DUKE POWER COMPANY

OCONEE NUCLEAR STATION

ATTACHMENT 1

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3.7-1 through 3.7-13	3.7-1 through 3.7-16

NOTE: There are no changes on page 3.7-12

3.7 AUXILIARY ELECTRICAL SYSTEMS

Applicability

Applies to the availability of off-site and on-site electrical power for station operation and for operation of station auxiliaries.

Objective

To define those conditions of electrical power availability necessary to provide for safe reactor operation and to provide for continuing availability of engineered safety features systems in an unrestricted manner and to prescribe safety evaluation and reporting requirements to be followed in the event that the auxiliary electric power systems become degraded.

Specifications

3.7.1 Except as permitted by 3.7.2, 3.7.3, 3.7.4, 3.7.5, 3.7.6, 3.7.7, and 3.7.8, the reactor shall not be above 200°F unless the following conditions are met.

(a) At least two 230KV transmission lines, on separate towers, shall be in service.

(b) Two independent on-site emergency power paths shall be operable and shall consist of:

1. One Keowee hydro unit; through the underground feeder path; through transformer CT4; through the Keowee standby bus feeder breaker (SK1 or SK2) to one standby bus; and capable of supplying emergency power through the standby bus to main feeder bus breaker (S1 or S2).

2. The other (redundant) Keowee hydro unit; through the Keowee main step-up transformer and breaker PCB-9; the 230 kV switchyard yellow bus and safety related PCB-18, -27, or 30; through the respective operating unit's startup transformer (CT-1, 2, or 3) or aligned and connected alternate startup transformer; and capable of supplying emergency power through the startup transformer to main feeder bus breaker (E1 or E2). One startup transformer may not be connected to supply power to more than one unit.

(c) The Emergency Power Switching Logic (EPSL) circuitry shall be operable as specified by the conditions of Table 3.7-1 for normal operation. Furthermore, if the reactor is subcritical, the conditions of Table 3.7-1 for normal operation shall be satisfied before the reactor is returned to criticality.

(d) The two 4160 volt main feeder buses shall be energized. Each 4160V main feeder bus shall be capable of receiving power from at least one of the two on-site emergency power flowpaths.

(e) The three 4160 volt Engineered Safety Features switchgear buses (TC, TD, and TE), three 600 volt load centers (X8, 9, and 10), and the three 600-208 volt Engineered Safety Features MCC Buses (XS1, XS2, XS3) shall be energized.

(f) For each unit, the 125 VDC Instrumentation and Control Power System shall be operable as specified below:

1. Both 125 VDC instrumentation and control distribution centers (DCA and DCB);

2. All four 125 VDC instrumentation and control panelboards (DIA, DIB, DIC, and DID), including the associated isolating transfer diodes and diode monitors (ADA 1 & 2, ADB 1 & 2, ADC 1 & 2, ADD 1 & 2);

3. All four 120 VAC vital instrumentation power panelboards (KVIA, KVIB, KVIC, and KVID), including the associated static inverters;

4. The 240/120 VAC regulated power panelboard (KRA).

5. The 125 VDC Instrumentation and Control (I&C) batteries with an associated charger shall be operable per all the following conditions:

   (a) Each unit, when in a cold shutdown condition, shall have at least one of that units I&C batteries operable;

   (b) For operation of two or more units, five of the six batteries shall be operable;

   (c) For operation of Unit 1, three of the following four batteries and their associated chargers shall be operable: 1CA, 1CB, 2CA, and 2CB.

   For operation of Unit 2, three of the following four batteries and their associated chargers shall be operable: 2CA, 2CB, 3CA, and 3CB.

   For operation of Unit 3, three of the following four batteries and their associated chargers shall be operable: 3CA, 3CB, 1CA, and 1CB.

(g) Both of the 125 VDC 230KV switching station batteries (SY-1, SY-2), with associated chargers, distribution centers, and panelboards shall be operable.

(h) Both of the 125 VDC Keowee batteries (Bank 1 & 2) with associated chargers and distribution centers (1DA & 2DA) shall be operable.

(i) The level of Keowee Reservoir shall be at least 775 feet above sea level.

(j) The Keowee station auxiliary transformers (1X and 2X) and the Keowee station backup auxiliary transformer (CX) shall be operable.

3.7.2 With the reactor heated above 200°F, provisions of 3.7.1 may be modified to allow the following conditions to exist:

(a)(1) One of the two independent on-site emergency power paths, as defined in 3.7.1(b), may be inoperable for periods not exceeding 72 hours for test or maintenance, provided the alternate power path is verified operable within one hour of the loss and every eight hours thereafter.

(2) Both Keowee station auxiliary transformers (1X and 2X) may be inoperable for periods not exceeding 72 hours for test or maintenance, provided that the backup auxiliary transformer (CX) and its associated underground power path from Oconee switchgear 1TC is operable;

(3) Keowee backup auxiliary transformer (CX) and its associated underground power path from Oconee switchgear 1TC may be inoperable for periods not exceeding 72 hours for test or maintenance, provided that the Keowee main step-up transformer and both auxiliary transformers (1X and 2X) are operable;

(4) Keowee auxiliary transformer (1X) may be inoperable for test or maintenance provided that Keowee Unit 2 is aligned to the overhead path;

(5) Keowee auxiliary transformer (2X) may be inoperable for test or maintenance provided that Keowee Unit 1 is aligned to the overhead path.

