT 3.5.2 3 03/05/2019  
**Title:** EMERGENCY CORE COOLING SYSTEMS (ECCS) REACTOR PRESSURE VESSEL (RPV) WATER  
INVENTORY CONTROL AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM ECCS  
OPERATING

TEXT 3.5.3 6 03/05/2019  
**Title:** EMERGENCY CORE COOLING SYSTEMS (ECCS) REACTOR PRESSURE VESSEL (RPV) WATER  
INVENTORY CONTROL AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM ECCS  
OPERATING

# SSFS MANUAL

Manual Name: TSB1

Manual Title: TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

|              |    |            |   |
|--------------|----|------------|---|
| 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                         |
| TEXT 3.6.1.3 | 15 | 03/05/2019 | 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 | 2  | 03/05/2019 | 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                              |

## SSES MANUAL

**Manual Name:** TSB1

**Manual Title:** TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

TEXT 3.6.3.3 3 09/29/2017  
**Title:** CONTAINMENT SYSTEMS PRIMARY CONTAINMENT OXYGEN CONCENTRATION

TEXT 3.6.4.1 15 03/05/2019  
**Title:** CONTAINMENT SYSTEMS SECONDARY CONTAINMENT

TEXT 3.6.4.2 14 03/05/2019  
**Title:** CONTAINMENT SYSTEMS SECONDARY CONTAINMENT ISOLATION VALVES (SCIVS)

TEXT 3.6.4.3 7 03/05/2019  
**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 4 03/05/2019  
**Title:** PLANT SYSTEMS CONTROL ROOM EMERGENCY OUTSIDE AIR SUPPLY (CREOAS) SYSTEM

TEXT 3.7.4 2 03/05/2019  
**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





## SSES MANUAL

Manual Name: TSB1

Manual Title: TECHNICAL SPECIFICATION BASES UNIT 1 MANUAL

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

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 2 03/05/2019  
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

## B 3.8 ELECTRICAL POWER SYSTEMS

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

#### BASES

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##### 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)

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BASES

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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).

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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.

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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, and starting air are required to be within limits when the associated DG is required to be OPERABLE.

(continued)

BASES

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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. The fuel oil level equivalent to a 6 day supply is 41,018 gallons for DG A-D and 52,340 gallons for DG E. 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.

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.

(continued)

BASES

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ACTIONS  
(continued)

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.

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.

(continued)

BASES

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ACTIONS  
(continued)

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.

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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 fuel oil level equivalent to a 7 day supply is 47,570 gallons for DG A-D and 60,480 gallons for DG E when calculated in accordance with References 2 and 3. The required fuel storage volume is determined using the most limiting energy content of the stored fuel. Using the known correlation of diesel fuel oil absolute specific gravity or API gravity to energy content, the required diesel generator output, and their corresponding fuel consumption rate, the onsite fuel storage volume required for 7 days of operation can be determined. SR 3.8.3.3 requires new fuel to be tested to verify that the density or API gravity is within the range assumed in the diesel fuel oil consumption calculations. 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.

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.

(continued)

BASES

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SURVEILLANCE  
REQUIREMENTS  
(continued)

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  $\geq 0.835$  kg/L and  $\leq 0.876$  kg/L per ASTM D1298 (Ref. 7) or an API Gravity of  $\geq 30$  and  $\leq 38$  per ASTM D287 (Ref. 7)
  - a Kinematic Viscosity at 40°C of  $\geq 1.9$  centistokes and  $\leq 4.1$  centistokes
  - A Flash Point of  $\geq 52^\circ\text{C}$
- 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.

(continued)



BASES

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SURVEILLANCE  
REQUIREMENT  
(continued)

SR 3.8.3.3 (continued)

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

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SURVEILLANCE  
REQUIREMENTS  
(continued)

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

(continued)

BASES

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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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