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ONS-2016-071

August 4, 2016

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Subject: Duke Energy Carolinas, LLC
Oconee Nuclear Station
Docket Numbers 50-269, 50-270, and 50-287
Technical Specification (TS) Bases Change

The attached change to the Oconee Nuclear Station (ONS) TS Bases was processed in accordance with the provisions of Technical Specification 5.5.15, "Technical Specifications (TS) Bases Control Program."

TS Bases 3.8.1, AC Sources - Operating, was revised to reflect the changes approved by Amendment Nos. 400, 402, and 401, which corrected a usage problem identified within the TS subsequent to the issuance of a previous license amendment that precludes TS 3.8.1, Condition H, from being used as planned. TS Bases 3.3.1, Reactor Protective System, and TS Bases 3.4.4, Reactor Coolant System Loops - MODES 1 and 2, were revised to reflect the changes approved by Amendment Nos. 397, 399, and 398, which added a Reactor Protective System (RPS) Nuclear Overpower - High Setpoint Trip for three (3) reactor coolant pump (RCP) operation to TS Table 3.3.1-1.

Any questions regarding this information should be directed to Boyd Shingleton, ONS Regulatory Affairs, at (864) 873-4716.

Sincerely,

Scott L. Batson
Vice President
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Attachment

ADD
NRR

U. S. Nuclear Regulatory Commission
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Attachment

TSB List of Effective Pages (LOEPs), Rev. 010	LOEP 1 - 4
TSB B 3.3.1 - RPS Instrumentation, Rev. 002	3.3.1 1 -27
TSB B 3.4.4 - RCS Loops - MODES 1 and 2, Rev. 001	3.4.4 1-4
TSB B 3.8.1 - AC Sources - Operating, Rev. 001	3.8.1 1-26

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Note: With the introduction of Fusion in June 2015, all controlled documents require a three-digit revision number. Thus, the revision numbers were set to "000" in the summer of 2015. As such, the revision dates for Revision 000 are based on the implementation dates for revisions in effect prior to this change.

B 3.3 INSTRUMENTATION

B 3.3.1 Reactor Protective System (RPS) Instrumentation

BASES

BACKGROUND

The RPS initiates a reactor trip to protect against violating the core fuel design limits and the Reactor Coolant System (RCS) pressure boundary during anticipated transients. By tripping the reactor, the RPS also assists the Engineered Safeguards (ES) Systems in mitigating accidents.

The protective and monitoring systems have been designed to assure safe operation of the reactor. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RPS, as well as the LCOs on other reactor system parameters and equipment performance.

The LSSS, defined in this Specification as the Allowable Value, in conjunction with the LCOs, establishes the threshold for protective system action to prevent exceeding acceptable limits during accidents or transients.

During anticipated transients, which are those events expected to occur one or more times during the unit's life, the acceptable limit is:

- a. The departure from nucleate boiling ratio (DNBR) shall be maintained above the Safety Limit (SL) value;
- b. Fuel centerline melt shall not occur; and
- c. The RCS pressure SL of 2750 psia shall not be exceeded.

Maintaining the parameters within the above values ensures that the offsite dose will be within the 10 CFR 20 and 10 CFR 50.67 criteria during anticipated transients. Accidents are events that are analyzed even though they are not expected to occur during the unit's life. The acceptable limit during accidents is that the offsite dose shall be maintained within reference 10 CFR 50.67 limits. Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event.

BASES

BACKGROUND
(continued)

RPS Overview

The RPS consists of four separate redundant protective channels that receive inputs of neutron flux, RCS pressure, RCS flow, RCS temperature, RCS pump status, reactor building (RB) pressure, main feedwater (MFW) pump turbines status, and main turbine status.

Figure 7.1 of UFSAR, Chapter 7 (Ref. 1), shows the arrangement of a typical RPS protective channel. A protective channel is composed of measurement channels, a manual trip channel, a reactor trip component (RTC), and a control rod drive (CRD) trip device. LCO 3.3.1 provides requirements for the individual measurement channels. These channels encompass all equipment and electronics from the point at which the measured parameter is sensed through the processor output trip devices in the trip string. LCO 3.3.2, "Reactor Protective System (RPS) Manual Reactor Trip," LCO 3.3.3, "Reactor Protective System (RPS) – Reactor Trip Component (RTC)," and LCO 3.3.4, "Control Rod Drive (CRD) Trip Devices," discuss the remaining RPS elements.

The RPS instrumentation measures critical unit parameters and compares these to predetermined setpoints.

If the setpoint for a parameter input to a single channel (for example, the RC high pressure input to Channel A) is exceeded, a channel trip does not occur. Due to the inter-channel communication, all 4 RPS channels recognize that this parameter input has been exceeded for one channel. However, due to the 2.MIN/2.MAX logic within the system, the same parameter input setpoint for one of the other three channels must be exceeded before channel trips occur. Again, due to the inter-channel communication, all 4 RPS channels will then trip since the 2.MIN/2.MAX condition has been satisfied.

The RTS consists of four AC Trip Breakers arranged in two parallel combinations of two breakers each. Each path provides independent power to the CRD motors. Either path can provide sufficient power to operate all CRD's. Two separate power paths to the CRD's ensure that a single failure that opens one path will not cause an unwanted reactor trip.

The RPS consists of four independent protective channels (A, B, C, and D). Each RPS protective channel contains the sensor input modules, a protective channel computer, output modules, four hardwired (energized during power operations) reactor trip relays (RTRs) (A, B, C, and D) and their associated 120 VAC contacts (closed when RTR is energized).

BASES

BACKGROUND RPS Overview (continued)

Protective channel A controls the channel A RTR and also controls the A RTR in channels B, C, and D. Likewise, channels B, C and D control the respective RTR in each of the four channels. Each energized RTR (A, B, C, and D) in each RPS channel A, B, C, and D maintains two closed 120 VAC contacts. One contact from each RTR is configured in two separate redundant output trip actuation logic schemes. Each output trip actuation logic scheme contains a contact from each of the four RTRs in the four channels. This configuration results in a two-out-of-four coincidence reactor trip logic. If any channel protective set initiates a trip signal, the respective four RTRs (one in each of the four channels) de-energize and open the respective contacts. The outputs from the RTR contacts interrupt the 120 VAC power to the CRD trip devices.

Three of the four RPS protective channel computers (A, B, and C) also perform a redundant Engineered Safeguards Protective System (ESPS) logic function. Therefore, three of the four RPS protective channels calculate both RPS and ESPS functions, and the fourth RPS channel D calculates only RPS functions. See Technical Specification Bases section B 3.3.5 for additional discussion of the ESPS protective channels and the duplicated ESPS functions performed by the RPS protective channels.

The reactor is tripped by opening the reactor trip breakers.

There are three bypasses: shutdown bypass, manual bypass, and channel trip function bypass. The shutdown bypass and the manual bypass are initiated by use of a keyswitch located in the respective RPS channel cabinet. The Shutdown bypass allows the withdrawal of safety rods for SDM availability and rapid negative reactivity insertion during unit cooldowns or heatups. The manual bypass allows putting a complete RPS channel into bypass for maintenance activities. This includes the planned power-down of the bypassed RPS channel computer. If the complete RPS channel is powered down, the manual bypass condition cannot be maintained. That RPS channel output signal goes to "trip" and the manual bypass Unit Statalarm window will not illuminate. The channel trip function bypass allows an individual channel trip function in any RPS channel to be bypassed through the use of the RPS screens of the Graphical Service Monitor (GSM). The GSM is located on the Service Unit.

The RPS operates from the instrumentation channels discussed next. The specific relationship between measurement channels and protective channels differs from parameter to parameter. Three basic configurations are used:

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BACKGROUND

RPS Overview (continued)

- a. Four completely redundant measurements (e.g., reactor coolant flow) with one channel input to each protective channel;
- b. Four channels that provide similar, but not identical, measurements (e.g., power range nuclear instrumentation where each RPS channel monitors a different quadrant), with one channel input to each protective channel; and
- c. Redundant measurements with combinational trip logic inside the protective channels and the combined output provided to each protective channel (e.g., main feedwater pump turbines trip instrumentation).

These arrangements and the relationship of instrumentation channels to trip Functions are discussed next to assist in understanding the overall effect of instrumentation channel failure.

Power Range Nuclear Instrumentation

Power Range Nuclear Instrumentation channels provide inputs to the following trip Functions:

1. Nuclear Overpower
 - a. Nuclear Overpower – High Setpoint;
 - b. Nuclear Overpower – Low Setpoint;
7. Reactor Coolant Pump to Power;
8. Nuclear Overpower Flux/Flow Imbalance;
9. Main Turbine Trip (Hydraulic Fluid Pressure); and
10. Loss of Main Feedwater (LOMFW) Pump Turbines (Hydraulic Oil Pressure).

BASES

BACKGROUND

Power Range Nuclear Instrumentation (continued)

The power range instrumentation has four linear level channels, one for each core quadrant. Each channel feeds one RPS protective channel. Each channel originates in a detector assembly containing two uncompensated ion chambers. The ion chambers are positioned to represent the top half and bottom half of the core. The individual currents from the chambers are fed to individual linear amplifiers. The summation of the top and bottom is the total reactor power. The difference of the top minus the bottom neutron signal is the measured AXIAL POWER IMBALANCE for the associated core quadrant.

Reactor Coolant System Outlet Temperature

The Reactor Coolant System Outlet Temperature provides input to the following Functions:

2. RCS High Outlet Temperature; and
5. RCS Variable Low Pressure.

The RCS Outlet Temperature is measured by two resistance temperature detection elements in each hot leg, for a total of four. One temperature detection element is associated with each protective channel.

Reactor Coolant System Pressure

The Reactor Coolant System Pressure provides input to the following Functions:

3. RCS High Pressure;
4. RCS Low Pressure;
5. RCS Variable Low Pressure; and
11. Shutdown Bypass RCS High Pressure.

The RPS inputs of reactor coolant pressure are provided by two pressure transmitters in each hot leg, for a total of four. One sensor is associated with each protective channel.

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BACKGROUND
(continued)

Reactor Building Pressure

The Reactor Building Pressure measurements provide input only to the Reactor Building High Pressure trip, Function 6. There are four RB High Pressure sensors, one associated with each protective channel.

Reactor Coolant Pump Power Monitoring

Reactor coolant pump power monitors are inputs to the Reactor Coolant Pump to Power trip, Function 7. Each RCP has a RCP Power Monitor (RCPPM), which monitors the electrical power and breaker status of each pump motor to determine if it is running. Each RCPPM provides inputs to all four RPS channels.

Reactor Coolant System Flow

The Reactor Coolant System Flow measurements are an input to the Nuclear Overpower Flux/Flow Imbalance trip, Function 8. The reactor coolant flow inputs to the RPS are provided by eight high accuracy differential pressure transmitters, four on each loop, which measure flow through calibrated flow tubes. One flow input in each loop is associated with each protective channel.

Main Turbine Hydraulic Fluid Pressure

Main Turbine Hydraulic Fluid Pressure is an input to the Main Turbine Trip (Hydraulic Fluid Pressure) reactor trip, Function 9. Each of the four protective channels receives turbine status information from one of the four pressure switches monitoring main turbine hydraulic fluid pressure. Each protective channel continuously monitors the status of the contact inputs and initiates an RPS trip when a main turbine trip is indicated.

Feedwater Pump Turbine Hydraulic Oil Pressure

Feedwater Pump Turbine Hydraulic Oil Pressure is an input to the Loss of Main Feedwater Pumps (Hydraulic Oil Pressure) trip, Function 10. Hydraulic Oil pressure is measured by four switches on each feedwater pump turbine. One switch on each pump turbine is associated with each protective channel.

BASES

BACKGROUND

Feedwater Pump Turbine Hydraulic Oil Pressure (continued)

Each RPS channel receives a contact input from both Feedwater Pump Turbines (A and B) Hydraulic Oil Pressure switches. When the switches from both turbines indicate that the associated Turbine Hydraulic Oil Pressure is low (turbine has tripped), a reactor trip signal is initiated on that channel.

RPS Bypasses

The RPS is designed with three types of bypasses: shutdown bypass, manual bypass and channel trip function bypass.

Each bypass is discussed next.

Shutdown Bypass

During unit cooldown and heatup, it is desirable to leave the safety rods at least partially withdrawn to provide shutdown capabilities in the event of unusual positive reactivity additions (moderator dilution, etc.).