(b) Except for the allowable conditions defined in Specifications 3.7.2(a), 3.7.2(c), 3.7.2(i), 3.7.4, 3.7.6 and 3.7.7 the circuits or channels of any single functional unit of the EPSL may be inoperable for test or maintenance for periods not exceeding 24 hours, provided that:

1. The conditions of Table 3.7-1 for degraded operation are satisified for that specific functional unit; and

2. The conditions of Table 3.7-1 for normal operation are satisified for all other functional units.

Beyond the conditions allowed by 3.7.2(b)(1) and (2), the circuits or channels of more than one functional unit of the EPSL may be inoperable only if:

1. The inoperability results from a loss of power due to the inoperability of a 125 VDC instrumentation and control panelboard (see 3.7.2(e) below); and

2. The conditions of Table 3.7-1 for degraded operation are satisfied for the affected functional units.

In any event, if the reactor is subcritical, the inoperable circuit(s) or channel(s) shall be restored to operability and the conditions of Table 3.7-1 for normal operation shall be satisifed for all functional units before the reactor is returned to criticality.

(c) One 4160 volt main feeder bus may be inoperable (as defined in 3.7.1(d)) for 24 hours.

(d) One complete single string (i.e., 4160 volt switchgear (TC, TD, or TE), 600 volt load center, (X8, X9, or X10), 600-208 volt MCC (XS1, XS2, or XS3), and their loads) of each unit's 4160 volt Engineered Safety Features Power System may be inoperable for 24 hours.

(e) One or more of the following DC distribution components may be inoperable for periods not exceeding 24 hours (except as noted in 3.7.2(g) below):

1. One complete single string or single component (i.e., 125VDC battery, charger, distribution center, and panelboards) of the 125VDC 230KV Switching Station Power System.

2. One complete single string or single component (i.e., 125VDC battery, charger, and distribution center) of the Keowee 125VDC Power System may be inoperable provided the remaining string of the Keowee 125 VDC Power System is operable and electrically connected to an operable Keowee hydro unit.

3. One complete single string or single component (i.e., 125VDC battery, charger, distribution center, and associated isolating and transfer diodes) of any units 125VDC Instrumentation and Control Power System. Only one battery more than the number allowed to be inoperable per 3.7.1 (f) for the Station may be removed from service under this paragraph.

4. One 125 VDC instrumentation and control panelboard and its associated loads, per unit, provided that no additional AC buses are made inoperable beyond the provisions of 3.7.2(a), (c), and (d), and provided that the conditions of Table 3.7-1 for normal operation are satisfied for all functional units of the EPSL before the 125 VDC instrumentation and control panelboard becomes inoperable. Additionally, the provisions of 3.7.2.(h) must be observed for the 120 VAC vital instrumentation power panelboard which is powered by the affected 125 VDC panelboard.

(f) For periods not to exceed 24 hours each unit's 125 VDC system may be separated from its backup unit via the isolating and transfer diodes.

(g) One battery each, from one or more of the following 125VDC systems may be simultaneously inoperable for 72 hours in order to perform an equalizer charge after the surveillance requirements of Specification 4.6.10 or performance test:

1. 230 KV Switching Station 125VDC Power System

2. Keowee Hydro Station 125VDC Power System

3. Each unit's 125VDC Instrumentation and Control Power System, provided that the unit's remaining battery is operable. However, for operation of 1 unit, no more batteries than those allowed to be inoperable per 3.7.1 (f) (5) may be removed from service. For operation of 2 or 3 units, at least 4 of the 6 station I&C batteries shall be operable.

(h) One 120 VAC vital instrumentation power panelboard per unit and/or its associated static inverter may be inoperable for periods as specified below:

Panelboard	Maximum Allowed Period of Inoperability
KVIA	4 hours
KVIB	4 hours
KVIC	24 hours
KVID	24 hours

A single vital bus static inverter per unit may continue to be inoperable beyond the specified period, but no longer than 7 days total, provided that its associated 120 VAC vital instrumentation power panelboard is connected to the 240/120 VAC Regulated Power System (KRA) and verified to be operable once every 24 hours.

(i) 1. A startup transformer may be inoperable for periods not exceeding 72 hours for test or maintenance, provided the underground feeder path, through transformer CT4; and to one 4160V standby bus is verified operable within one hour of loss and every eight hours thereafter. The remaining operable startup transformers can be shared between units within the same 72 hours of the above startup transformer being determined inoperable. Prior to exceeding 72 hours, they shall be aligned and connected such that each one is providing a path for power to one and only one unit.

2. In the event that a startup transformer becomes inoperable for unplanned reasons, then one unit shall be in cold shutdown within 72 hours with its loads powered from the standby buses. The remaining operable startup transformers can be shared between units within the same 72 hours of the above startup transformer being determined inoperable. Prior to exceeding 72 hours, they shall be aligned and connected such that each one is providing a path for power to one and only one unit.

3.7.3 In the event that the conditions of Specifications 3.7.1 are not met within the time specified in Specification 3.7.2, except as noted below in Specification 3.7.4, 3.7.5, 3.7.6, 3.7.7, and 3.7.8, the reactor shall be placed in a hot shutdown condition within 12 hours. If these requirements are not met within an additional 48 hours, the reactor shall be placed in the cold shutdown condition within 24 hours.

3.7.4 In the event that all conditions in Specification 3.7.1 are met except that one of the two Keowee hydro units is expected to be unavailable for longer than the test or maintenance period of 72 hours, the reactors may be heated above 200°F if previously shutdown or be permitted or remain critical or be restarted provided the following restrictions are observed.

(a) Prior to heating the reactor above 200°F or prior to the restart of a shutdown reactor or within 72 hours of the loss of one Keowee hydro unit, the 4160 volt standby buses shall be energized by a Lee gas turbine through the 100 kV circuit. The Lee gas turbine and 100 kV transmission circuit shall be electrically separate from the system grid and offsite non-safety-related loads.

