16.9 AUXILIARY SYSTEMS

16.9.7 KEOWEE LAKE LEVEL

COMMITMENT:

1. Keowee lake level shall be ≥ 794.15 ft to ensure that the requirements of Technical Specification 3.3.7 (LPSW System Operability) are met for **all three Units**.

2. Two siphon sources shall be operable to ensure that the requirements of Technical Specification 3.3.7 (LPSW System Operability) are met for **Units 1 and 3**.

3. The HPSW system shall be operable to supply sealing water to the CCW pumps to ensure that the requirements of Technical Specification 3.3.7 (LPSW System Operability) are met for **Units 1 and 3**.

4. Maintain lake level ≥ 784.15 ft to assure that the Keowee Oil Storage Room Water Spray System shall be operable.

5. Maintain lake level ≥ 781.15 ft to assure that adequate water supply shall be available for 7 days of Keowee emergency operation.

6. Maintain lake level ≥ 780.60 ft to assure that the Keowee Step-up Transformer Mulsifyre System shall be operable.

APPLICABILITY:

- Commitment #1 is applicable any time the LPSW System is required to be operable for Units 1, 2, or 3.

- Commitments #2 and #3 are applicable any time the LPSW System is required to be operable for Unit 1 or Unit 3. Commitments #2 and #3 are not applicable to Unit 2 due to a different design.

- Commitment #4 is applicable any time the Keowee Oil Storage Room Water Spray System is required to be operable.

- Commitment #5 is applicable any time the Keowee Hydro Station is required to be operable to supply emergency power to the Oconee Units.

- Commitment #6 is applicable any time the Keowee Step-up Transformer Mulsifyre System is required to be operable.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
NOTE: Applicable to Units 1 and 3 only. A. HPSW System not available to supply sealing water to CCW pumps.	A.1 Verify lake level ≥ minimum level required for gravity (non-siphon) flow per Table 16.9-7. OR Verify LPSW pumps are capable of being supplied suction by Unit 2 ECCW per T.S. 3.19. (Note: Unit 2 cannot supply both Units 1 & 2 LPSW pumps and Unit 3 LPSW pumps simultaneously.)	Immediately Immediately
NOTE: Applicable to Units 1 and 3 only. B. Required Action and associated Completion Time for Condition A not met.	B.1 LPSW is inoperable for affected unit(s). Enter Tech. Spec. 3.0 for affected unit(s)	Immediately
NOTE: Applicable to Units 1 and 3 only. C. Only one siphon source available from Units 1 and 3.	C.1 Establish an additional siphon source by starting additional CCW pump(s) on Units 1 or 3. OR Verify LPSW pumps are capable of being supplied suction by Unit 2 ECCW per T.S. 3.19. (Note: Unit 2 cannot supply both Units 1 & 2 LPSW pumps and Unit 3 LPSW pumps simultaneously.) OR Verify lake level ≥ minimum level required	Immediately Immediately Immediately

CONDITION	REQUIRED ACTION	COMPLETION TIME
	for gravity (non-siphon) flow per Table 16.9-7.	
NOTE: Applicable to Units 1 and 3 only. D. Required Action and associated Completion Time for Condition C not met.	D.1 The LPSW system cannot withstand a single failure. Enter a 72 hour LCO per T.S. 3.3.7 for affected unit(s).	Immediately
NOTE: Applicable to Units 1 and 3 only. E. No siphon sources are available from Units 1 and 3.	E.1 Establish additional siphon source(s) by starting additional CCW pump(s) on Units 1 or 3. OR Verify LPSW pumps are capable of being supplied suction by Unit 2 ECCW per T.S. 3.19. (Note: Unit 2 cannot supply both Units 1 & 2 LPSW pumps and Unit 3 LPSW pumps simultaneously.) OR Verify lake level ≥ minimum level required for gravity (non-siphon) flow per Table 16.9-7.	Immediately Immediately Immediately
NOTE: Applicable to Units 1 and 3 only. F. Required Action and associated Completion Time for Condition E not met.	F.1 LPSW is inoperable for affected unit(s). Enter Tech. Spec. 3.0 for affected unit(s)	Immediately
G. Lake level less than 794.15 ft.	G.1 The LPSW system cannot withstand a single failure. Enter a 72 hour LCO per T.S. 3.3.7.	Immediately