However, the unit is also depressurized as coolant temperature is decreased. If the safety rods are withdrawn and coolant pressure is decreased, an RCS Low Pressure trip will occur at 1800 psig and the rods will fall into the core. To avoid this, the protective system allows the operator to bypass the low pressure trip and maintain shutdown capabilities. During the cooldown and depressurization, the safety rods are inserted prior to the low pressure trip of 1800 psig. The RCS pressure is decreased to less than 1720 psig, then each RPS channel is placed in shutdown bypass.

A shutdown bypass signal is provided by the operator from the shutdown bypass keyswitch (status shall be indicated by a light). This action bypasses the RCS Low Pressure trip, Nuclear Overpower Flux/Flow Imbalance trip, Reactor Coolant Pump to Power trip, and the RCS Variable Low Pressure trip, and inserts a new RCS High Pressure, 1720 psig trip. The operator can now withdraw the safety rods for additional rapidly insertable negative reactivity.

The insertion of the new high pressure trip performs two functions. First, with a trip setpoint of 1720 psig, the processor output trip device prevents operation at normal system pressure, 2155 psig, with a portion of the RPS bypassed. The second function is to ensure that the bypass is removed prior to normal operation. When the RCS pressure is increased during a

BASES

BACKGROUND

Shutdown Bypass (continued)

unit heatup, the safety rods are inserted prior to reaching 1720 psig. The shutdown bypass is removed, which returns the RPS to normal, and system pressure is increased to greater than 1800 psig. The safety rods are then withdrawn and remain at the full out condition for the rest of the heatup.

In addition to the Shutdown Bypass RCS High Pressure trip, the High Flux Reactor Trip setpoint is automatically lowered to less than 5% when the operator closes the shutdown bypass keyswitch. This provides a backup to the Shutdown Bypass RCS High Pressure trip and allows testing while preventing the generation of any significant amount of power.

Manual Bypass

The RPS Manual Bypass allows putting the complete RPS channel into bypass for maintenance activities. Placing the RPS channel in bypass does not power-down the computer. If it is necessary to power-down the computer for one channel, the Manual Bypass keyswitch is used to keep the four RTRs associated with the respective channel energized while the channel computer is powered down. To place a protective channel in manual bypass, the other three channels must not be in manual bypass or otherwise inoperable (e.g., a channel trip function in bypass).

The RPS Manual Bypass status information is sent to the Unit Statalarm panel (hardwired output of the RPS Channel computer and in parallel as a hardwired signal from a keyswitch contact in case the computer is powered down) and is sent to the plant Operator Aid Computer (OAC) via a gateway.

If the complete RPS cabinet is powered down, the Manual Bypass condition cannot be maintained. That RPS channel output signal goes to "trip" and the Manual Bypass Unit Statalarm window will not illuminate.

Channel Trip Function Bypass

An individual Channel Trip Function Bypass allows placing one trip function in bypass for maintenance activities through the RPS GSM screens. This allows the remaining trip functions in the channel to remain operable while the channel input device for the affected channel is inoperable. Operation to put functions in bypass is administratively controlled since there is no interlock to prevent placing functions in multiple channels in bypass. Channel trip functions may be placed in bypass in only one RPS channel at a time.

BASES

BACKGROUND
(continued)

Parameter Change Enable Mode

Parameter Change Enable Mode allows each RPS instrument input channel processor to be placed in different operating modes through the use of the Parameter Change Enable keyswitches and commands from the Service Unit. Each protective channel has a keyswitch located in that channel's cabinet pair.

Placing RPS Channels A, B, or C in Parameter Change Enable Mode through the use of the "Parameter Change Enable" keyswitch will also place the corresponding ESPS Channels A1, B1 or C1 in Parameter Change Enable Mode.

When a keyswitch is placed from the normal Operating Mode position to the Parameter Change Enable Mode position:

- The processors continue with normal operation.
- A permissive is provided that allows the Service Unit to be used to change the operating mode of the processors associated with that keyswitch.

With the keyswitch in the Parameter Change Enable Position the following modes of operation are allowed for processors:

- Normal Operation – with permissive for operating mode change.
- Parameterization – allows changes to specific parameters (example placing a parameter into a tripped condition or performing Reactor Trip Relay testing).
- Function Test – for disabling the application function and forcing output signal for testing purposes (normally not used).
- Diagnostics – for downloading new application software.

The Function Test and Diagnostics modes result in the processor ceasing its cyclic processing of the application functions. Entry into these modes first requires entry into Parameterization mode and setting a separate parameter.

When a keyswitch is placed in the Parameter Change Enable Mode Position for any activity, the affected processor shall first be declared out of service. In addition to declaring the processor out of service (1) the affected RPS channel shall be bypassed and (2) either the affected ESPS input channel (A1, B1, or C1) shall be tripped OR the ESPS Set 1 voters shall be placed in Bypass for the following activities:

- Loading or revising the software in a processor.
- Changing parameters via the RPS High Flux Trip (Variable Setpoint) screen at the Service Unit.

BASES

BACKGROUND Parameter Change Enable Mode (continued)

- Changing parameters via the RPS Flux/Flow/Imbalance Parameters screen at the Service Unit.

Only one RPS channel at a time is allowed to be placed into Parameter Change Enable Mode Position for these activities.

Each Parameter Change Enable keyswitch status information is sent to the Statalarm panel and to the OAC via the Gateway.

RPS Parameter Change Enable keyswitches are administratively controlled (there are no hardware or software interlocks between channels).

Trip Setpoints/Allowable Value

The Allowable Value and trip setpoint are based on the analytical limits stated in UFSAR, Chapter 15 (Ref. 2). The selection of the Allowable Value and associated trip setpoint is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those RPS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 3), the Allowable Values specified in Table 3.3.1-1 in the accompanying LCO are conservative with respect to the analytical limits to account for all known uncertainties for each channel. The actual trip setpoint entered into the processor output trip device is more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL CALIBRATION. A channel is inoperable if its actual trip setpoint is not within its required Allowable Value. All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes. The trip setpoints are the nominal values at which the processor output trip devices are set. Any processor output trip device is considered to be properly adjusted when the "as left" value is within the band for CHANNEL CALIBRATION accuracy. A detailed description of the methodology used to determine the Allowable Value and associated uncertainties is provided in Reference 4.

Setpoints in conjunction with the Allowable Value ensure that the limits of Chapter 2.0, "Safety Limits," in the Technical Specifications are not violated during anticipated transients and that the consequences of accidents will be acceptable, providing the unit is operated from within the LCOs at the onset of the anticipated transient or accident and the equipment functions

BASES

BACKGROUND Trip Setpoints/Allowable Value (continued)

as designed. Note that in LCO 3.3.1 the Allowable Values listed in Table 3.3.1-1 for Functions 1 through 8 and 11 are the LSSS.

With the exception of the RB High Pressure function, each channel is tested online by manually retrieving the software setpoint to ensure it has been entered correctly. Signals into the system (from the field instrument or at the protective system cabinet) are applied during the channel calibration to ensure that the instrumentation is within the specified allowance requirements.

APPLICABLE
SAFETY ANALYSES,
LCO, and
APPLICABILITY

Each of the analyzed accidents and transients that require a reactor trip to meet the acceptance criteria can be detected by one or more RPS Functions. The accident analysis contained in the UFSAR, Chapter 15 (Ref. 2), takes credit for most RPS trip Functions. Functions not specifically credited in the accident analysis were qualitatively credited in the safety analysis and the NRC staff approved licensing basis for the unit. These Functions are high RB pressure, turbine trip, and loss of main feedwater. These Functions may provide protection for conditions that do not require dynamic transient analysis to demonstrate Function performance. These Functions also serve as backups to Functions that were credited in the safety analysis.

The LCO requires all instrumentation performing an RPS Function to be OPERABLE. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions. The three channels of each Function in Table 3.3.1-1 of the RPS instrumentation shall be OPERABLE during its specified Applicability to ensure that a reactor trip will be actuated if needed. Additionally, during shutdown bypass with any CRD trip breaker closed, the applicable RPS Functions must also be available. This ensures the capability to trip the withdrawn CONTROL RODS exists at all times that rod motion is possible. The trip Function channels specified in Table 3.3.1-1 are considered OPERABLE when all channel components necessary to provide a reactor trip are functional and in service for the required MODE or Other Specified Condition listed in Table 3.3.1-1.

Only the Allowable Values are specified for each RPS trip Function in the LCO. Nominal trip setpoints are specified in the setpoint calculations. The nominal setpoints are selected to ensure that the setpoint measured by CHANNEL CALIBRATIONS does not exceed the Allowable Value. A trip setpoint found less conservative than the nominal trip setpoint, but within its Allowable Value, is considered OPERABLE with respect to the uncertainty allowances assumed for the applicable surveillance interval provided that

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APPLICABLE
SAFETY ANALYSES,
LCO, and
APPLICABILITY
(continued)

operation, testing and subsequent calibration are consistent with the assumptions of the setpoint calculations. Each Allowable Value specified is more conservative than instrument uncertainties appropriate to the trip Function. These uncertainties are defined in Reference 4.

For most RPS Functions, the Allowable Value in conjunction with the nominal trip setpoint ensure that the departure from nucleate boiling (DNB), center line fuel melt, or RCS pressure SLs are not challenged. Cycle specific values for use during operation are contained in the COLR.

Certain RPS trips function to indirectly protect the SLs by detecting specific conditions that do not immediately challenge SLs but will eventually lead to challenge if no action is taken. These trips function to minimize the unit transients caused by the specific conditions. The Allowable Value for these Functions is selected at the minimum deviation from normal values that will indicate the condition, without risking spurious trips due to normal fluctuations in the measured parameter.

The safety analyses applicable to each RPS Function are discussed next.

1. Nuclear Overpower

a. Nuclear Overpower – High Setpoint

The Nuclear Overpower – High Setpoint trip provides protection for the design thermal overpower condition based on the measured out of core neutron leakage flux.

There is a setpoint for 4 and 3 RCP operation. The purpose of the 3 RCP trip is to provide protection for power excursion events initiated from 3 RCP operation, most notably the small steam line break.

The Nuclear Overpower – High Setpoint trip initiates a reactor trip when the neutron power reaches a predefined setpoint at the design overpower limit. Because THERMAL POWER lags the neutron power, tripping when the neutron power reaches the design overpower will limit THERMAL POWER to prevent exceeding acceptable fuel damage limits.

Thus, the Nuclear Overpower – High Setpoint trip protects against violation of the DNBR and fuel centerline melt SLs. However, the RCS Variable Low Pressure, and Nuclear Overpower Flux/Flow Imbalance, provide more direct protection. The role of the Nuclear Overpower – High Setpoint trip is to limit reactor THERMAL POWER below the highest

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a. Nuclear Overpower – High Setpoint (continued)

power at which the other two trips are known to provide protection.

The Nuclear Overpower – High Setpoint trip also provides transient protection for rapid positive reactivity excursions during power operations. These events include the rod withdrawal accident and the rod ejection accident. By providing a trip during these events, the Nuclear Overpower – High Setpoint trip protects the unit from excessive power levels and also serves to limit reactor power to prevent violation of the RCS pressure SL.

Rod withdrawal accident analyses cover a large spectrum of reactivity insertion rates (rod worths), which exhibit slow and rapid rates of power increases. At high reactivity insertion rates, the Nuclear Overpower – High Setpoint trip provides the primary protection. At low reactivity insertion rates, the high pressure trip provides primary protection.

b. Nuclear Overpower – Low Setpoint

When initiating shutdown bypass, the Nuclear Overpower – Low Setpoint trip must be reduced to $\leq 5\%$ RTP. The low power setpoint, in conjunction with the lower Shutdown Bypass RCS High Pressure setpoint, ensure that the unit is protected from excessive power conditions when other RPS trips are bypassed.

The setpoint Allowable Value was chosen to be as low as practical and still lie within the range of the out of core instrumentation.

2. RCS High Outlet Temperature

The RCS High Outlet Temperature trip, in conjunction with the RCS Low Pressure and RCS Variable Low Pressure trips, provides protection for the DNBR SL. A trip is initiated whenever the reactor vessel outlet temperature approaches the conditions necessary for DNB. Portions of each RCS High Outlet Temperature trip channel are common with the RCS Variable Low Pressure trip. The RCS High Outlet Temperature trip provides steady state protection for the DNBR SL.