(b) The remaining Keowee hydro unit shall be connected to the underground feeder circuit and this path shall be verified operable within 1 hour and weekly thereafter.

(c) The remaining Keowee hydro unit shall be available to the overhead transmission circuit but generation to the system grid shall be prohibited except for periods of test.

(d) Operation in this mode is restricted to periods not to exceed 45 days and the provisions of this specification may be utilized without prior NRC approval only once in three years for each Keowee hydro unit. The U.S. NRC Regional Office, Region II, will be notified within 24 hours.

3.7.5 In the event that all conditions of Specification 3.7.1 are met except that all 230 kV transmission lines are lost, the reactors shall be permitted to remain critical or be restarted provided the following restrictions are observed:

(a) Prior to the restart of a shutdown reactor or within 1 hour of losing all 230 kV transmission lines for an operating reactor, the 4160 volt standby buses shall be energized by one of the Lee gas turbines through the 100 kV transmission circuit. The Lee gas turbine and the 100kV transmission circuit shall be completely separate from the system grid and offsite non-safety-related loads.

(b) The reactor coolant T_{avg} shall be above 525°F. Reactor coolant pump power may be used to elevate the temperature from 500°F to 525° in the case of restart. If T_{avg} decreases below 500°F, restart is not permitted by this specification.

(c) If all 230 kV transmission lines are lost, restore at least one of the inoperable 230kV offsite sources to operable status within 24 hours or be in at least hot standby within the next 6 hours. With only one offsite source restored, restore at least two 230kV offsite circuits to operable status within 72 hours from time of initial loss or be in at least hot standby within the next 6 hours and in cold shutdown within the following 30 hours.

(d) After loss of all 230 kV transmission lines, this information shall be reported within 24 hours to the U.S. NRC Regional Office, Region II. If the outage is expected to exceed 24 hours, a written report shall be submitted detailing the circumstances of the outage and the estimated time to return the 230 kV transmission lines to operating condition.

3.7.6 In the event that all conditions of Specification 3.7.1 are met, and planned tests or maintenance are required which will make both Keowee units unavailable, the 4160 volt standby buses shall first be energized by a Lee gas turbine through the 100 kV transmission circuit and shall be separate from the system grid and offsite non-safety-related loads. The reactor shall then be permitted to remain critical for periods not to exceed 72 hours with both Keowee units unavailable.

Prior to hot restart of a reactor from a tripped condition, the causes and the effects of the shutdown shall be established and analyzed. A restart will be permitted if the cause of such trips is the result of error or of minor equipment malfunctions. A restart will not be permitted if the trip is a result of system transients or valid protection system action.

3.7.7 In the event that all conditions of Specification 3.7.1 are met except that both Keowee hydro units become unavailable for unplanned reasons, the reactors shall be permitted to remain critical for periods not to exceed 24 hours provided the 4160 volt standby buses are energized within 1 hour by the Lee gas turbine through the 100 kV transmission circuit and it shall be separate from the system grid and all offsite non-safety-related loads.

Prior to hot restart of a reactor from a tripped condition, the causes and the effects of the shutdown shall be established and analyzed. A restart will be permitted if the cause of such trips is the result of error or of minor equipment malfunctions. A restart will not be permitted if the trip is a result of system transients or or valid protection system action.

3.7.8 In the event that all conditions in Specification 3.7.1 are met except that any one of the following is expected to be unavailable for longer than the test or maintenance period of 72 hours, as allowed by 3.7.2(a):

1) Keowee Main Step-up transformer;
2) Both Keowee Auxiliary Transformers (1X and 2X);
3) Keowee Backup Auxiliary Transformer (CX);

the reactor may be heated above 200°F if previously shutdown or be permitted to remain critical or be restarted provided the following restrictions are observed:

(a) Prior to heating the reactor above 200°F or prior to the restart of a shutdown reactor or within 72 hours of the loss of any one of the following:
   1) Keowee Main Step-up Transformer;
   2) Both Keowee Auxiliary Transformers (1X and 2X);
   3) Keowee Backup Auxiliary Transformer (CX);
the 4160 volt standby buses shall be energized by a Lee gas turbine through the 100kV circuit. The Lee gas turbine and 100kV transmission circuit shall be electrically separate from the system grid and off-site and non-safety related loads.

(b) A Keowee hydro unit shall be connected to the underground feeder circuit and this path shall be verified operable within 1 hour and weekly thereafter.

(c) The remaining Keowee Hydro Unit shall be available to the overhead if using this Specification due to Keowee Backup Transformer (CX) unavailability. Generation to the system grid shall be prohibited except for periods of test.

If the overhead path is unavailable, the remaining Keowee Hydro Unit must be operable and shall be available to the underground feeder circuit.

(d) Operating in this mode is restricted to periods not to exceed 28 days and the provisions of this specification may be utilized without prior NRC approval. The U.S. NRC Regional Office Region II, will be notified within 24 hours.

3.7.9 Any degradation beyond Specifications 3.7.2, 3.7.4, 3.7.5, 3.7.6, 3.7.7, and 3.7.8 above shall be reported to the U.S. NRC Regional Office, Region II, within 24 hours. A safety evaluation shall be performed by Duke Power Company for the specific situation involved which justifies the safest course of action to be taken. The results of this evaluation together with plans for expediting the return to the unrestricted operating conditions of Specification 3.7.1 above shall be submitted in a written report to the Office of Nuclear Reactor Regulation with a copy to the U.S. NRC Regional Office, Region II, within five days.