CONDITION	REQUIRED ACTION	COMPLETION TIME
H. Lake level less than 784.15 ft.	H.1 Declare the Keowee Oil Storage Room Water Spray System inoperable AND Establish the required fire watch per SLC 16.9.2.	Immediately Immediately
I. Lake level less than 781.15 ft.	I.1 Stop Keowee generation to the grid. AND Notify the Plant Operations Review Committee (PORC) per NSD-308 and Request plant operation (and reportability) guidance.	Immediately Immediately
J. Lake Level less than 780.60 ft.	J.1 Declare the Keowee Step-up Transformer Mulsifyre inoperable AND Establish the required fire watch per SLC 16.9.2.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 16.9.7.1 Monitor Keowee lake level	Each Shift

BASES:

An instrument error of 1.15 ft has been added to the absolute lake level to obtain the indicated lake levels identified in this SLC. The indicated lake levels in this SLC are based on the use of a computer point to verify level. Absolute lake level can be determined at the Keowee Hydro intake structure.

LPSW System Commitments:

UNIT 2:

The CCW system provides the source of water to the CCW crossover piping which supplies suction to the LPSW system. Normally, this crossover header is aligned to all three Oconee units, and CCW pumps provide adequate flow for the requirements of the LPSW systems for all 3 units. To meet the requirements of T.S. 3.3.7, the Emergency CCW (ECCW) system must be capable of supplying suction to the LPSW pumps in the event of a Loss of Off-site Power (LOOP). The ECCW supply to LPSW must be capable of withstanding a single active failure.

After a loss of power to the CCW pumps, the ECCW System for Unit 2 is designed to supply suction to the LPSW pumps using a siphon assisted by the Essential Siphon Vacuum (ESV) pumps. Technical Specification 3.19 establishes requirements for the ECCW and ESV Systems.

UNITS 1 AND 3:

The CCW system provides the source of water to the CCW crossover piping which supplies suction to the LPSW system. Normally, this crossover header is aligned to all three Oconee units, and CCW pumps provide adequate flow for the requirements of the LPSW systems for all 3 units. To meet the requirements of T.S. 3.3.7, the Emergency CCW (ECCW) system must be capable of supplying suction to the LPSW pumps in the event of a Loss of Off-site Power (LOOP). The ECCW supply to LPSW must be capable of withstanding a single active failure.

After a loss of power to the CCW pumps, the ECCW System for Units 1 and 3 is designed to supply suction to the LPSW pumps using an unassisted siphon. To maintain siphon flow capability, the ECCW piping must be relatively air-free and leak-tight. At high lake levels, such as those depicted in Table 16.9-7, gravity flow may be adequate to supply suction to the LPSW pumps without relying on the siphon.

To help maintain ECCW siphon flow capability, HPSW must supply seal water to the CCW pump shafts for Units 1 and 3 to prevent air inleakage that may defeat the siphon. The Elevated Water Storage Tank (EWST) through valve HPSW-25 provides the seal water necessary to the CCW pumps immediately following a LOOP. For longer-term CCW pump restart capability following a LOOP, refer to SLC 16.9.8 for HPSW pump requirements.

If the lake level is greater than 799.26 feet, it is possible to provide adequate suction pressure to the LPSW pumps due to gravity flow without

dependance upon siphon flow. The minimum lake level for gravity flow depends on the number of open CCW pump discharge valves before and during the LOOP event. Since the CCW pump discharge valves remain as is after a LOOP event, the number of open CCW pump discharge valves during a LOOP is the same as the number of open CCW pump discharge valves before the LOOP event. Table 16.9-7 provides the minimum lake level for gravity flow as a function of the number of open CCW pump discharge valves.