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2. RCS High Outlet Temperature (continued)

The RCS High Outlet Temperature trip limits the maximum RCS temperature to below the highest value for which DNB protection by the Variable Low Pressure trip is ensured. The trip setpoint Allowable Value is selected to ensure that a trip occurs before hot leg temperatures reach the point beyond which the RCS Low Pressure and Variable Low Pressure trips are analyzed. Above the high temperature trip, the variable low pressure trip need not provide protection, because the unit would have tripped already. The setpoint Allowable Value does not reflect errors induced by harsh environmental conditions that the equipment is expected to experience because the trip is not required to mitigate accidents that create harsh conditions in the RB.

3. RCS High Pressure

The RCS High Pressure trip works in conjunction with the pressurizer and main steam relief valves to prevent RCS overpressurization, thereby protecting the RCS High Pressure SL.

The RCS High Pressure trip has been credited in the transient analysis calculations for slow positive reactivity insertion transients (rod withdrawal transients and moderator dilution). The rod withdrawal transient covers a large spectrum of reactivity insertion rates and rod worths that exhibit slow and rapid rates of power increases. At high reactivity insertion rates, the Nuclear Overpower – High Setpoint trip provides the primary protection. At low reactivity insertion rates, the RCS High Pressure trip provides the primary protection.

The setpoint Allowable Value is selected to ensure that the RCS High Pressure SL is not challenged during steady state operation or slow power increasing transients. The setpoint Allowable Value does not reflect errors induced by harsh environmental conditions because the equipment is not required to mitigate accidents that create harsh conditions in the RB.

4. RCS Low Pressure

The RCS Low Pressure trip, in conjunction with the RCS High Outlet Temperature and Variable Low Pressure trips, provides protection for the DNBR SL. A trip is initiated whenever the system pressure approaches the conditions necessary for DNB. The RCS Low Pressure trip provides DNB low pressure limit for the RCS Variable Low Pressure trip.

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4. RCS Low Pressure (continued)

The RCS Low Pressure setpoint Allowable Value is selected to ensure that a reactor trip occurs before RCS pressure is reduced below the lowest point at which the RCS Variable Low Pressure trip is analyzed. The RCS Low Pressure trip provides protection for primary system depressurization events and has been credited in the accident analysis calculations for small break loss of coolant accidents (LOCAs). Harsh RB conditions created by small break LOCAs cannot affect performance of the RCS pressure sensors and transmitters within the time frame for a reactor trip. Therefore, degraded environmental conditions are not considered in the Allowable Value determination.

5. RCS Variable Low Pressure

The RCS Variable Low Pressure trip, in conjunction with the RCS High Outlet Temperature and RCS Low Pressure trips, provides protection for the DNBR SL. A trip is initiated whenever the system parameters of pressure and temperature approach the conditions necessary for DNB. The RCS Variable Low Pressure trip provides a floating low pressure trip based on the RCS High Outlet Temperature within the range specified by the RCS High Outlet Temperature and RCS Low Pressure trips.

The RCS Variable Low Pressure setpoint Allowable Value is selected to ensure that a trip occurs when temperature and pressure approach the conditions necessary for DNB while operating in a temperature pressure region constrained by the low pressure and high temperature trips. The RCS Variable Low Pressure trip is assumed for transient protection in the main steam line break analysis. The setpoint allowable value does not include errors induced by the harsh environment, because the trip actuates prior to the harsh environment.

6. Reactor Building High Pressure

The Reactor Building High Pressure trip provides an early indication of a high energy line break (HELB) inside the RB. By detecting changes in the RB pressure, the RPS can provide a reactor trip before the other system parameters have varied significantly. Thus, this trip acts to minimize accident consequences. It also provides a backup for RPS trip instruments exposed to an RB HELB environment.

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6. Reactor Building High Pressure (continued)

The Allowable Value for RB High Pressure trip is set at the lowest value consistent with avoiding spurious trips during normal operation. The electronic components of the RB High Pressure trip are located in an area that is not exposed to high temperature steam environments during HELB transients inside containment. The components are exposed to high radiation conditions. Therefore, the determination of the setpoint Allowable Value accounts for errors induced by the high radiation.

7. Reactor Coolant Pump to Power

The Reactor Coolant Pump to Power trip provides protection for changes in the reactor coolant flow due to the loss of multiple RCPs. Because the flow reduction lags loss of power indications due to the inertia of the RCPs, the trip initiates protective action earlier than a trip based on a measured flow signal.

The Reactor Coolant Pump to Power trip has been credited in the accident analysis calculations for the loss of more than two RCPs.

The Allowable Value for the Reactor Coolant Pump to Power trip setpoint is selected to prevent normal power operation unless at least three RCPs are operating. Each reactor coolant pump has an RCPPM, which monitors the electrical power and breaker status of each pump motor to determine if the pump is running. Each RCPPM provides inputs to all four RPS channels. The RCPPM will initiate a reactor trip if fewer than three reactor coolant pumps are operating and reactor power is greater than approximately 2% rated full power.

8. Nuclear Overpower Flux/Flow Imbalance

The Nuclear Overpower Flux/Flow Imbalance trip provides steady state protection for the power imbalance SLs. A reactor trip is initiated prior to the core power, AXIAL POWER IMBALANCE, and reactor coolant flow conditions exceeding the DNB or fuel centerline temperature limits.

This trip supplements the protection provided by the Reactor Coolant Pump to Power trip, through the power to flow ratio, for loss of reactor coolant flow events. The power to flow ratio provides direct protection for the DNBR SL for the loss of one or more RCPs and for locked RCP rotor accidents.

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8. Nuclear Overpower Flux/Flow Imbalance (continued)

The power to flow ratio of the Nuclear Overpower Flux/Flow Imbalance trip also provides steady state protection to prevent reactor power from exceeding the allowable power when the primary system flow rate is less than full four pump flow. Thus, the power to flow ratio prevents overpower conditions similar to the Nuclear Overpower trip. This protection ensures that during reduced flow conditions the core power is maintained below that required to begin DNB.

The Allowable Value is selected to ensure that a trip occurs when the core power, axial power peaking, and reactor coolant flow conditions indicate an approach to DNB or fuel centerline temperature limits. By measuring reactor coolant flow and by tripping only when conditions approach an SL, the unit can operate with the loss of one pump from a four pump initial condition at power levels at least as low as approximately 80% RTP. The Allowable Value for the Function, including the upper limits of the Function are given in the unit COLR because the cycle specific core peaking changes affect the Allowable Value.

9. Main Turbine Trip (Hydraulic Fluid Pressure)

The Main Turbine Trip Function trips the reactor when the main turbine is lost at high power levels. The Main Turbine Trip Function provides an early reactor trip in anticipation of the loss of heat sink associated with a turbine trip. The Main Turbine Trip Function was added to the B&W designed units in accordance with NUREG-0737 (Ref. 5) following the Three Mile Island Unit 2 accident. The trip lowers the probability of an RCS power operated relief valve (PORV) actuation for turbine trip cases. This trip is activated at higher power levels, thereby limiting the range through which the Integrated Control System must provide an automatic runback on a turbine trip.

Each of the four turbine hydraulic fluid pressure switches feeds one protective channel that continuously monitors the status of the contacts.

For the Main Turbine Trip (Hydraulic Fluid Pressure), the Allowable Value of 800 psig is selected to provide a trip whenever main turbine hydraulic fluid pressure drops below the normal operating range. This trip is bypassed at power levels < 30% RTP for unit startup. The turbine trip is not required to protect against events that can create a harsh environment in the turbine building. Therefore, errors induced by harsh environments are not included in the determination of the setpoint Allowable Value.

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(continued)

10. Loss of Main Feedwater Pump Turbines (Hydraulic Oil Pressure)

The Loss of Main Feedwater Pump Turbines (Hydraulic Oil Pressure) trip provides a reactor trip at high power levels when both MFW pump turbines are lost. The trip provides an early reactor trip in anticipation of the loss of heat sink associated with the LOMF. This trip was added in accordance with NUREG-0737 (Ref. 5) following the Three Mile Island Unit 2 accident. This trip provides a reactor trip at high power levels for a LOMF to minimize challenges to the PORV.

For the feedwater pump turbine hydraulic oil pressure, the Allowable Value of 75 psig is selected to provide a trip whenever feedwater pump turbine hydraulic oil pressure drops below the normal operating range. This trip is bypassed at power levels < 2% RTP for unit startup. The Loss of Main Feedwater Pump Turbines (Hydraulic Oil Pressure) trip is not required to protect against events that can create a harsh environment in the turbine building. Therefore, errors caused by harsh environments are not included in the determination of the setpoint Allowable Value.

11. Shutdown Bypass RCS High Pressure

The RPS Shutdown Bypass RCS High Pressure is provided to allow for withdrawing the CONTROL RODS prior to reaching the normal RCS Low Pressure trip setpoint. The shutdown bypass provides trip protection during deboration and RCS heatup by allowing the operator to at least partially withdraw the safety groups of CONTROL RODS. This makes their negative reactivity available to terminate inadvertent reactivity excursions. Use of the shutdown bypass trip requires that the neutron power trip setpoint be reduced to 5% of full power or less. The Shutdown Bypass RCS High Pressure trip forces a reactor trip to occur whenever the unit switches from power operation to shutdown bypass or vice versa. This ensures that the CONTROL RODS are all inserted before power operation can begin. The operator is required to remove the shutdown bypass, reset the Nuclear Overpower – High Power trip setpoint, and again withdraw the safety group rods before proceeding with startup.

Accidents analyzed in the UFSAR, Chapter 15 (Ref. 2), do not describe events that occur during shutdown bypass operation, because the consequences of these events are enveloped by the events presented in the UFSAR.

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11. Shutdown Bypass RCS High Pressure (continued)

During shutdown bypass operation with the Shutdown Bypass RCS High Pressure trip active with a setpoint of ≤ 1720 psig and the Nuclear Overpower – Low Setpoint set at or below 5% RTP, the trips listed below can be bypassed. Under these conditions, the Shutdown Bypass RCS High Pressure trip and the Nuclear Overpower – Low Setpoint trip act to prevent unit conditions from reaching a point where actuation of these Functions is necessary.

- 1a. Nuclear Overpower – High Setpoint;
3. RCS High Pressure;
4. RCS Low Pressure;
5. RCS Variable Low Pressure;
7. Reactor Coolant Pump to Power; and
8. Nuclear Overpower Flux/Flow Imbalance.

The Shutdown Bypass RCS High Pressure Function's Allowable Value is selected to ensure a trip occurs before producing THERMAL POWER.

General Discussion

The RPS satisfies Criterion 3 of 10 CFR 50.36 (Ref. 7). In MODES 1 and 2, the following trips shall be OPERABLE because the reactor can be critical in these MODES. These trips are designed to take the reactor subcritical to maintain the SLs during anticipated transients and to assist the ESPS in providing acceptable consequences during accidents.

- 1a. Nuclear Overpower – High Setpoint;
2. RCS High Outlet Temperature;
3. RCS High Pressure;
4. RCS Low Pressure;
5. RCS Variable Low Pressure;
6. Reactor Building High Pressure;

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General Discussion (continued)

7. Reactor Coolant Pump to Power; and
8. Nuclear Overpower Flux/Flow Imbalance.

Functions 1a, 3, 4, 5, 7, and 8 just listed may be bypassed in MODE 2 when RCS pressure is below 1720 psig, provided the Shutdown Bypass RCS High Pressure and the Nuclear Overpower – Low setpoint trip are placed in operation. Under these conditions, the Shutdown Bypass RCS High Pressure trip and the Nuclear Overpower – Low setpoint trip act to prevent unit conditions from reaching a point where actuation of these Functions is necessary.

The Main Turbine Trip (Hydraulic Fluid Pressure) Function is required to be OPERABLE in MODE 1 at $\geq 30\%$ RTP. The Loss of Main Feedwater Pump Turbines (Hydraulic Oil Pressure) Function is required to be OPERABLE in MODE 1 and in MODE 2 at $\geq 2\%$ RTP. For operation below these power levels, these trips are not necessary to minimize challenges to the PORVs as required by NUREG-0737 (Ref. 5).

Because the safety function of the RPS is to trip the CONTROL RODS, the RPS is not required to be OPERABLE in MODE 3, 4, or 5 if either the reactor trip breakers are open, or the CRD System is incapable of rod withdrawal. Similarly, the RPS is not required to be OPERABLE in MODE 6 because the CONTROL RODS are normally decoupled from the CRDs.

However, in MODE 2, 3, 4, or 5, the Shutdown Bypass RCS High Pressure and Nuclear Overpower – Low setpoint trips are required to be OPERABLE if the CRD trip breakers are closed and the CRD System is capable of rod withdrawal. Under these conditions, the Shutdown Bypass RCS High Pressure and Nuclear Overpower – Low setpoint trips are sufficient to prevent an approach to conditions that could challenge SLs.