Bases

The auxiliary electrical power systems are designed to supply the required Engineered Safeguards loads in one unit and safe shutdown loads of the other two units and are so arranged that no single contingency can inactivate enough engineered safety features to jeopardize plant safety. These systems were designed to meet the following criteria:

"Alternate power systems shall be provided and designed with adequate independency, redundancy, capacity and testability to permit the functions required of the engineered safety features of each unit."

The auxiliary power system meets the above criteria and the intent of Criterion 17 of Appendix A to 10 CFR Part 50. The adequacies of the AC and DC systems are discussed below as are the bases for permitting degraded conditions for AC power.

Capacity of AC Systems

The 4kV auxiliaries of two units in hot shutdown (6.237MVa each) plus the auxiliaries of the one unit with a LOCA (7.754MVa) require a total AC power capacity of 20.228 MVa. The continuous AC power capacity available from the on-site power systems (Keowee Hydro Units) is 22.4 MVa (limited by transformer CT4) if furnished by the underground circuit or 30 MVa (limited by CT1, CT2, or CT3) if furnished through the 230kV off-site transmission lines. Capacity available from the backup 100 kV off-site transmission line (Lee Station Gas Turbine Generator) is 22.4 MVa (limited by CT5).

Thus, the minimum available capacity from any one of the multiple sources of AC power, 22.4 MVa, is adequate.

The adequacy of the Oconee electrical distribution system voltages has been evaluated. Under the conservative assumptions of the analysis, it has been established that a single startup transformer should not be shared between two operating units. In the event a startup transformer becomes inoperable, it effectively causes one onsite emergency power path to the affected unit to become inoperable. The time frames for the degraded mode of an inoperable startup transformer are thus consistent with those for an inoperable onsite emergency power path. Because the preferred mode of unit shutdown is with reactor coolant pumps providing forced circulation and because of the low likelihood of an accident during a 72 hour period, the unit which is being shut down is allowed to share a startup transformer with another unit until the unit is in cold shutdown with loads being powered from the standby buses.

Capacity of DC Systems

Normally, for each unit AC power is rectified and supplies the DC system buses as well as keeping the storage batteries on these buses in a charged state. Upon loss of this normal AC source of power, each unit's DC auxiliary systems important to reactor safety have adequate stored capacity (ampere-hours) to independently supply their required emergency loads for at least one hour. One hour is considered to be conservative since there are redundant sources of AC power providing energy to these DC auxiliary systems. The loss of all AC power to any DC system is expected to occur very infrequently, and for very short periods of time. The following tabulation for the service test demonstrates the margin of installed battery charger rating and battery capacity when compared to one hour of operation (a) with AC power (in amps) and (b) without AC power (in ampere hours) for each of the three safety-related DC systems installed at Oconee:

A. 125 VDC Instrumentation and Control Power System

Charger XCA, XCB, or XCS	a.	600 amps each	
Battery XCA or XCB Capacity (X = 1, 2, or 3)	b.	825 ampere-hours each	
Combined total connected loads on both 125 VDC I & C buses XDCA and XDCB during 1st hour of LOCA (x = 1, 2, or 3)	a.	Inrush (2 sec) - 709 amps next 59 min. - 566 amps	
	b.	568.4 ampere-hours	

B. 125 VDC Switching Station Power Systems

Charger SY-1, SY-2, or SY-s Rating	a.	50 amps each
Battery SY-1 or SY-2 Capacity	b.	160 ampere-hours
Active load per battery during 1st hour of LOCA	a.	Inrush (2 seconds) - 130 amps next 59 min. - 10 amps
	b.	12 ampere-hours

C. 125 VDC Keowee Station Power System

Charger No. 1, No. 2 or Standby Rating	a.	200 amps
Battery No. 1 or No. 2 Capacity	b.	975 ampere-hours
Active load per battery during 1st hour of LOCA	a.	Inrush (14 seconds) - 775.5 amps next 59 min. - 114.7 amps
	b.	125.7 ampere-hours

In addition to the service test, the battery performance test may be conducted every 5 years (per IEEE standard 450), unless there are signs of degradation. Degradation is indicated when the battery capacity drops more than 10 percent of rated capacity from its average on previous performance tests, or is below 90 percent of manufacturer's rating. If there is degradation per above definition, the test should be conducted annually until the battery is replaced or until tests prove the battery is not in a degraded state.

Redundancy of AC Systems

There are three 4160 V engineered safety feature switchgear buses per unit. Each bus can receive power from either of the two 4160 V main feeder buses per unit. Each feeder bus in turn can receive power from the 230 kV switchyard through the start-up transformers, through the unit auxiliary transformer by backfeeding through the main step-up transformer, or from the 4160 V standby bus. Another unit's start-up transformer serving as an alternate supply can be placed in service in one hour.

Under normal unit auxiliary power system alignment, one main feeder bus shall be capable of receiving power from the startup transformer through its associated E breaker. The other main feeder bus shall be capable of receiving power from the standby bus through the appropriate S breaker.

The standby bus can receive power from the hydro station through the underground feeder circuit or from a combustion turbine generator at the Lee Steam Station over an isolated 100 kV transmission line. The 230 kV switchyard can receive power from the on-site Keowee hydro station or from several off-site sources via transmission lines which connect the Oconee Station with the Duke Power system power distribution network.