To ensure siphon capability will be established in the event forced flow is stopped, the CCW inlet piping from the intake structure to the CCW crossover must be maintained water-solid. Since the Continuous Vacuum Priming connections to the CCW inlet piping are normally isolated, the CCW piping for Units 1 and 3 is maintained water-solid by requiring a minimum number of CCW pumps operating on a given unit. "Water-solid" is defined as sufficient positive pressure to prevent gases from coming out of solution and sufficient flow to ensure accumulated gases will be swept away. The CCW flowpath is maintained water-solid by operating at least three CCW pumps on each Oconee unit being used as a siphon source.

Two siphon sources shall be capable of providing siphon flow to the LPSW pumps. These the two siphon sources shall be from different units. A "siphon source" for Units 1 and 3 is defined as a water-solid flow path consisting of two 8 ft. CCW pump discharge valves open to a common 11 ft. CCW inlet header. One 11 ft. CCW inlet header being supplied by two CCW pumps alone does not constitute a siphon source. This is because a third CCW pump must be running to supply sufficient back-pressure through the other 11 ft. CCW inlet header. Therefore, whenever at least three CCW pumps are operating on a given unit, a water-solid flow path is assured in the 11 ft. CCW inlet header being fed by the two pumps. Running four CCW pumps does not result in two siphon sources on one unit. Therefore, if an additional siphon source needs to be established, this must be done on the unit (Unit 1 or 3) which has less than three CCW pumps running.

The failure of a siphon source for Units 1 and 3 is not postulated since the siphon sources contain no active components. Two siphon sources originating from different units are required to maintain adequate NPSH to each LPSW pump. If only one siphon source is available due to maintenance, testing, etc., then the LPSW System cannot withstand a single failure which causes the loss of an LPSW pump, and a 72 hour LCO shall be entered per T.S. 3.3.7. However, if the Unit 2 ECCW System is fully operable per T.S. 3.19, then Unit 2 may be credited for supplying either the Units 1 & 2 LPSW pumps or the Unit 3 LPSW pumps, and an LCO need not be declared for those pumps being supplied by Unit 2 ECCW. If a 72 hour LCO has been declared because lake level has fallen below 794.15 ft, then at least one siphon source must continue to be maintained to avoid entering T.S. 3.0.

Since Technical Specification 3.19 has been implemented for Unit 2, this SLC does not apply to Unit 2. However, Unit 2 can help in meeting the requirement to maintain two siphon sources for Units 1 and 3. For example, if either Unit 1 or Unit 3 cannot operate three CCW pumps, then Unit 2 may be credited as one of the two required siphon sources provided that both ECCW siphon headers for Unit 2 are operable under T.S. 3.19. Since the Unit 2 ECCW siphon headers rely

on active components, they are vulnerable to active single failures. Therefore, both ECCW headers for Unit 2 must be operable for Unit 2 to qualify as a single siphon source for Units 1 and 3.

ALL THREE UNITS:

With lake level below 794.15 ft, calculations show that the LPSW pumps could experience inadequate NPSH with assisted siphon flow if a single failure causes only the minimum number of LPSW pumps (two for the shared Unit 1 and 2 LPSW System) to be available during a design basis event. Therefore, the LPSW system must be considered unable to withstand a single failure for lake level below 794.15 ft and a 72 hour LCO must be entered per T.S. 3.3.7.

Keowee Oil Storage Room Commitment:

Should lake level fall below 784.15 ft, the Keowee Oil Storage Room water spray system may not provide the required flowrates because the system is dependent on lake level for driving head. For this reason, the spray system should be declared inoperable and the appropriate compensatory actions taken.

Keowee Hydro Station Commitment:

With lake level below 781.15 ft, the water supply (for Keowee Hydro Station to provide emergency power to the overhead path at 46.5 MVA and the underground path at 22.35 MVA) could be inadequate for 7 days of continuous operation at these levels. Neither Keowee Hydro or Oconee Nuclear Station should be considered inoperable at this lake level. Keowee Hydro should not generate to the grid at lake levels below 781.15 ft in order to ensure ample water capacity for emergency power operation.