ACTIONS

Conditions A and B are applicable to all RPS protective Functions. If a channel's trip setpoint is found nonconservative with respect to the required Allowable Value in Table 3.3.1-1, or the transmitter, instrument loop, signal processing electronics or processor output trip device is found inoperable, the channel must be declared inoperable and Condition A entered immediately.

When an RPS channel is manually tripped, the functions that were inoperable prior to tripping remain inoperable. Other functions in the same channel that were OPERABLE prior to tripping remain OPERABLE.

BASES

ACTIONS
(continued)

A.1

For Required Action A.1, if one or more Functions in a required protective channel becomes inoperable, the affected protective channel must be placed in trip.

Placing the affected Function in trip places only the affected Function in each required channel in a one-out-of-two logic configuration. If the same function in another channel exceeds the setpoint, all channels will trip. In this configuration, the RPS can still perform its safety function in the presence of a random failure of any single Channel. The 4 hour Completion Time is justified based on the continuous monitoring and signal validation being performed and is sufficient time to place a Function in trip. If the individual Function cannot be placed in trip, the Operator can trip the affected channel with the use of the Manual Trip Keyswitch until such time that the Function can be placed in trip. This places all RPS Functions in a one-out-of-two logic configuration.

B.1

Required Action B.1 directs entry into the appropriate Condition referenced in Table 3.3.1-1. The applicable Condition referenced in the table is Function dependent. If the Required Action and the associated Completion Time of Condition A are not met or if more than two channels are inoperable, Condition B is entered to provide for transfer to the appropriate subsequent Condition.

C.1 and C.2

If the Required Action and associated Completion Time of Condition A are not met and Table 3.3.1-1 directs entry into Condition C, the unit must be brought to a MODE in which the specified RPS trip Functions are not required to be OPERABLE. The allowed Completion Time of 12 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and to open all CRD trip breakers without challenging unit systems.

D.1

If the Required Action and associated Completion Time of Condition A are not met and Table 3.3.1-1 directs entry into Condition D, the unit must be brought to a MODE in which the specified RPS trip Functions are not

BASES

ACTIONS

D.1 (continued)

required to be OPERABLE. To achieve this status, all CRD trip breakers must be opened. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to open CRD trip breakers without challenging unit systems.

E.1

If the Required Action and associated Completion Time of Condition A are not met and Table 3.3.1-1 directs entry into Condition E, the unit must be brought to a MODE in which the specified RPS trip Function is not required to be OPERABLE. To achieve this status, THERMAL POWER must be reduced < 30% RTP. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach 30% RTP from full power conditions in an orderly manner without challenging unit systems.

F.1

If the Required Action and associated Completion Time of Condition A are not met and Table 3.3.1-1 directs entry into Condition F, the unit must be brought to a MODE in which the specified RPS trip Function is not required to be OPERABLE. To achieve this status, THERMAL POWER must be reduced < 2% RTP. The allowed Completion Time of 12 hours is reasonable, based on operating experience, to reach 2% RTP from full power conditions in an orderly manner without challenging unit systems.

SURVEILLANCE
REQUIREMENTS

The SRs for each RPS Function are identified by the SRs column of Table 3.3.1-1 for that Function. Most Functions are subject to CHANNEL CHECK, CHANNEL FUNCTIONAL TEST, and CHANNEL CALIBRATION testing.

The SRs are modified by a Note. The Note directs the reader to Table 3.3.1-1 to determine the correct SRs to perform for each RPS Function.

SR 3.3.1.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred.

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SURVEILLANCE
REQUIREMENTS

SR 3.3.1.1 (continued)

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 two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. CHANNEL CHECK will detect gross channel failure; therefore, it is key in verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined based on a combination of the channel instrument uncertainties, including isolation, indication, and readability. If a channel is outside the criteria, it may be an indication that the transmitter or the signal processing equipment has drifted outside its limit. If the channels are within the criteria, it is an indication that the channels are OPERABLE. If the channels are normally off scale during times when surveillance is required, the CHANNEL CHECK will only verify that they are off scale in the same direction.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. The CHANNEL CHECK supplements less formal but more frequent checks of channel OPERABILITY during normal operational use of the displays associated with the LCO's required channels.

For Functions that trip on a combination of several measurements, such as the Nuclear Overpower Flux/Flow Imbalance Function, the CHANNEL CHECK must be performed on each input.

The CHANNEL CHECK requirement is met automatically. The digital RPS provides continuous online automatic monitoring of each of the input signals in each channel, performs signal online validation against required acceptance criteria, and provides hardware functional validation. If any protective channel input signal is identified to be in the failure status, this condition is alarmed on the Unit Statalarm and input to the plant OAC. Immediate notification of the failure status is provided to the Operations staff.

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.3.1.2

This SR is the performance of a heat balance calibration for the power range channels when reactor power is $> 15\%$ RTP. The heat balance calibration consists of a comparison of the results of the calorimetric with the power range channel output. The outputs of the power range channels are normalized to the calorimetric. If the calorimetric exceeds the Nuclear Instrumentation System (NIS) channel output by $\geq 2\%$ RTP, the NIS is not declared inoperable but must be adjusted. If the NIS channel cannot be properly adjusted, the channel is declared inoperable. A Note clarifies that this Surveillance is required to be performed only if reactor power is $\geq 15\%$ RTP and that 24 hours is allowed for performing the first Surveillance after reaching 15% RTP. At lower power levels, calorimetric data are less accurate.

The power range channel's output shall be adjusted consistent with the calorimetric results if the calorimetric exceeds the power range channel's output by $\geq 2\%$ RTP. The value of 2% is adequate because this value is assumed in the safety analyses of UFSAR, Chapter 15 (Ref. 2). These checks and, if necessary, the adjustment of the power range channels ensure that channel accuracy is maintained within the analyzed error margins. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.1.3

A comparison of power range nuclear instrumentation channels against incore detectors shall be performed when reactor power is $\geq 15\%$ RTP. A Note clarifies that 24 hours is allowed for performing the first Surveillance after reaching 15% RTP. If the absolute value of imbalance error is $\geq 2\%$ RTP, the power range channel is not inoperable, but an adjustment of the measured imbalance to agree with the incore measurements is necessary. The Imbalance error calculation is adjusted for conservatism by applying a correlation slope (CS) value to the error calculation formula. This ensures that the value of the API_o is $> API_i$. The CS value is listed in the COLR and is cycle dependent. If the power range channel cannot be properly recalibrated, the channel is declared inoperable. The calculation of the Allowable Value envelope assumes a difference in out of core to incore measurements of 2.0%. Additional inaccuracies beyond those that are measured are also included in the setpoint envelope calculation.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

**SURVEILLANCE
REQUIREMENTS**
(continued)

SR 3.3.1.4

This SR has been deleted.

SR 3.3.1.5

This SR manually retrieves the software setpoints and verifies they are correct. The proper functioning of the processor portion of the channel is continuously checked by an automatic cyclic self monitoring. Verification of field instrument setpoints is not required by this surveillance. This surveillance does not apply to the Reactor Building Pressure Function because it consists of pressure switches which provide a contact status to the system and there is no software setpoint to verify.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.1.6

This SR requires manual actuation of the output channel interposing relays to demonstrate OPERABILITY of the relays. The proper functioning of the processor portion of the channel is continuously checked by an automatic cyclic self monitoring.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.1.7

A Note to the Surveillance indicates that neutron detectors are excluded from CHANNEL CALIBRATION. This Note is necessary because of the difficulty in generating an appropriate detector input signal. Excluding the detectors is acceptable because the principles of detector operation ensure virtually instantaneous response.

A CHANNEL CALIBRATION is a complete check of the instrument channel, including the sensor. The test verifies that the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift to ensure that the instrument channel remains operational between successive tests. CHANNEL CALIBRATION shall find that

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.3.1.7 (continued)

measurement errors and processor output trip device setpoint errors are within the assumptions of the uncertainty analysis. Whenever a sensing element is replaced, the CHANNEL CALIBRATION of the resistance temperature detectors (RTD) sensors is accomplished by an in-place cross calibration that compares the other sensing elements with the recently installed sensing element.

Since the CHANNEL FUNCTIONAL TEST is a part of the CHANNEL CALIBRATION a separate SR is not required. The digital RPS software performs a continuous online automated cross channel check, separately for each channel, and continuous online signal error detection and validation. The protection system also performs continuous online hardware monitoring. The CHANNEL CALIBRATION essentially validates the self monitoring function and checks for a small set of failure modes that are undetectable by the self monitoring function.

The digital processors shall be rebooted as part of the calibration. This verifies that the software has not changed. Signals into the system (from the field instrument or at the protective system cabinet) are applied during the channel calibration to ensure that the instrumentation is within the specified allowance requirements. This, in combination with ensuring the setpoints are entered into the software correctly per SR 3.3.1.5, verifies the setpoints are within the Allowable Values.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

For Functions for which TSTF-493, "Clarify Application of Setpoint Methodology for LSSS Functions" (Reference 8) has been implemented, this SR is modified by two Notes as identified in Table 3.3.1-1. The first Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its as-found tolerance but conservative with respect to the Allowable Value. Evaluation of channel performance will verify that the channel will continue to behave in accordance with safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service. The performance of these channels will be evaluated under the station's Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition for continued OPERABILITY. The second Note requires that the as-left setting for the channel be returned to within the as-left tolerance of the Nominal Trip Setpoint (NTSP). Where a

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SR 3.3.1.7 (continued)

setpoint more conservative than the NTSP is used in the plant surveillance procedures, the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Safety Limit and/or Analytical Limit is maintained. If the as-left channel setting cannot be returned to a setting within the as-left tolerance of the NTSP, then the channel shall be declared inoperable. The second Note also requires that the NTSP and the methodologies for calculating the as-left and the as-found tolerances be in the Selected Licensee Commitments Manual.

REFERENCES

1. UFSAR, Chapter 7.
 2. UFSAR, Chapter 15.
 3. 10 CFR 50.49.
 4. EDM-102, "Instrument Setpoint/Uncertainty Calculations."
 5. NUREG-0737, "Clarification of TMI Action Plan Requirements," November 1979.
 6. BAW-10167, May 1986.
 7. 10 CFR 50.36.
 8. Technical Specification Task Force, Improved Standard Technical Specifications Change Traveler, TSTF 493, "Clarify Application of Setpoint Methodology for LSSS Functions," Revision 4.
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.4 RCS Loops – MODES 1 and 2

BASES

BACKGROUND

The primary function of the reactor coolant is removal of the heat generated in the fuel due to the fission process, and transfer of this heat, via the steam generators (SGs), to the secondary plant.

The secondary functions of the reactor coolant include:

- a. Moderating the neutron energy level to the thermal state, to increase the probability of fission;
- b. Improving the neutron economy by acting as a reflector;
- c. Carrying the soluble neutron poison, boric acid;
- d. Providing a second barrier against fission product release to the environment; and
- e. Removing the heat generated in the fuel due to fission product decay following a unit shutdown.

The RCS configuration for heat transport uses two RCS loops. Each RCS loop contains an SG and two reactor coolant pumps (RCPs). An RCP is located in each of the two SG cold legs. The pump flow rate has been sized to provide core heat removal with appropriate margin to departure from nucleate boiling (DNB) during power operation and for anticipated transients originating from power operation. This Specification requires two RCS loops with either three or four pumps to be in operation. With three pumps in operation the reactor power level is restricted to 75% RTP to preserve the core power to flow relationship, thus maintaining the margin to DNB. The intent of the specification is to require core heat removal with forced flow during power operation. Specifying the minimum number of pumps is an effective technique for designating the proper forced flow rate for heat transport, and specifying two loops provides for the needed amount of heat removal capability for the allowed power levels. Specifying two RCS loops also provides the minimum necessary paths (two SGs) for heat removal.

The Reactor Protection System (RPS) trip setpoint based on flux/flow/imbalance is automatically reduced when one pump is taken out of service; manual resetting is not necessary.

BASES (continued)

APPLICABLE SAFETY ANALYSES Safety analyses contain various assumptions for the accident analyses initial conditions including: RCS pressure, RCS temperature, reactor power level, core parameters, and safety system setpoints. The important aspect for this LCO is the reactor coolant forced flow rate, which is represented by the number of pumps in service.

Both transient and steady state analyses have been performed to establish the effect of flow on DNB. The transient or accident analysis for the plant has been performed assuming either three or four pumps are in operation.