Redundancy of DC System

A. 125 VDC Instrumentation and Control Power System

The 125 VDC Instrumentation and Control (I&C) Power System consists of two batteries, three battery chargers, and two I&C distribution centers per unit. All reactor protection and engineered safety features loads on this system can be powered from either the Unit 1 and Unit 2 or Unit 2 and Unit 3 or Unit 3 and Unit 1 125 VDC I&C distribution centers. The 125 VDC I&C distribution centers are normally supplied from their associated battery and charger. For one unit, in the event that only one of its batteries and associated chargers are operable, both I&C distribution centers will be tied together allowing operation of the DC loads from the unit's operable battery and charger. As shown above, one I&C battery (e.g., ICA) can supply both I&C distribution centers (e.g., IDCA and IDCB) and their associated panelboard loads. Also, one of the three battery chargers for each unit can supply all connected ESF and reactor protection loads.

In order to find and correct a DC ground on the 125 VDC Instrumentation and Control system each unit's DC system must be separated from the other two units. This is due to the interconnected design of the system. With the backup function disabled the units would be in a degraded mode but would in fact have all of its own DC system available if needed. Each unit's batteries either CA or CB is capable of carrying all the 125 VDC Instrumentation and Control loads on that unit.

B. 125 VDC Switching Station Power System

There are two essentially independent subsystems each complete with an AC/DC power supply (battery charger), a battery bank, a battery charger bus, motor control center (distribution panel). All safety-related equipment and the relay house in which it is located are seismic Category I design. Each subsystem provided the necessary DC power to:

a. Continuously monitor operations of the protective relaying,

b. Isolate Oconee (including Keowee) from all external 230 kV grid faults,

c. Connect on-site power to Oconee from a Keowee hydro unit or,

d. Restore off-site power to Oconee from non-faulted portions of the external 230 kV grid.

Provisions are included to manually connect a standby battery charger to either battery/charger bus.

C. 125 VDC Keowee Station Power System

There are essentially two independent physically separated seismic Category I subsystems, each complete with an AC/DC power supply (charger) a battery bank, a battery/charger bus and a DC distribution center. Each subsystem provides the necessary power to automatically or manually start, control and protect one of the hydro units.

An open or short in any one battery, charger, or DC distribution center, cannot cause loss of both hydro units.

The 230 KV sources, while expected to have excellent availability, are not under the direct control of the Oconee station and, based on past experience, cannot be assumed to be available at all times. However, the operation of the onsite hydro-station is under the direct control of the Oconee Station and requires no offsite power to start up. Therefore, an onsite backup source of auxiliary power is provided in the form of twin hydro-electric turbine generators 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 Duke Power Company (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.

Operation with one Keowee Hydro unit out of service for periods less than 72 hours is permitted. The operability of the remaining Keowee hydro unit is verified within one hour by starting the unit and energizing the standby buses through the underground feeder circuit. This action is repeated once every eight hours thereafter until the Keowee hydro unit is restored to service and will provide additional assurance of the operability of the remaining unit.

Provisions have been established for those conditions in which long term preventative maintenance of a Keowee Hydro unit are necessary. The primary long term maintenance items are expected to be hydro turbine runner and discharge ring welding repairs which are estimated to be necessary every six to eight years. Also, generator thrust and guide bearing replacements will be necessary. Other items which manifest as failures are expected to be extremely rare and could possibly be performed during the permitted maintenance periods. Time periods of up to 45 days for each Keowee Hydro unit are permitted every three years. During these outages the remaining Keowee Hydro unit will be verified to be operable within one hour and weekly thereafter by starting the unit and energizing the underground feeder circuit. The remaining Keowee hydro unit will also be available through the overhead transmission path and will not be used for system peaking. Additionally, the standby buses will be energized continuously by one of the Lee gas turbines through the 100 kV transmission circuits.

This transmission circuit would be electrically separated from the system grid and all off-site non-safety-related loads. This arrangement provides a high degree of reliability for the emergency power systems.

Operation with both Keowee Hydro units out of service is permitted for planned or unplanned outages for periods of 72 or 24 hours respectively. Planned outages are necessary for the inspection of common underwater areas such as the penstock and to enable the removal of one Keowee unit from service. This would be a controlled evolution in which the availability and condition of the offsite grid, startup transformers and weather would be evaluated and a Lee gas turbine would be placed in operation on the isolated 100 kV transmission line prior to commencement of the outage.

A time period of 24 hours for unplanned outages of both Keowee units is acceptable since a Lee gas turbine will be started within one hour and will energize the standby buses through the dedicated 100 kV transmission line. This period of time is reasonable to determine and rectify the situation which caused the loss of both Keowee units.

If the overhead power path from Keowee is inoperable for more than 72 hours due to an extended outage of the Keowee main step-up transformer, both Keowee Auxiliary Transformers (1X and 2X), or Keowee Backup Auxiliary Transformer (CX) operation is permitted provided that certain actions are taken to ensure the quick availability of emergency power. These actions include: continuous energization of the standby buses by a Lee gas turbine through the 100kV transmission circuits; connection of a Keowee unit to the underground feeder path and periodic verification of its operability; and, availability of the remaining Keowee unit to the underground feeder path. Operation in this mode is permitted for a maximum of 28 days, which allows a reasonable period of time to remove the existing transformer and install a replacement.

In the event that none of the sources of off-site power are available and it is considered important to continue to maintain an Oconee reactor critical or return it to criticality from a hot shutdown condition, one of the Lee gas turbines can be made available as an additional backup source of power, thus assuring continued availability as an auxiliary power to perform an orderly shutdown of a unit should a problem develop requiring shutdown of both hydro units.

The power system of the Keowee Hydro station is designed to allow the alignment of each of the two units to the Oconee emergency power systems through either the underground feeder or the overhead path via the main step-up transformer. During an emergency start one of the Keowee units will be aligned to the underground feeder and the other to the overhead path. Each Keowee unit's 600VAC auxiliaries are powered from the unit's generator through a 750KVA auxiliary transformer. Each auxiliary transformer is capable of handling auxiliary loads of both units. Unit's auxiliaries can be aligned to receive power from either transformer by a manual transfer capability at the load center level. A backup 750KVA auxiliary transformer (CX) is provided and powered from Oconee 4KV switchgear 1TC through an underground feeder. Transformer CX is capable of backing up one or both units auxiliary transformers.