Keowee Main Start-up Transformer Commitment:

Should lake level fall below 780.60 ft, the Keowee main Step-up Transformer Mulsifyre system may not provide the required flowrates because the system is dependent upon lake level for driving head. For this reason, the Mulsifyre should be declared inoperable and the appropriate compensatory actions taken.

REFERENCES:

1. PIR 0-092-0535, Potential Insufficient NPSH for LPSW pumps

2. LER 269/93-04, Rev. 0 and Rev. 1

3. OSS-0254.00-00-1003, Rev. 8, Design Basis Specification for the CCW System

4. OSS-0254.00-00-1039, Rev. 10, Design Basis Specification for the LPSW System

5. Calculation OSC-2895, Rev. 4, Hydraulic Calculations for Keowee Deluge Systems

6. Calculation OSC-5325, Rev. 0, Keowee Lake Level Uncertainty Calculation

7. Calculation OSC-5304, Rev. 1, Minimum Lake Level for Radwaste Equipment Cooling System Isolation

8. Calculation OSC-5022, Rev. 1, USQ Evaluation for Operability Evaluation of PIR O-092-0535

9. Calculation OSC-2280, Rev. 10, LPSW NPSH and Minimum Required Lake Level

10. Calculation OSC-5349, Rev. 1, Minimum Lake Level Required to Maintain Sufficient NPSH to the LPSW pumps via Gravity Flow

11. Calculation OSC-5670, Rev. 5, Required Number of CCW Intake Flow Paths

12. Calculation OSC-5461, Rev. 1, Isolation of the Continuous Vacuum Priming System to the CCW Intake Piping

13. Calculation OSC-5409, Rev. 4, Single Failure Analysis of the ECCW System Supply to the LPSW Supply

14. Calculation OSC-3528, Rev. 3, Keowee Lake Level Minimum Administrative Limits

15. Technical Specification 3.19, Emergency Condenser Circulating Water, Amendment Nos. 229/230/226 dated April 24, 1998.

TABLES AND FIGURES:

TABLE 16.9-7
MINIMUM INIDICATED LAKE LEVEL FOR
GRAVITY FLOW TO LPSW PUMPS SUCTION

If Keowee lake level $\geq$ minimum lake level in the following table, then gravity flow will provide adequate suction for the LPSW pumps without relying on the ECCW siphon:

Number of CCW Pump Discharge Valves Currently Open	**Minimum Lake Level for Gravity Flow * (Indicated level in feet)**
1	805.06
2	801.79
3	800.85
4	800.37
5	800.08
6	799.87
7	799.71
8	799.59
9	799.48
10	799.40
11	799.33
12	799.26

* Note: These lake levels are based on the assumption that all CCW crossover isolation valves (1CCW-40, 2CCW-41, 3CCW-42 and 3CCW-94) are open. If any of these valves are closed, contact Mechanical Systems Engineering to determine the minimum lake level for gravity flow.

STATION MANAGER APPROVAL _____ DATE 4/30/98

16.9 AUXILIARY SYSTEMS

16.9.8 HPSW PUMP REQUIREMENT TO SUPPORT LPSW

COMMITMENT

Adequate suction to the LPSW Pumps requires water from the CCW system to be supplied. In order for water to be supplied to LPSW from CCW for Units 1 and 3 during a LOCA/LOOP, HPSW is required to support initial CCW siphon flow and subsequent CCW pump restart. This requires BOTH of the following conditions:

1. Two HPSW Pumps shall be operable and capable of restarting prior to complete drain of the Elevated Water Storage Tank (EWST). This is required to provide sealing water for CCW Pump shafts to prevent loss of siphon flow and to provide cooling for the CCW Pump(s) after restart of the CCW Pump(s) for Units 1 and 3.

AND EITHER

2.a. Elevated Water Storage Tank with HPSW-25 functionally operable to provide sealing/cooling water for CCW Pumps.

OR

2.b. Minimum lake level to provide gravity flow to the suction of the LPSW Pumps without dependency on siphon flow. (See SLC 16.9.7)

APPLICABILITY:

Any time the LPSW system is required to be operable. Action statements apply to Units 1 and 3 only.