The majority of the plant safety analysis is based on initial conditions at high core power or zero power. The analyses that are of most importance to RCP operation are the two pump coastdown, single pump locked rotor, and single pump broken shaft (Ref. 1).

Steady state DNB analysis has been performed for four, and three pump combinations. For four pump operation, the steady state DNB analysis, which generates the pressure and temperature protective limit (i.e., the departure from nucleate boiling ratio (DNBR) limit), assumes a maximum power level equal to the Nuclear Overpower – High Setpoint - 4 reactor coolant pumps running trip setpoint plus instrument uncertainty and conservatism. The DNBR limit defines a locus of pressure and temperature points that result in a minimum DNBR greater than or equal to the critical heat flux correlation limit.

The three pump pressure temperature limit is tied to the steady state DNB analysis, which is evaluated each cycle. The flow used is the minimum allowed for three pump operation. The actual RCS flow rate will exceed the assumed flow rate. With three pumps operating, overpower protection is automatically provided by the power to flow ratio of the RPS nuclear overpower trip setpoint based on flux/flow/imbalance and the Nuclear Overpower – High Setpoint – 3 reactor coolant pumps running once it has been reset by the operators. The maximum power level for three pump operation is 75% RTP and is based on the three pump flow as a fraction of the four pump flow at full power.

Continued power operation with two RCPs removed from service is not allowed by this Specification.

RCS Loops – MODES 1 and 2 satisfy Criterion 2 of 10 CFR 50.36 (Ref. 2).

LCO The purpose of this LCO is to require adequate forced flow for core heat removal. Flow is represented by the number of RCPs in operation in both RCS loops for removal of heat by the two SGs. To meet safety analysis acceptance criteria for DNB, four pumps are required at rated power; if only three pumps are available, power must be reduced as must the Nuclear Overpower – High Setpoint – 3 reactor coolant pumps.

BASES (continued)

APPLICABILITY In MODES 1 and 2, the reactor is critical and has the potential to produce maximum THERMAL POWER. To ensure that the assumptions of the accident analyses remain valid, all RCS loops are required to be OPERABLE and in operation in these MODES to prevent DNB and core damage.

The decay heat production rate is much lower than the full power heat rate. As such, the forced circulation flow and heat sink requirements are reduced for lower, noncritical MODES as indicated by the LCOs for MODES 3, 4, and 5.

Operation in other MODES is covered by:

- LCO 3.4.5, "RCS Loops – MODE 3";
 - LCO 3.4.6, "RCS Loops – MODE 4";
 - LCO 3.4.7, "RCS Loops – MODE 5, Loops Filled";
 - LCO 3.4.8, "RCS Loops – MODE 5, Loops Not Filled";
 - LCO 3.9.4, "Decay Heat Removal (DHR) and Coolant Circulation – High Water Level" (MODE 6); and
 - LCO 3.9.5, "Decay Heat Removal (DHR) and Coolant Circulation – Low Water Level" (MODE 6).
-

ACTIONS

A.1

If the requirements of LCO 3.4.4.b.2 are not met, the Required Action is to reset the Nuclear Overpower - High Setpoint to satisfy the requirements of LCO 3.4.4.b.2. This minimizes the possibility of violating DNB limits.

The Completion Time of 6 hours is reasonable, based on operating experience, to reset the RPS setpoints in an orderly manner and without challenging safety systems.

B.1

If the Required Action and associated Completion Time of Condition A is not met or the requirements of the LCO are not met, the Required Action is to reduce power and bring the unit to MODE 3. This lowers power level and thus reduces the core heat removal needs and minimizes the possibility of violating DNB limits.

The Completion Time of 12 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging safety systems.

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.4.4.1

This SR requires verification of the required number of loops in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal while maintaining the margin to DNB. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. UFSAR, Chapter 15.
 2. 10 CFR 50.36.
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.1 AC Sources – Operating

BASES

BACKGROUND

The AC Power System consists of the offsite power sources (preferred power) and the onsite standby power sources, Keowee Hydro Units (KHU). This system is designed to supply the required Engineered Safeguards (ES) loads of one unit and safe shutdown loads of the other two units and is so arranged that no single failure can disable enough loads to jeopardize plant safety. The design of the AC Power System provides independence and redundancy to ensure an available source of power to the ES systems (Ref. 1). The KHU turbine generators are powered through a common penstock by water taken from Lake Keowee. The use of a common penstock is justified on the basis of past hydro plant experience of the licensee (since 1919) which indicates that the cumulative need to dewater the penstock can be expected to be limited to about one day a year, principally for inspection, plus perhaps four days every tenth year.

The preferred power source is provided from offsite power to the red or yellow bus in the 230 kV switchyard to the units startup transformer and the E breakers. The 230 kV switchyard is electrically connected to the 525 kV switchyard via the autobank transformer. Emergency power is provided using two emergency power paths, an overhead path and an underground path. The underground emergency power path is from one KHU through the underground feeder circuit, transformer CT-4, the CT-4 incoming breakers (SK breakers), standby bus and the standby breakers (S breakers). The standby buses may also receive offsite power from the 100 kV transmission system through transformer CT-5 and the CT-5 incoming breakers (SL breakers). The overhead emergency power path is from the other KHU through the startup transformer and the startup incoming breakers (E breakers). In addition to supplying emergency power for Oconee, the KHUs provide peaking power to the generation system. During periods of commercial power generation, the KHUs are operated within the acceptable region of the KHU operating restrictions. This ensures that the KHUs are able to perform their emergency power functions from an initial condition of commercial power generation. The KHU operating restrictions for commercial power generation are contained in UFSAR Chapter 16, (Ref. 2). The standby buses can also

BASES

BACKGROUND
(continued)

receive power from a combustion turbine generator at the Lee Steam Station through a dedicated 100 kV transmission line, transformer CT-5, and both SL breakers. The 100 kV transmission line can be supplied from a Lee combustion turbine (LCT) and electrically separated from the system grid and offsite loads. The minimum capacity available from any of the multiple sources of AC power is 22.4MVA (limited by CT-4 and CT-5 transformer capacities).

APPLICABLE
SAFETY ANALYSIS

The initial conditions of design basis transient and accident analyses in the UFSAR Chapter 6 (Ref. 4) and Chapter 15 (Ref. 5) assume ES systems are OPERABLE. The AC power system is designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ES systems so that the fuel, reactor coolant system, and containment design limits are not exceeded.

Consistent with the accident analysis assumptions of a loss of offsite power (LOOP) and a single failure of one onsite emergency power path, two onsite emergency power sources are required to be OPERABLE.

AC Sources – Operating are part of the primary success path and function to mitigate an accident or transient that presents a challenge to the integrity of a fission product barrier. As such, AC Sources – Operating satisfies the requirements of Criterion 3 of 10 CFR 50.36 (Ref. 3).

LCO

Two sources on separate towers connected to the 230 kV switchyard to a unit startup transformer and one main feeder bus are required to be OPERABLE. Two KHUs with one capable of automatically providing power through the underground emergency power path to both main feeder buses and the other capable of automatically providing power through the overhead emergency power path to both main feeder buses are required to be OPERABLE. The Keowee Reservoir level is required to be ≥ 775 feet above sea level to support OPERABILITY of the KHUs. The zone overlap protection circuitry is required to be OPERABLE when the overhead electrical disconnects for the KHU associated with the underground power path are closed to provide single failure protection for the KHUs. The zone overlap protection circuitry includes the step-up transformer lockout, the underground KHU lockout, the Keowee emergency start signal, and the underground breaker for the overhead KHU to ensure the zone overlap protection circuitry logic is OPERABLE.

BASES

LCO
(continued)

Operable offsite sources are required to be "physically independent" (separate towers) prior to entering the 230 kV switchyard. Once the 230 kV lines enter the switchyard, an electrical pathway must exist through OPERABLE power circuit breakers (PCBs) and disconnects such that both sources are available to energize the Unit's startup transformer either automatically or with operator action. Once within the boundary of the switchyard, the electrical pathway may be the same for both independent offsite sources. In addition, at least one E breaker must be available to automatically supply power to a main feeder bus from the energized startup transformer. The voltage provided to the startup transformer by the two independent offsite sources must be sufficient to ensure ES equipment will operate. Two of the following offsite sources are required:

- 1) Jocassee (from Jocassee) Black or White,
- 2) Dacus (from North Greenville) Black or White,
- 3) Oconee (from Central) Black or White,
- 4) Calhoun (from Central) Black or White,
- 5) Autobank transformer fed from either the Asbury (from Newport), Norcross (from Georgia Power), or Katoma (from Jocassee) 525 kV line.

An OPERABLE KHU and its required emergency power path are required to be able to provide sufficient power within specified limits of voltage and frequency within 23 seconds after an emergency start initiate signal and includes its required emergency power path, required instrumentation, controls, auxiliary and DC power, cooling and seal water, lubrication and other auxiliary equipment necessary to perform its safety function. Two emergency power paths are available. One emergency power path consists of an underground circuit while the other emergency power pathway uses an overhead circuit through the 230 kV switchyard.

BASES

LCO
(continued)

An OPERABLE KHU and its required overhead emergency power path must be capable of automatically supplying power from the KHU through the KHU main step-up transformer, the 230 kV yellow bus, the Unit startup transformer and both E breakers to both main feeder buses. At least one channel of switchyard isolation (by actuation from degraded grid voltage protection) is required to be OPERABLE to isolate the 230 kV switchyard yellow bus. If closed, each N breaker must be capable of opening using either of its associated breaker trip circuits. KPF-9 (for KHU1) and KPF-10 (for KHU2) must remain open since there is no engineering analysis that ensures that the associated KHU can power both PSW and Engineered Safeguards (ES) system loads should an event occur (with the breaker closed). Either of the following combinations provides an acceptable KHU and required overhead emergency power path:

- | <u>Keowee Hydro Unit</u> | <u>Keowee Hydro Unit</u> |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| 1A) Keowee Unit 1 generator, | 1B) Keowee Unit 2 generator, |
| 2A) Keowee ACB 1 (enabled by one channel of Switchyard Isolate Complete), | 2B) Keowee ACB 2 (enabled by one channel of Switchyard Isolate Complete), |
| 3A) Keowee auxiliary transformer 1X, Keowee ACB 5, Keowee Load Center 1X, | 3B) Keowee auxiliary transformer 2X, Keowee ACB 6, Keowee Load Center 2X, |
| 4A) Keowee MCC 1XA, | 4B) Keowee MCC 2XA, |
| 5A) Keowee Battery #1, Charger #1 or Standby Charger, and Distribution Center 1DA, | 5B) Keowee Battery #2, Charger #2 or Standby Charger, and Distribution Center 2DA, |
| 6A) ACB-1 to ACB-3 interlock, | 6B) ACB-2 to ACB-4 interlock, |
| 7A) Keowee Unit 1 Voltage and Frequency out of tolerance (OOT) logic | 7B) Keowee Unit 2 Voltage and Frequency out of tolerance (OOT) logic |
| 8) Keowee reservoir level \geq 775 feet above sea level, | |
| 8A) KPF-9 is OPEN with closing spring discharged, | 8B) KPF-10 is OPEN with closing spring discharged, |

Overhead Emergency Power Path

- 9) Keowee main step-up transformer,
- 10) PCB 9 (enabled by one channel of Switchyard Isolate Complete),
- 11) The 230kV switchyard yellow bus capable of being isolated by one channel of Switchyard Isolate,
- 12) A unit startup transformer and associated yellow bus PCB (CT-1 / PCB 18, CT-2 / PCB 27, CT-3 / PCB 30),
- 13) Both E breakers.