Each Keowee unit has a generation capacity of 87.5 MVA and the main step up transformer is rated for 230 MVA. This power capacity exceeds the Oconee emergency power requirements.

Emergency Power Switching Logic Circuits

The Emergency Power Switching Logic (EPSL) in conjunction with its associated circuits, is designed with sufficient redundancy to assure that power is supplied to the unit Main Feeder Buses and, hence, to the unit's essential loads, under accident conditions. The logic system monitors the normal and emergency power sources and, upon loss of the normal power source (the unit auxiliary transformer), the logic will seek an alternate source of power.

Operation of the unit with certain circuits or channels of the EPSL inoperable for test or maintenance is permitted for periods of up to 24 hours, provided that the inoperable circuits/channels are in only one portion, or functional unit, of the EPSL and provided that a sufficient number of circuits/channels in the affected functional unit remain operable such that the functional unit does not lose its ability to perform its designed safety function. These provisions ensure that only one portion of the EPSL is degraded at a time for test or maintenance on the EPSL and that the affected portion remains operable although degraded.

Emergency power system components (transformers, buses, Keowee Hydro Units, etc.) which become inoperable for testing or maintenance cause their associated circuitry (functional units) of the EPSL to become ineffective. Therefore, the operability of these associated functional units is irrelevant and not required. In these cases the controlling Technical Specification for the LCO will be the one associated with the inoperability of the emergency power system component(s). However, all other functional units unaffected by the inoperability of the emergency power system component(s) must meet the requirements of Table 3.7-1 to ensure the operability of the remaining emergency power system.

Also, if the circuits or channels or more than one functional unit are inoperable due to the inoperability of a 125 VDC instrumentation and control panel-board, continued operation is permitted. In addition, the affected functional units must remain capable of performing their designed safety functions in spite of the inoperable circuits/channels. By itself, a 125 VDC instrumentation and control panel-board becoming inoperable could cause a loss of function in portions of the EPSL. For that reason, operation is permitted with an inoperable panelboard only if the EPSL was not in a degraded mode prior to the panelboard becoming inoperable.

In the event that the EPSL is in a degraded mode while the reactor is subcritical, a return to criticality may not be made unless the return to criticality is permitted by a controlling Technical Specification for an emergency power system component(s). However, all functional units of the EPSL not affected by the inoperability of the emergency power system component(s) must be operable prior to return to criticality. This ensures the availability of the EPSL during all reactor startups.

The normal source breakers (N_1 and N_2) provide power to the main feeder busses from the auxiliary transformer under normal power operation of the plant. Under accident conditions the normal breakers open to allow an emergency power flowpath to the main feeder busses. Since there is no emergency closing function, the N_1 and N_2 breakers may be opened and control circuitry deenergized without degrading the capability of the EPSL to perform its intended safety function. Therefore, while the N_1 and N_2 breakers are open, Technical Specification 3.7.2(b) is considered to be satisfied with respect to functional units of the EPSL.

120 VAC Vital Instrumentation Power Panelboards

For each unit, four redundant 120 VAC vital instrument power panelboards are provided to supply power in a predetermined arrangement to vital power, instrumentation, and control loads under all operating conditions. Each panelboard is supplied power separately from a static inverter connected to one of the four 125 VDC instrumentation and control power panelboards. In addition, a tie with breakers is provided to each of the 120 VAC vital panelboards from the alternate 120 VAC regulated bus to provide backup for each vital panelboard and to permit servicing of the inverters.

For each unit, each of the four redundant channels of the nuclear instrumentation and reactor protective system (RPS) equipment is supplied power from a separate 120 VAC vital panelboard. Also for each unit, each of the three redundant engineered safety features actuation system (ESFAS) analog channels and each of the two redundant ESFAS digital channels are powered from separate vital panelboards.

The period allowed for corrective action on an inoperable vital panelboard depends on the loads carried by the affected panelboard. For example, panelboards KVIA and KVIB are allowed to be inoperable for only four hours because they provide power to the digital ESFAS channels, which are in turn allowed to be inoperable for only four hours by Technical Specification 3.5.1. In contrast, panelboards KVIC and KVID carry loads which do not necessarily become inoperable upon loss of power (e.g., RPS channels and ESFAS analog channels go to a tripped state upon loss of power) and thus do not necessitate immediate corrective action. Thus, these panelboards have been limited to a period of inoperability which does not exceed that allowed for their normal source of power, the 125 VDC instrumentation and control panelboards.

In the event that failure of a static inverter results in the inoperability of its associated vital panelboard, the affected panelboard may be tied to the 240/120 VAC regulated power system and unit operation may continue for seven days. This specification allows sufficient time for the inverter to be repaired without penalizing unit operation by permitting the use of alternate power sources.