ACTION:

a. If the HPSW Jockey Pump is unable to maintain EWST level or fill the EWST, it shall be declared out of service.

b. If any two HPSW Pumps (HPSWP "A", HPSWP "B", or Jockey Pump) are removed from service or inoperable, the LPSW system may not be single failure proof. Enter a 72-hour LCO per Technical Specification 3.3.7.b for any LPSW pumps not being supplied by Unit 2 ECCW per Technical Specification 3.19. (Note: Unit 2 ECCW cannot supply Units 1 & 2 LPSW pumps and Unit 3 LPSW pumps simultaneously.)

c. If either of the two Unit 1 Main Feeder Busses is out of service or inoperable, then the LPSW system may not be single failure proof. Enter a 72-hour LCO per Technical Specification 3.3.7.b for any LPSW pumps not being supplied by Unit 2 ECCW per Technical Specification 3.19. (Note: Unit 2 ECCW cannot supply Units 1 & 2 LPSW pumps and Unit 3 LPSW pumps simultaneously.)

d. If three HPSW Pumps (HPSWP "A", HPSWP "B", and Jockey Pump) are removed from service or inoperable at the same time, then the LPSW system is inoperable unless LPSW pumps are capable of being supplied suction by Unit 2 ECCW per Technical Specification 3.19. (NOTE: Unit 2 ECCW cannot supply both Units 1 & 2 LPSW pumps and Unit 3 LPSW pumps simultaneously.) Enter Technical Specification 3.0 for any LPSW pumps not being supplied by Unit 2 ECCW.

e. If the EWST is out of service AND the lake level is not adequate to support gravity flow per SLC 16.9.7, then the LPSW system is inoperable unless LPSW pumps are capable of being supplied suction by Unit 2 ECCW per Technical Specification 3.19. (NOTE: Unit 2 ECCW cannot supply both Units 1 & 2 LPSW pumps and Unit 3 LPSW pumps simultaneously. Also, EWST is considered out of service if HPSW-25 is out of service or if in any way water cannot be supplied from the EWST via the sealing water path to the CCW Pumps or if EWST level cannot be maintained > 70,000 gallons. Enter Technical Specification 3.0 for any LPSW pumps not being supplied by Unit 2 ECCW.

SURVEILLANCE:

Surveillance per SLC 16.9.1 and the Appendix B testing program is adequate to demonstrate the availability of the equipment and systems discussed here.

BASES:

The HPSW system provides support for the LPSW system suction, station fire suppression capability, back-up service water to the TDEFW Pump Bearing and Oil coolers. HPSW system make-up demands are normally met by the HPSW Jockey Pump.

The HPSW system must provide upper guide bearing sealing and motor cooling to the Unit 1 and Unit 3 CCW Pumps to ensure the CCW system can provide a suction supply to the LPSW system. Sealing is required any time the CCW system is in the siphon flow mode of operation. Cooling to the CCW Pump motors is required any time the CCW Pumps are required to operate. The Unit 2 CCW pumps no longer rely upon the HPSW system for these functions, since the Siphon Seal Water (SSW) System, supplied from the LPSW system, fulfills these functions for Unit 2. Under some conditions, the Unit 2 ECCW System can supply adequate suction supply to the LPSW pumps for either Units 1 and 2 or Unit 3 per Technical Specification 3.19. Therefore, the action statements for SLC 16.9.8 allow credit for the Unit 2 CCW supply to the LPSW system if Technical Specification 3.19 requirements are met.

At certain lake levels unassisted gravity flow may be possible. If so, the EWST is not required to support siphon flow by providing sealing of the CCW Pump Upper Guide Bearing to prevent some of the air in-leakage that could defeat the ECCW siphon. However, HPSW is still required to support operation of the Unit 1 and Unit 3 CCW Pumps since procedures

require that the Unit 1 and Unit 3 CCW pumps must be restarted following a LOCA/LOOP.