BASES

LCO
(continued)

An OPERABLE KHU and its required underground emergency power path must be capable of automatically supplying power from the KHU through the underground feeder, transformer CT-4, both standby buses, and both Unit S breakers to both main feeder buses. If closed, each N breaker and each SL breaker must be capable of opening using either of its associated breaker trip circuits. KPF-9 (for KHU1) and KPF-10 (for KHU2) must remain open since there is no engineering analysis that ensures that the associated KHU can power both PSW and Engineered Safeguards (ES) system loads should an event occur (with the breaker closed). Either of the following combinations provides an acceptable KHU and required underground emergency power path:

- | <u>Keowee Hydro Unit</u> | <u>Keowee Hydro Unit</u> |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| 1A) Keowee Unit 1 generator, | 1B) Keowee Unit 2 generator, |
| 2A) Keowee ACB 3, | 2B) Keowee ACB 4, |
| 3A.1) Keowee auxiliary transformer CX, Keowee ACB 7, Keowee Load Center 1X, | 3B.1) Keowee auxiliary transformer CX, Keowee ACB 8, Keowee Load Center 2X, |
| 3A.2) One Oconee Unit 1 S breaker capable of feeding switchgear 1TC, | 3B.2) One Oconee Unit 1 S breaker capable of feeding switchgear 1TC, |
| 3A.3) Switchgear 1TC capable of feeding Keowee auxiliary transformer CX, | 3B.3) Switchgear 1TC capable of feeding Keowee auxiliary transformer CX, |
| 4A) Keowee MCC 1XA, | 4B) Keowee MCC 2XA, |
| 5A) Keowee Battery #1, Charger #1 or Standby Charger, and Distribution Center 1DA, | 5B) Keowee Battery #2, Charger #2 or Standby Charger, and Distribution Center 2DA, |
| 6A) ACB-1 to ACB-3 interlock, | 6B) ACB-2 to ACB-4 interlock, |
| 7A) Keowee Unit 1 Voltage and Frequency OOT logic | 7B) Keowee Unit 2 Voltage and Frequency OOT logic |
| 8) Keowee reservoir level \geq 775 feet above sea level, | |
| 8A) KPF-9 is OPEN with closing spring discharged, | 8B) KPF-10 is OPEN with closing spring discharged, |

Underground Emergency Power Path

- 9) The underground feeder,
- 10) Transformer CT-4,
- 11) Both SK breakers,
- 12) Both standby buses,
- 13) Both S breakers, and
- 14) ACB-3 to ACB-4 interlock.

BASES

LCO
(continued)

This LCO is modified by three Notes. Note 1 indicates that a unit startup transformer may be shared with a unit in MODES 5 and 6. Note 2 indicates that the requirements of Specification 5.5.18, "KHU Commercial Power Generation Testing Program," shall be met for commercial KHU power generation. Note 3 indicates that the requirements of Specification 5.5.19, "Lee Combustion Turbine Testing Program," shall be met when a Lee Combustion Turbine (LCT) is used to comply with Required Actions.

APPLICABILITY

The AC power sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure that:

- a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of accidents and transients, and
- b. Adequate core cooling is provided, and containment OPERABILITY and other vital functions are maintained in the event of a postulated accident.

AC source requirements during MODE 5 and 6 are covered in LCO 3.8.2, AC Sources-Shutdown.

ACTIONS

The ACTIONS are modified by a Note. The Note excludes the MODE change restriction of LCO 3.0.4 when both standby buses are energized from an LCT via an isolated power path to comply with Required Actions. This exception allow entry into an applicable MODE while relying on the ACTIONS even though the ACTIONS may eventually require a unit shutdown. This exception is acceptable due to the additional capabilities afforded when both standby buses are energized from an LCT via an isolated power path.

A.1, A.2, A.3.1, and A.3.2

In the event a startup transformer becomes inoperable, it effectively causes the emergency overhead power path and both of the offsite sources to be inoperable. A KHU and its required underground power path remain available to ensure safe shutdown of the unit in the event of a transient or accident without a single failure.

BASES

ACTIONS

A.1, A.2, A.3.1, and A.3.2 (continued)

Operation may continue provided the KHU and its required underground emergency power path are tested using SR 3.8.1.3 within one hour if not performed in the previous 12 hours. This Required Action provides assurance that no undetected failures have occurred in the KHU and its required underground emergency power path. Since Required Action A.1 only specifies "perform," a failure of SR 3.8.1.3 acceptance criteria does not result in a Required Action not met. However, if the KHU and its required underground emergency path fails SR 3.8.1.3, both emergency power paths and both required offsite circuits are inoperable, and Condition I for both KHUs and their required emergency power paths inoperable for reasons other than Condition G and H is entered concurrent with Condition A.

If available, another Unit's startup transformer should be aligned to supply power to the affected Unit's auxiliaries so that offsite power sources and the KHU and its required overhead emergency power path will also be available if needed. Although this alignment restores the availability of the offsite sources and the KHU and its required overhead emergency power path, the shared startup transformer's capacity and voltage adequacy could be challenged under certain DBA conditions. The shared alignment is acceptable because the preferred mode of Unit shutdown is with reactor coolant pumps providing forced circulation and due to the low likelihood of an event challenging the capacity of the shared transformer during a 72 hour period to bring a Unit to MODE 5. Required Action A.3.1 requires that the unit startup transformer be restored to OPERABLE status and normal startup bus alignment in 36 hours or Required Action 3.2 requires designating one unit sharing the startup transformer, to be shutdown. For example, if Unit 1 and 2 are operating and CT-2 becomes inoperable, Unit 2 may align CT-1 to be available to the Unit 2 main feeder buses and continue operating for up to 36 hours. At that time, if CT-2 has not been restored to OPERABLE status, one Unit must be "designated" to be shutdown. The designated Unit must be shut down per ACTION B. Note that with one Unit in MODES 1, 2, 3 or 4 and another Unit in a condition other than MODES 1, 2, 3, or 4, the units may share a startup transformer indefinitely provided that the loads on the unit not in MODES 1, 2, 3 or 4 are maintained within acceptable limits. For example, if Unit 1 is in MODE 5 and CT-2 becomes inoperable, Unit 2 may align CT-1 to the Unit 2 main feeder buses and continue operation indefinitely.

BASES

ACTIONS
(continued)

B.1 and B.2

When a unit is designated to be shutdown due to sharing a unit startup transformer per Required Action A.3.2, the unit must be brought to a MODE in which the LCO does not apply, since the shared unit startup transformer's capacity could be challenged under certain DBA conditions. To achieve this status, the unit must be brought to at least MODE 3 within 12 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

C.1, C.2.1, C.2.2.1, C.2.2.2, C.2.2.3, C.2.2.4, and C.2.2.5

With the KHU or its required overhead emergency power path inoperable due to reasons other than an inoperable startup transformer (Condition A), sufficient AC power sources remain available to ensure safe shutdown of the unit in the event of a transient or accident. Operation may continue if the OPERABILITY of the remaining KHU and its required underground emergency power path is determined by performing SR 3.8.1.3 within 1 hour if not performed in the previous 12 hours and once every 7 days thereafter. This demonstration assures the remaining emergency power path is not inoperable due to a common cause or other failure. Testing on a 7 day Frequency is acceptable since both standby buses must be energized from an LCT via an isolated power path when in Condition C for > 72 hours. When the standby buses are energized by an LCT via an isolated power path, the likelihood that the OPERABLE KHU and its required underground emergency power path will be required is decreased. Since Required Action C.1 only specifies "perform," a failure of SR 3.8.1.3 acceptance criteria does not result in a Required Action not met. SR 3.8.1.3 is only required to be performed when the KHU associated with the underground emergency power path is OPERABLE.

If the KHU and its required underground emergency path fails SR 3.8.1.3, both KHUs and their required emergency power paths are inoperable, and Condition I (Both KHUs or their required emergency power paths inoperable for reasons other than Condition G or H) is entered concurrent with Condition C.

BASES

ACTIONS

C.1, C.2.1, C.2.2.1, C.2.2.2, C.2.2.3, C.2.2.4, and C.2.2.5 (continued)

If the inoperable KHU or its required overhead emergency power path are not restored to OPERABLE status within 72 hours as required by Required Action C.2.1, a controlled shutdown must be initiated as required by the Required Actions for Condition M unless the extended Completion Times of Required Action C.2.2.5 are applicable. The second Completion Time for Required Action C.2.1 establishes a limit on the maximum time allowed for a KHU to be inoperable during any single contiguous occurrence of having a KHU inoperable. If Condition C is entered as a result of switching an inoperable KHU from the underground to the overhead emergency power path, it may have been inoperable for up to 72 hours. This could lead to a total of 144 hours since the initial failure of the KHU. The second Completion Time allows for an exception to the normal "time zero" for beginning the allowed time "clock." This will result in establishing the "time zero" at the time the KHU become inoperable, instead of at the time Condition C was entered.

The extended Completion Times of Required Action C.2.2.5 apply when the KHU or its required overhead emergency power path is inoperable due to an inoperable Keowee main step-up transformer, an inoperable KHU (if not used for that KHU in the previous 3 years), or a KHU made inoperable to perform generator field pole rewind work. In order to use the extended Completion Times, within 72 hours of entering Condition C both standby buses must be energized from an LCT (Required Action C.2.2.1), KHU generation to the grid except for testing must be suspended (Required Action C.2.2.2), the remaining KHU and its required underground emergency power path and both required offsite sources must be verified OPERABLE, the LCOs indicated in Required Action C.2.2.3 must be verified to be met, and alternate power source capability must be verified by performing SR 3.8.1.16.

Required Action C.2.2.5 permits maintenance and repair of a Keowee main step-up transformer which requires longer than 72 hours. Transformer replacement is rare but is time extensive. A 28 day Completion Time is permitted by Required Action C.2.2.5 to restore the KHU and its overhead power path to OPERABLE status when inoperable due to an inoperable Keowee main step-up transformer. This allows a reasonable period of time for transformer replacement.

Required Action C.2.2.5 also permits maintenance and repair of a KHU which requires longer than 72 hours. The primary long term maintenance items are expected to be hydro turbine runner and discharge ring welding

BASES

ACTIONS

C.1, C.2.1, C.2.2.1, C.2.2.2, C.2.2.3, C.2.2.4, and C.2.2.5 (continued)

repairs which are estimated to be necessary every six to eight years. Also, generator thrust and guide bearing replacements are necessary. Other items which manifest as failures are expected to be rare and may be performed during the permitted maintenance periods. The 45-day Completion Time of Required Action C.2.2.5 is allowed to be applied cumulatively over a rolling three year period for each KHU. This Completion Time is 45 days from discovery of initial inoperability of the KHU. This effectively limits the time the KHU can be inoperable to 45 days from discovery of initial inoperability rather than 45 days from entry into Condition C and precludes any additional time that may be gained as a result of switching an inoperable KHU from the underground to the overhead emergency power path. The Completion Time is modified by three notes. Note 1 indicates that the Completion Time is cumulative per a rolling 3-year time period for each KHU. For example, if KHU-1 is inoperable for 15 days, the 45-day Completion Time for KHU-1 is reduced to 30 days for the rolling 3-year time period containing the 15 day inoperability. This requires a review of entries for the previous 3 years to determine the remaining time allowed in the 45-day Completion Time. If the 72 hour Completion Time of C.2.1 is not exceeded, the 45-day Completion is not applicable and is not reduced. Notes 2 and 3 indicate the Completion Time is not applicable during generator field pole rewind work or until one year after the KHU is declared OPERABLE following generator field pole rewind work. Note 2 is added to avoid using up the 45-day Completion Time concurrent with the 62-day Completion Time and preserves some time to perform emergent maintenance work should the need arise after a one year waiting period. Note 3 is added to require a one year waiting period prior to use.

The temporary 62-day Completion Time of Required Action C.2.2.5 is allowed for each KHU to perform generator field pole rewind work. The 62-day Completion Time is modified by three notes that provide conditions for using the extended outage. Note 1 indicates that no discretionary maintenance or testing is allowed on the Standby Shutdown Facility (SSF), Emergency Feedwater (EFW), and essential alternating current (AC) Power Systems. Note 2 indicates that the 62-day Completion Time is only applicable one time for each KHU due to generator field pole rewind work and expires on January 1, 2015. Note 3 indicates that it is only applicable if the SSF and EFW are administratively verified OPERABLE prior to entering the extended Completion Time. This increases the probability, even in the unlikely event of an additional failure, that the risk significant systems will function as required to support their safety function.

Required Actions C.2.2.1, C.2.2.2, C.2.2.3, and C.2.2.4 must be met in order to allow the longer restoration times of Required Action C.2.2.5.

BASES

ACTIONS

C.1, C.2.1, C.2.2.1, C.2.2.2, C.2.2.3, C.2.2.4, and C.2.2.5 (continued)

Required Action C.2.2.1 requires that both standby buses be energized using an LCT through the 100 kV transmission circuit. With this arrangement (100 kV transmission circuit electrically separated from the system grid and all offsite loads), a high degree of reliability for the emergency power system is provided. In this configuration, the LCT is serving as a second emergency power source, however, since the 100 kV transmission circuit is vulnerable to severe weather a time limit is imposed. The second Completion Time of Required Action C.2.2.1 permits the standby buses to be re-energized by an LCT within 1 hour in the event this source is subsequently lost. Required Action C.2.2.2 requires suspension of KHU generation to the grid except for testing. The restriction reduces the number of possible failures which could cause loss of the underground emergency power path. Required Action C.2.2.3 requires verifying by administrative means that the remaining KHU and its required underground emergency power path and both required offsite sources are OPERABLE. This provides additional assurance that offsite power will be available. In addition, this assures that the KHU and its required underground emergency power path are available.