TABLE 3.7-1

OPERABILITY REQUIREMENTS FOR THE
EMERGENCY POWER SWITCHING LOGIC CIRCUITS

Functional Unit	Minimum Operable Circuits/Channels	
	Normal Operation Per Spec 3.7.1(c)	Degraded Operation Per Spec 3.7.2(b)
1. Normal Source Voltage Sensing Circuits (One per Phase)	3	2
2. Startup Source Voltage Sensing Circuits (One per Phase)	3	2
3. Standby Bus Voltage Sensing Circuits (One per Phase on each bus)	6	4[a]
4. Main Feeder Bus Undervoltage Relays (Three per bus)	6	4[a]
5. Load Shed and Transfer to Standby Circuits (Channels A and B)	2	1
6. Keowee Emergency Start Circuit (Channels A and B)	2	1
7. Retransfer to Startup Circuits (Channels A and B)	2	1
8. Normal Source Breakers N1* and N2 Control Circuitry	4[b]	2[c]

Notes:
a. 2 per bus.
b. 2 trip coils and associated trip circuitry for each breaker.
c. 1 trip coil and associated trip circuitry for each breaker.

*The trip coils and associated trip circuitry for the N_1 and/or N_2 breaker(s) are not required to be operable if the breaker(s) are in the tripped position.

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

ATTACHMENT 2

Technical Justification

Technical Justification

The auxiliary electrical power systems are designed to supply the required engineered safeguard loads of one unit and safe shutdown loads of the other two units and are so arranged that no single failure can inactivate enough engineered safety features to jeopardize plant safety. These systems were designed to meet the following criteria:

> "Alternate power systems shall be provided and designed with adequate independency, redundancy, capacity, and testability to permit the functions required of the engineered safety features of each unit."

This amendment request is comprised of three basic changes: 1) resolution of apparent conflicts regarding operability of Emergency Power Switching Logic (EPSL) functional units, 2) incorporation of operability requirements for Keowee auxiliary transformers, and 3) update of operability requirements for 125 VDC Instrument and Control (I&C) batteries. Changes within each of these areas are described in detail below.

As detailed in Licensee Event Report (LER) 269/87-09 apparent conflicts exist within currently existing Technical Specifications regarding operability requirements for EPSL functional units. The apparent conflicts were incorporated into the specification following an April 30, 1982 amendment request by amendment numbers 117/117/114 as a result of a Reportable Occurrence (RO 287/80-09). RO 287/80-09 described an event in which a unit was returned to power without a safety-grade method for transferring from the normal source to the startup source. A contributing cause of this event was the lack of explicit operability requirements for the EPSL. The reason for the amendment to the specification was to list which components could be taken out of service and not remove both channels of the EPSL.

The EPSL in conjunction with its associated circuits, provides a means for assuring that power is supplied to the main feeder buses and therefore to the essential plant loads under accident conditions. The EPSL monitors the normal and emergency power sources and upon loss of the normal power source, the EPSL will seek an alternate source of power. The first priority as the alternate power source is the unit startup transformer powered from either the plant 230 kV switchyard or from one of the Keowee hydro units via the 230 kV overhead feeder. In the event the startup source is not available, the EPSL will select the standby bus as the alternate power source with power provided from an emergency power source (the other Keowee hydro unit via the 13.8 kV underground feeder). If none of the alternate power sources are available, the EPSL waits until power is available at one of the sources and then selects that source as the emergency power supply. (See figure 1)

When the additions were made to Specification 3.7, a Table (3.7-1) was added to the end of the specification that restricted which components

could be taken out of service. Table 3.7-1 includes restricting the removal of only the control circuitry of the S(1) or the SK(1) breakers from service (likewise for the S(2) and SK(2) breakers), this is due to the fact that portions of EPSL are normally fed from the same control fuses which feed the control power to the S and SK breakers. This would prevent any standby bus from being removed from service. However, T.S. 3.7.1(b) requires only one standby bus to be operable for the on-site emergency power system. Therefore, the specification states that there is only one standby bus required, but it restricts the removal of either of the standby buses. These conflicts caused the operator to misinterpret the specification which resulted in the incident.

There is another confusing factor in the currently existing specification. Specification 3.7.2(a) allows the removal of the Keowee underground feeder and both standby buses for 72 hours for test or maintenance. Meanwhile, Specification 3.7.2(b) allows only one functional unit in T.S. Table 3.7-1 to be removed from service for only 24 hours. This conflict within the specification has led to confusion and various interpretations on how to remove an underground feeder to the standby buses. In order to perform maintenance on the standby buses to assure long term reliability, personnel safety consideration dictate the need to isolate the buses.

The intent of the original Technical Specifications to maintain both EPSL channels operable is preserved by this amendment request. Changes included within this amendment request accurately reflect the versatility of the Oconee emergency power system design.

Changes included within this amendment request resolve these conflicts. Specifically, the conflicts are resolved by:

1) Specification 3.7.1 (b)(1) explicitly details the emergency power flow path requirements for the Keowee underground feeder to a main feeder bus. Existing Specification 3.7.1(b)(1) does not include explicit operability requirements for breakers and defines the flowpath only to a standby bus. This change clearly identifies breakers and defines the power path all the way to the standby bus to main feeder bus breaker.

2) Specification 3.7.1(b)(2) explicitly details the emergency power flowpath requirements for the Keowee overhead feeder to a startup transformer to main feeder bus breaker. Existing Specification 3.7.1(b)(2) does not include explicit operability requirements for startup transformer to main feeder bus breakers and defines the flowpath only to the standby bus. This change clearly identifies the breakers and defines the power path all the way to the startup transformer to main feeder bus breaker.

3) Specification 3.7.1(d) has been further clarified to require each main feeder bus be capable of receiving power from at least one on-site emergency power flowpath.

4) Specification 3.7.2(b) details which specifications are controlling with regard to EPSL functional units. Thus, in situations where equipment is removed from service for test or maintenance, the Limiting Condition for Operation (LCO) of that component is the controlling specification.

5) Specification 3.7.2(c) has been clarified by addition of a reference to Specification 3.7.1(d).