LPSW takes suction from the CCW crossover header. During certain analyzed accident conditions, a loss of power to the CCW Pumps for all three units must be assumed. This results in a loss of forced flow to the CCW crossover header. Initially, the sealing requirements for Units 1 and 3 are met via the EWST. The duration of the event may last beyond the capability of the inventory of the EWST. Therefore the HPSW Pumps must be capable of being started following a loss of power in order to meet the cooling and seal lubrication requirements of the Unit 1 and Unit 3 CCW Pumps.

The HPSW Jockey Pump is supplied by "load shed" power and would not be available until after the load shed is reset. The CCW Design Basis Document (Section 20.1.1.3) requires a restart of a CCW Pump (for Units 1 and 3) within one and one-half hours (for Units 1 and 3). The load shed must be reset to restart the CCW pump (for Units 1 and 3), thus the power would also be available to the Jockey Pump within that time frame. The Jockey Pump is of smaller capacity, would not meet fire protection capacity requirements, and would take longer to refill the EWST. Therefore, the Jockey Pump is considered as a substitute for an HPSW Pump only for purposes of supporting the siphon or the restart of a Unit 1 or Unit 3 CCW Pump and not for Fire Protection.

The HPSW Jockey Pump is of smaller capacity than HPSW Pumps A and B. Calculation OSC-5945, "HPSW Pump and Fire Protection Flow Test Acceptance Criteria" calculates the accident loads and concludes the HPSW Jockey Pump has sufficient capacity to supply those loads plus system leakage provided it is able to maintain the EWST level or fill the EWST in normal usage. Accident loads plus system leakage are calculated to be approximately the same as normal loads plus normal system leakage.

All three HPSW pumps are powered from the Unit 1 Main Feeder Busses. Backup power to the Unit 1 Main Feeder Busses is not available from another unit. Therefore, if one of the two available Unit 1 Main Feeder Busses is removed from service, then the remaining HPSW pumps are vulnerable to a single failure of the other Unit 1 Main Feeder Bus. This would also result in LPSW not being single failure proof since HPSW is necessary for LPSW operation in the conditions described above. This condition would affect LPSW for all three units.

An EWST level of 70,000 gallons is chosen as the minimum level for EWST operability since this is the lowest level which would exist during normal daily operation. An EWST level of 70,000 gallons is the setpoint at which an HPSW pump in "base" would start to make up to the EWST. This situation would not be expected to occur during normal system operation since the HPSW Jockey pump is capable of maintaining EWST level at 100,000 gallons.

REFERENCES:

1. OSC-5409, Rev. 3, "Single Failure Analysis of the ECCW System Supply to the LPSW System".

2. OSC-5349, Rev. 1, "Minimum Lake Level Required to Maintain Sufficient NPSH to the LPSW Pumps via Gravity Flow".

3. OSC-5945, Rev. 0, "HPSW Pump and Fire Protection Test Acceptance Criteria".

4. PIP 0-O94-0952

5. PIP 0-O94-0995

6. PIP 0-O95-0307

7. PIP 0-O95-0174

8. Oconee UFSAR Sections 9.2.2, 9.5.1, 15.0, Table 9-4, Figure 9-9 through 9-12; 12/31/96 update.

9. Technical Specifications 3.0, 3.3.7, 4.0.4, Table 4.1-2, as amended to 11/21/97.

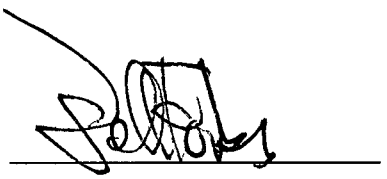
10. Selected Licensee Commitments 16.9.1, 16.9.7, as amended to 9/19/97.

11. OSS-O254.00-00-1002, Rev. 7, "Design Basis Specification for HPSW".

12. OSS-0254.00-00-1039, Rev. 10, "Design Basis Specification for LPSW".

13. OSS-0254.00-00-1003, Rev. 8, "Design Basis Specification for CCW".

14. Letter dated 4/20/94 from J. W. Hampton (Duke) to NRC regarding supplemental information for revision to Tech. Spec. 3.4.

STATION MANAGER APPROVAL  DATE 4/30/98