Required Action C.2.2.3 also requires verifying by administrative means that the requirements of the following LCOs are met:

LCO 3.8.3, "DC Sources – Operating;"

LCO 3.8.6, "Vital Inverters – Operating;"

LCO 3.8.8, "Distribution Systems – Operating;"

LCO 3.3.17, "EPSL Automatic Transfer Function;"

LCO 3.3.18, "EPSL Voltage Sensing Circuits;"

LCO 3.3.19, "EPSL 230 kV Switchyard DGVP;" and

LCO 3.3.21, "EPSL Keowee Emergency Start Function."

This increases the probability, even in the unlikely event of an additional failure, that the DC power system and the 120 VAC Vital Instrumentation power panelboards will function as required to support EPSL, power will not be lost to ES equipment, and EPSL will function as required.

BASES

ACTIONS

C.1, C.2.1, C.2.2.1, C.2.2.2, C.2.2.3, C.2.2.4, and C.2.2.5 (continued)

Verifying by administrative means allows a check of logs or other information to determine the OPERABILITY status of required equipment in place of requiring unique performance of Surveillance Requirements. If the AC Source is subsequently determined inoperable, or an LCO stated in Required Action C.2.2.3 is subsequently determined not met, continued operation up to a maximum of four hours is allowed by ACTION L. Required Action C.2.2.3 is modified by a note indicating that it is not applicable to the remaining KHU and its required underground emergency power path or LCO 3.3.21 when in Condition H to perform generator field pole rewind work. This note is needed to allow entry into the 60 hour dual unit outage to reassemble the refurbished KHU and return it to functional condition, as well as perform balance runs and shots, post modification testing, and a commissioning run prior to declaring the refurbished KHU operable. Without this note, entry into Condition L would be required allowing only 16 hours to restore the KHU and its required underground path and only 4 hours to restore compliance with LCO 3.3.21.

Required Action C.2.2.4 requires verifying alternate power source capability by performing SR 3.8.1.16. This confirms that entry into Condition C is due only to an inoperable main step-up transformer or an inoperable KHU, as applicable. If SR 3.8.1.16 is subsequently determined not met, continued operation up to a maximum of four hours is allowed by ACTION L.

D.1, D.2 and D.3

With the KHU or its required underground emergency power path inoperable, sufficient AC power sources remain available to ensure safe shutdown of the unit in the event of a transient or accident. Operation may continue for 72 hours if the remaining KHU and its required overhead emergency power path are tested using SR 3.8.1.4 within one hour if not performed in the previous 12 hours. SR 3.8.1.4 is only required to be performed when the KHU associated with the overhead emergency power path is OPERABLE. This Required Action provides assurance that no undetected failures have occurred in the overhead emergency power path. Since Required Action D.1 only specifies "perform," a failure of SR 3.8.1.4 acceptance criteria does not result in a Required Action not met. However, if the KHU and its required overhead emergency path fails SR 3.8.1.4, both KHUs and their required emergency power paths are inoperable, and Condition I for both KHUs and their emergency power paths inoperable for reasons other than Condition G or H is entered concurrent with Condition D. This

BASES

ACTIONS

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

demonstration is to assure that the remaining emergency power path is not inoperable due to a common cause or due to an undetected failure. For outages of the KHU and its required underground emergency power path in excess of 24 hours, an LCT (using the 100 kV transmission circuit electrically separated from the grid and offsite loads) must energize a standby bus prior to the outage exceeding 24 hours. This ensures the availability of a power source on the standby buses when the KHU and its required underground emergency power path are out of service in excess of 24 hours. The second Completion Time of Required Action D.2 permits the standby buses to be re-energized by an LCT within 1 hour in the event this source is subsequently lost.

The second Completion Time for Required Action D.3 establishes a limit on the maximum time allowed for a KHU to be inoperable during any single contiguous occurrence of having a KHU inoperable. If Condition D is entered as a result of switching an inoperable KHU from the overhead to the underground emergency power path, it may have been inoperable for up to 72 hours. This could lead to a total of 144 hours since the initial failure of the KHU. The second Completion Time allows for an exception to the normal "time zero" for beginning the allowed time "clock." This will result in establishing the "time zero" at the time the KHU become inoperable, instead of at the time Condition D was entered.

E.1 and E.2

If the Required Action and associated Completion Time for Required Action D.2 are not met, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 12 hours for one Oconee unit and 24 hours for other Oconee unit(s) and to MODE 5 within 84 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 plant systems.

F.1 and F.2

With the zone overlap protection circuitry inoperable when the overhead electrical disconnects for the KHU associated with the underground power path are closed, the zone overlap protection circuitry must be restored to OPERABLE status or the overhead electrical disconnects must be opened within 72 hours. In this Condition, both KHUs and their required emergency power paths are OPERABLE, however a single failure could result in the loss of both KHUs.

BASES

ACTIONS
(continued)

G.1

With both emergency power paths inoperable due to an E breaker and S breaker inoperable on the same main feeder bus, one breaker must be restored to OPERABLE status. In this Condition, both emergency power paths can still provide power to the remaining main feeder bus.

H.1 and H.2

With both KHUs or their required emergency power paths inoperable for planned maintenance or test with both standby buses energized from an LCT via an isolated power path, the KHU must be restored to OPERABLE status within 60 hours. Operation with both KHUs and their required power paths inoperable is permitted for 60 hours provided that both standby buses are energized using an LCT through the 100 kV transmission circuit and the requirements of the Note to the Condition are met. The Note to the Condition indicates that it may only be entered when both offsite sources are verified by administrative means to be OPERABLE and the requirements of the following LCOs are verified by administrative means to be met:

LCO 3.8.3, "DC Sources – Operating;"

LCO 3.8.6, "Vital Inverters – Operating;"

LCO 3.8.8, "Distribution Systems – Operating;"

LCO 3.3.17, "EPSL Automatic Transfer Function;"

LCO 3.3.18, "EPSL Voltage Sensing Circuits;" and

LCO 3.3.19, "EPSL 230 kV Switchyard DGVP."

This increases the probability, even in the unlikely event of an additional failure, that the DC power system and the 120 VAC Vital Instrumentation power panelboards will function as required to support EPSL, power will not be lost to ES equipment, and EPSL will function as required.

BASES

ACTIONS

H.1 and H.2 (continued)

Verifying by administrative means allows a check of logs or other information to determine the OPERABILITY status of required equipment in place of requiring unique performance of Surveillance Requirements. If the AC Source is subsequently determined inoperable, or an LCO stated in the Note to Condition H is subsequently determined not met, continued operation up to a maximum of four hours is allowed by ACTION L.

With both standby buses energized from an LCT via an isolated power path (100 kV transmission circuit electrically separated from the system grid and all offsite loads), a high degree of reliability for the emergency power system is provided. In this configuration, the LCT is serving as the Oconee emergency power source, however, since the Oconee Units are vulnerable to a single failure of the 100 kV transmission circuit a time limit of 60 hours is imposed. Required Action H.1 permits the standby buses to be re-energized by an LCT within 1 hour in the event this source is subsequently lost. The second Completion Time of Required Action H.2 limits the amount of time two KHUs can be inoperable during the 45-day Completion Time of Required Action C.2.2.5 to a cumulative 240 hours over a rolling 3-year period. This requires a review of entries for the previous 3 years to determine the remaining time allowed in the 240-hour Completion Time. This limits the dual KHU outage time when using the 45-day Completion Time of Required Action C.2.2.5 on a cumulative basis over a 3-year time period.

If both emergency power paths are restored, unrestricted operation may continue. If only one power path is restored, operation may continue per ACTIONS C or D.

I.1, I.2, and I.3

With both KHUs or their required emergency power paths inoperable for reasons other than Conditions G and H, insufficient standby AC power sources are available to supply the minimum required ES functions. In this Condition, the offsite power system is the only source of AC power available for this level of degradation. The risk associated with continued operation for one hour without an emergency power source is considered acceptable due to the low likelihood of a LOOP during this time period, and because of the potential for grid instability caused by the simultaneous shutdown of all three units. This instability would increase the probability of a total loss of AC power. Operation with both KHUs or their required power paths inoperable is permitted for 12 hours provided that Required Actions I.1 and I.2 are met. Required Action I.1 requires that both standby buses be energized using an LCT via an isolated power

BASES

ACTIONS

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

path. With this arrangement (100 kV transmission circuit electrically separated from the system grid and all offsite loads), a high degree of reliability for the emergency power system is provided. In this configuration, the LCT is serving as the Oconee emergency power source, however, since the Oconee Units are vulnerable to a single failure of the 100 kV transmission circuit a time limit of 12 hours is imposed. The second Completion Time of Required Action I.1 permits the standby buses to be re-energized by an LCT within 1 hour in the event this source is subsequently lost. Required Action I.2 requires that the OPERABILITY status of both offsite sources be determined by administrative means and that the OPERABILITY status of equipment required by the following LCOs be determined by administrative means:

LCO 3.8.3, "DC Sources – Operating;"

LCO 3.8.6, "Vital Inverters – Operating;"

LCO 3.8.8, "Distribution Systems – Operating;"

LCO 3.3.17, "EPSL Automatic Transfer Function;"

LCO 3.3.18, "EPSL Voltage Sensing Circuits;" and

LCO 3.3.19, "EPSL 230 kV Switchyard DGVP."

This increases the probability, even in the unlikely event of an additional failure, that the DC power system and the 120 VAC Vital Instrumentation power panelboards will function as required to support EPSL, power will not be lost to ES equipment, and EPSL will function as required.

Determining by administrative means allows a check of logs or other information to determine the OPERABILITY status of required equipment in place of requiring unique performance of Surveillance Requirements. If the AC Source is initially or subsequently determined inoperable, or an LCO stated in Required Action I.2 is initially or subsequently determined not met, continued operation up to a maximum of four hours is allowed by ACTION L.

If both emergency power paths are restored, unrestricted operation may continue. If only one power path is restored, operation may continue per ACTIONS C or D.

BASES

ACTIONS
(continued)

J.1, J.2, and J.3

With one or both required offsite sources inoperable for reasons other than Condition A, sufficient AC power sources are available to supply necessary loads in the event of a DBA. However, since the AC power system is degraded below the Technical Specification requirements, a time limit on continued operation is imposed. With only one of the required offsite sources OPERABLE, the likelihood of a LOOP is increased such that the Required Actions for all required offsite circuits inoperable are conservatively followed. The risk associated with continued operation for one hour without a required offsite AC source is considered acceptable due to the low likelihood of a LOOP during this time period, and because of the potential for grid instability caused by the simultaneous shutdown of all three units.

Operation with one or both required offsite sources inoperable is permitted for 24 hours provided that Required Actions J.1 and J.2 are met. Required Action J.1 requires that both standby buses be energized using an LCT via an isolated power path. With this arrangement (100 kV transmission circuit electrically separated from the system grid and all offsite loads), a high degree of reliability for the emergency power system is provided. In this configuration, the LCT is serving as an emergency power source, however, since the Oconee units are vulnerable to a single failure of the 100 kV transmission circuit a time limit is imposed. The second Completion Time of Required Action J.1 permits the standby buses to be re-energized by an LCT within 1 hour in the event this source is subsequently lost. Required Action J.2 requires that the OPERABILITY status of both KHUs and their required emergency power paths be determined by administrative means and that the OPERABILITY status of equipment required by the following LCOs be determined by administrative means:

LCO 3.8.3, "DC Sources – Operating;"

LCO 3.8.6, "Vital Inverters – Operating;"

LCO 3.8.8, "Distribution Systems – Operating;"

LCO 3.3.17, "EPSL Automatic Transfer Function;"

LCO 3.3.18, "EPSL Voltage Sensing Circuits;"

LCO 3.3.19, "EPSL 230 kV Switchyard DGVP," and

LCO 3.3.21, "EPSL Keowee Emergency Start Function."

BASES

ACTIONS

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

This increases the probability, even in the unlikely event of an additional failure, that the DC power system and the 120 VAC Vital Instrumentation power panelboards will function as required to support EPSL, power will not be lost to ES equipment, and EPSL will function as required.

Determining by administrative means allows a check of logs or other information to determine the OPERABILITY status of required equipment in place of requiring unique performance of Surveillance Requirements. If the AC Source is initially or subsequently determined inoperable, or an LCO stated in Required Action J.2 is initially or subsequently determined not met, continued operation up to a maximum of four hours is allowed by ACTION L.