6) Table 3.7-1 has been revised to explicitly include only EPSL functional units by separating breaker/bus availability from EPSL channel availability. Specifically, existing items 8 and 9 (breaker S1, S2, SK1, and SK2 control circuitry) have been combined, operability of this circuitry is implicitly included within retransfer to startup circuitry (new item 7). Restrictions for breakers E1 and E2 have been incorporated into Specification 3.7.1(b)(2).

   Within Table 3.7-1, Notes b and c have been clarified to describe trip coil and trip circuitry operability requirements. In addition, a footnote has been added regarding the normal source breakers N1 and N2. When the N1 and N2 breakers are in the open position, the control circuitry of these breakers has no impact on the ability of the EPSL to perform its intended safety function.

7) The Bases of Specification 3.7 regarding EPSL have been rewritten to provide consistency with the above changes.

The second area addressed within this amendment request regards Keowee auxiliary transformers. A single failure analysis of the Keowee auxiliary power system was performed as a follow-up to the NRC Safety System Functional Inspection (SSFI) at Oconee. The results of the analysis indicated that due to the lack of automatic transfer capability within the Keowee auxiliary power system, LCOs were necessary for Keowee auxiliary transformers (see figure 2) to assure availability of Keowee during a Design Basis Accident (DBA). The following changes address the results of this analysis and constitute additional restrictions not presently included within the Technical Specifications:

1) Specification 3.7.1(j) has been added to require operability of Keowee auxiliary transformers 1X and 2X and the backup auxiliary transformer CX.

2) Specifications 3.7.2(a)(2) through (a)(5) have been added to provide action statements in the event that Keowee auxiliary transformer 1X and 2X or Keowee backup auxiliary transformer CX becomes inoperable.

3) Specification 3.7.8 has been revised to allow inoperability of Keowee auxiliary transformers for longer than the test or maintenance period of 72 hours (as allowed by Specification 3.7.2(a)) provided compensatory measures as detailed in 3.7.8(a), (b), (c), and (d) are taken. This change provides consistency with revisions to Specifications 3.7.1(j) and 3.7.2(a). Unavailability of the Keowee main step-up transformer places the on-site emergency power system in a configuration which is vulnerable to a postulated single failure. Similarly, unavailability of transformers 1X and 2X or transformer CX will place the on-site emergency power system in a configuration which is vulnerable to a postulated single failure. Significant restrictions on operation under the provisions of Specification 3.7.8 are provided, including notification of the NRC within 24 hours.

4) The Bases of Specification 3.7 have been updated to include a discussion of the Keowee auxiliary power system and provide consistency with the above changes.

The third area addressed within this amendment request regards operability requirements for 125 VDC I&C batteries. Tests have been performed at Oconee to determine the load on Instrumentation and Control (I&C) batteries under worst case DBA conditions (i.e. Loss of Offsite Power (LOOP) coincident with an ES actuation). Data from these tests have been analyzed to determine the emergency load and the I&C batteries on each corresponding power panel board. The results of this analysis indicated that the following changes were necessary.

1) 3.7.1 (f) has been reformatted and details operability requirements for the 125 VDC I&C batteries within part (f) 5 based on the results of testing and design analyses. Testing and analyses have indicated that in order to mitigate a DBA with a single failure:

   a) Each unit, when in a cold shutdown condition shall have at least one of that units I&C batteries operable;

   b) For operation of two or three units, five of the six batteries shall be operable;

   c)(1) For operation of Unit 1, three of the following four batteries shall be operable: 1CA, 1CB, 2CA, and 2CB;

   (2) For operation of Unit 2, three of the following four batteries shall be operable: 2CA, 2CB, 3CA, and 3CB;

   (3) For operation of Unit 3, three of the following four batteries shall be operable: 3CA, 3CB, 1CA, and 1CB.

2) Specification 3.7 Bases have been updated to include current acceptance criteria for the battery service test.

In addition to the above change regarding I&C batteries, the following change has been made concerning battery performance testing. Oconee predates battery performance test guidance described in IEEE standard 450. As such, if a performance test was completed, Specification 3.7.2(e) would allow only 24 hours to perform an equalizer change prior to returning the battery to service. It is not possible to complete the equalizer charge in 24 hours. Specification 3.7.2(g) includes an allowable outage time of 72 hours to perform an equalizer charge following a service test (per Specification 4.6.10). Specification 3.7.2(g) has been expanded to allow 72 hours to perform an equalizer charge following completion of a performance test as well. Thus, upon approval of this amendment request Oconee will be capable of more thoroughly testing batteries to ensure that they can fulfill their intended safety function. The Bases of Specification 3.7 have also been updated to include a description of the performance test.

In support of this amendment request the following editorial and administrative changes have been included:

1) Specification 3.7.1(e) details which the three 600-208 volt engineered safety features motor control center buses must be energized (XS1, XS2, XS3).

2) Specification 3.7.2(a) has been renumbered 3.7.2(a)(1) to provide consistency with changes to Specification 3.7.2.

3) Specification 3.7.2(b) has been revised to correct a typographical error. In the last paragraph, "If any event," has been changed to "In any event."

4) Specification 3.7.2(e)(2) has been revised to delete an expired footnote regarding installation of new batteries and battery racks and is clarified to be the Keowee 125VDC power system.

5) Specification 3.7.2(h) details which 240/120 VAC regulated power system the 120 VAC vital instrumentation power panel board must be connected to (KRA).

6) Specification 3.7.4(c) has been revised to correct a typographical error; "...generation of the system grid..." has been changed to "...generation to the system grid..."

7) Bases regarding capacity of AC systems has been updated to provide consistency with the FSAR and delete expired information regarding seismic design of the 125 VDC switching station power system.