K.1

The two trip circuits for each closed N and SL breakers are required to ensure both breakers will open. An N breaker trip circuit encompasses those portions of the breaker control circuits necessary to trip the associated N breaker from the output of the 2 out of 3 logic matrix formed by the auxiliary transformer's undervoltage sensing circuits up to and including an individual trip coil for the associated N breaker. The undervoltage sensing channels for the auxiliary transformer are addressed in LCO 3.3.18, "Emergency Power Switching Logic (EPSL) Voltage Sensing Circuits." An SL breaker trip circuit encompasses those portions of the breaker control circuits necessary to trip the SL breaker from the output of both 2 out of 3 logic matrices formed by each standby bus's undervoltage sensing circuits up to and including an individual trip coil for the associated SL breaker. The undervoltage sensing channels for the CT- 5 transformer are addressed in LCO 3.3.18, "Emergency Power Switching Logic (EPSL) Voltage Sensing Circuits." With one trip circuit inoperable a single failure could cause an N or SL breaker to not open. This could prevent the transfer to other available sources. Therefore, 24 hours is allowed to repair the trip circuit or open the breaker (opening the breaker results in exiting the Condition). The Completion Time is based on engineering judgement taking into consideration the time required to complete the required action and the availability of the remaining trip circuit.

A Note modifies the Condition, indicating that separate Condition Entry is permitted for each breaker. Thus, Completion Times are tracked separately for the N1, N2, SL1, and SL2 breaker.

BASES

ACTIONS
(continued)

L.1, L.2, and L.3

With an AC Source inoperable or LCO not met, as stated in Note for Condition H entry; or with an AC Source inoperable or LCO not met, as stated in Required Action C.2.2.3 when in Condition C for > 72 hours; or with an AC Source inoperable or LCO not met, as stated in Required Action I.2 or J.2 when in Conditions I or J for > 1 hour; or with SR 3.8.1.16 not met, Required Action L.1, L.2 and L.3 requires restoration within four hours. Condition L is modified by a Note indicating that separate Condition entry is permitted for each inoperable AC Source, and LCO or SR not met. The Required Action is modified by a Note that allows the remaining OPERABLE KHU and its required emergency power path to be made inoperable if required to restore both KHUs and their required emergency power paths to OPERABLE status. This note is necessary since certain actions such as dewatering the penstock may be necessary to restore the inoperable KHU although these actions would also cause both KHUs to be inoperable.

The purpose of this Required Action is to restrict the allowed outage time for an inoperable AC Source or equipment required by an LCO when in Conditions C, H, I or J. For Conditions I and J when the LCOs stated are initially not met, the maximum Completion Time is four hours or the remaining Completion Time allowed by the stated LCO, whichever is shorter.

M.1 and M.2

If a Required Action and associated Completion Time for Condition C, F, G, H, I, J, K or L are not met; or if a Required Action and associated Completion Time are not met for Required Action D.1 or D.3, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 12 hours and to MODE 5 within 84 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE
REQUIREMENTS

SR 3.8.1.1

This SR ensures proper circuit continuity for the offsite AC electrical power supply to the onsite distribution network and availability of offsite AC electrical power. The breaker alignment verifies that each breaker is in its correct position to ensure that distribution buses and loads are

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.1.1 (continued)

connected to their power source, and that appropriate separation of offsite sources is maintained. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.2

This SR verifies adequate battery voltage when the KHU batteries are on float charge. This SR is performed to verify KHU battery OPERABILITY. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.3

This SR verifies the availability of the KHU associated with the underground emergency power path to start automatically and energize the underground power path. Utilization of either the auto-start or emergency start sequence assures the control function OPERABILITY by verifying proper speed control and voltage. Power path verification is included to demonstrate breaker OPERABILITY from the KHU onto the standby buses. This is accomplished by closing the Keowee Feeder Breakers (SK) to energize each deenergized standby bus. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.4

This surveillance verifies the availability of the KHU associated with the overhead emergency power path. Utilization of either the auto-start or emergency start sequence assures the control function OPERABILITY by verifying proper speed control and voltage. The ability to supply the overhead emergency power path is satisfied by demonstrating the ability to synchronize (automatically or manually) the KHU with the grid system. If an automatic start of the KHU is performed and a manual synchronization is desired, the KHU will need to be shutdown and re-started in manual to allow a manual synchronization of the KHU. The SR also requires that the underground power path be energized after removing the KHU from the overhead emergency power path. This surveillance can be satisfied by first demonstrating the ability of the KHU

BASES

**SURVEILLANCE
REQUIREMENTS**

SR 3.8.1.4 (continued)

associated with the underground emergency path to energize the underground path then synchronizing the KHU to the overhead emergency power path. The SR is modified by a Note indicating that the requirement to energize the underground emergency power path is not applicable when the overhead disconnects are open for the KHU associated with the underground emergency power path or 2) when complying with Required Action D.1. The latter exception is necessary since Required Action D.1 continues to be applicable when both KHUs are inoperable.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.5

This surveillance verifies OPERABILITY of the trip functions of each closed SL and each closed N breaker. Neither of these breakers have any automatic close functions; therefore, only the trip coils require verification. Cycling of each breaker demonstrates functional OPERABILITY and the coil monitor circuits verify the integrity of each trip coil. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

This SR modified by a Note that states it is not required to be performed for an SL breaker when its standby bus is energized from a LCT via an isolated power path. This is necessary since the standby buses are required to be energized from a LCT by several Required Actions of Specification 3.8.1 and the breakers must remain closed to energize the standby buses from a LCT.

SR 3.8.1.6

Infrequently used source breakers are cycled to ensure OPERABILITY. The Standby breakers are to be cycled one breaker at a time to prevent inadvertent interconnection of two units through the standby bus breakers. Cycling the startup breakers verifies OPERABILITY of the breakers and associated interlock circuitry between the normal and startup breakers. This circuitry provides an automatic, smooth, and safe transfer of auxiliaries in both directions between sources. The Surveillance Frequency is based on operating experience, equipment

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.1.6 (continued)

reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

This SR is modified by a Note which states the SR is not required to be performed for an S breaker when its standby bus is energized from a LCT via an isolated power path. This is necessary since the standby buses are required to be energized from a LCT by several Required Actions of Specification 3.8.1 and cycling the S breakers connects the standby buses with the main feeder buses which are energized from another source.

SR 3.8.1.7

The KHU tie breakers to the underground path, ACB3 and ACB4, are interlocked to prevent cross-connection of the KHU generators. The safety analysis utilizes two independent power paths for accommodating single failures in applicable accidents. Connection of both generators to the underground path compromises the redundancy of the emergency power paths. Installed test logic is used to verify a circuit to the close coil on one underground ACB does not exist with the other underground ACB closed. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.8

Each KHU tie breaker to the underground emergency power path and tie breaker to the overhead emergency path, are interlocked to prevent the unit associated with the underground circuit from automatically connecting to the overhead emergency power path. The safety analysis utilizes two independent power paths for accommodating single failures in applicable accidents. Connection of both generators to the overhead emergency power path compromises the redundancy of the emergency power paths. Temporary test instrumentation is used to verify a circuit to the close coil on the overhead ACB does not exist with the Underground ACB closed. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.8.1.9

This surveillance verifies the KHUs' response time to an Emergency Start signal (normally performed using a pushbutton in the control room) to ensure ES equipment will have adequate power for accident mitigation. UFSAR Section 6.3.3.3 (Ref. 9) establishes the 23 second time requirement for each KHU to achieve rated frequency and voltage based on the assumption that an engineered safeguards actuation in one unit occurs simultaneously with a loss of offsite power to all three units. Emergency start without a design basis event or minimal load such as unit shutdown could conceivably cause the KHU to experience overshoot or over-frequency.

This surveillance also verifies the KHU's steady-state frequency is ≥ 59.4 Hz and ≤ 61.8 Hz. These limits were established to ensure key mechanical systems and equipment have adequate frequency for accident mitigation. The limits are automatically maintained by Keowee control systems. A nominal time of 60 seconds following the Emergency Start signal is sufficient time to begin monitoring steady state operation.

Since the only available loads of adequate magnitude for simulating an accident is the grid, subsequent loading on the grid is required to verify the KHU's ability to assume rapid loading under accident conditions. Sequential block loads are not available to fully test this feature. This is the reason for the requirement to load the KHUs at the maximum practical rate. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.10

A battery service test is a special test of the battery capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The discharge rate and test length should correspond to the design duty cycle requirements as specified in Reference 4.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

**SURVEILLANCE
REQUIREMENTS**
(continued)

SR 3.8.1.11

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.12

Verification of cell to cell connection cleanliness, tightness, and proper coating with anti-corrosion grease provides an indication of any abnormal condition, and assures continued OPERABILITY of the battery. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.13

The KHU underground ACBs have a control feature which will automatically close the KHU, that is pre-selected to the overhead path, into the underground path upon an electrical fault in the zone overlap region of the protective relaying. This circuitry prevents an electrical fault in the zone overlap region of the protective relaying from locking out both emergency power paths during dual KHU grid generation. In order to ensure this circuitry is OPERABLE, an electrical fault is simulated in the zone overlap region and the associated underground ACBs are verified to operate correctly. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

This SR is modified by a Note indicating the SR is only applicable when the overhead disconnects to the underground KHU are closed. When the overhead disconnects to the underground KHU are open, the circuitry preventing the zone overlap protective lockout of both KHUs is not needed.

SR 3.8.1.14

This surveillance verifies OPERABILITY of the trip functions of the SL and N breakers. This SR verifies each trip circuit of each breaker

BASES

**SURVEILLANCE
REQUIREMENTS**
(continued)

SR 3.8.1.14 (continued)

independently opens each breaker. Neither of these breakers have any automatic close functions; therefore, only the trip circuits require verification. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

The SR is modified by a Note indicating that the SR is not required for an SL breaker when its standby bus is energized by a LCT via an isolated power path. This is necessary since the standby buses are required to be energized from a LCT by several Required Actions of Specification 3.8.1 and the breakers must remain closed to energize the standby buses from a LCT.

SR 3.8.1.15

This surveillance verifies proper operation of the 230 kV switchyard circuit breakers upon an actual or simulated actuation of the Switchyard Isolation circuitry. This test causes an actual switchyard isolation (byactuation of degraded grid voltage protection) and alignment of KHUs to the overhead and underground emergency power paths. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. The effect of this SR is not significant because the generator red bus tie breakers and feeders from the Oconee 230 kV switchyard red bus to the system grid remain closed. Either Switchyard Isolation Channel causes full system realignment, which involves a complete switchyard realignment. To avoid excessive switchyard circuit breaker cycling, realignment and KHU emergency start functions, this SR need be performed only once each SR interval.

SR 3.8.1.16

This SR verifies by administrative means that one KHU provides an alternate manual AC power source capability by manual or automatic KHU start with manual synchronize, or breaker closure, to energize its non-required emergency power path. That is, when the KHU to the overhead emergency power path is inoperable, the SR verifies by administrative means that the overhead emergency power path is OPERABLE. When the overhead emergency power path is inoperable, the SR verifies by administrative means that the KHU associated with the overhead emergency power path is OPERABLE.

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.1.16 (continued)

This SR is modified by a Note indicating that the SR is only applicable when complying with Required Action C.2.2.4.

SR 3.8.1.17

This SR verifies the Keowee Voltage and Frequency out of tolerance logic trips and blocks closure of the appropriate overhead or underground power path breakers on an out of tolerance trip signal. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

There are three over voltage relays, three under voltage relays, and three over/under frequency relays per KHU with each relay actuating an auxiliary relay used to provide two out of three logic. These relays monitor generator output voltage and if two phases are above/below setpoint, prevent the power path breakers from closing or if closed, provide a trip signal which is applied after a time delay, to open the power path breakers. Testing demonstrates that relays actuate at preset values, that timers time out and that two under voltage relays, two over voltage relays, or two over/under frequency relays will actuate the logic channel. This ensures that the power path breakers will not close and if closed, will trip after a preset time delay that becomes effective when the KHU first reaches the required frequency and voltage band.

REFERENCES

1. UFSAR, Section 3.1.39
2. UFSAR, Chapter 16
3. 10 CFR 50.36
4. UFSAR, Chapter 6
5. UFSAR, Chapter 15
6. Regulatory Guide 1.32
7. Regulatory Guide 1.129
8. IEEE-450-1980
9. UFSAR, Section 6.3.3.3