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 RECIP. NAME RECIPIENT AFFILIATION

SUBJECT: LER 92-014-01: on 920929, relay found to have failed results in inoperability of Keowee Hydro Unit 2 over head emergency power path. Caused by equipment failure. Degraded grid & switchyard isolation functional test performed. W/940105 ltr.

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DUKE POWER

January 5, 1994

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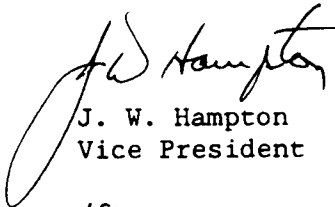
Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 269/92-14, Revision 1

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Revision 1 to Licensee Event Report (LER) 269/92-14, concerning the inoperability of Keowee Hydro Unit 2 overhead emergency power path. This revision includes additional information discovered after the initial report was submitted.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(v)(D). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,


J. W. Hampton
Vice President

/ftr

Attachment

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JEJZ

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) Oconee Nuclear Station, Unit 1	DOCKET NUMBER (2) 05000 269	PAGE (3) 1 OF 8
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TITLE (4) **Equipment Failure Results In The Inoperability of Keowee Hydro Unit 2 Overhead Emergency Power Path and a Technical Specification Violation**

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
09	29	92	92	14	01	01	05	94	Oconee, Unit 2	05000 270
									Oconee, Unit 3	05000 287

OPERATING MODE (9) N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10) 100	<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.405(c)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 73.71(b)
	<input type="checkbox"/> 20.405(a)(1)(i)	<input type="checkbox"/> 50.36(c)(1)	<input checked="" type="checkbox"/> 50.73(a)(2)(v) (D)	<input type="checkbox"/> 73.71(c)
	<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> OTHER
	<input type="checkbox"/> 20.405(a)(1)(iii)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)
	<input type="checkbox"/> 20.405(a)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
	<input type="checkbox"/> 20.405(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME S. G. Benesole, Safety Review Manager	TELEPHONE NUMBER (Include Area Code) (803) 885-3518
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
F	EK	RLY	W121	Y					

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)			
YES (If yes, complete EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/>	NO		MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On September 29, 1992 at 2200 hours, Oconee Units 1 and 2 were operating at 100 percent Full Power and Unit 3 was operating at 30 percent Full Power and increasing. While performing post-modification testing a relay was found to have failed resulting in the inoperability of Keowee Unit 2's overhead emergency power path. Technical Specification 3.7 requires both Keowee Hydro (KH) units and both power paths from KH to be operable. The relay was repaired and retested. The root cause of this event is Equipment Failure. Corrective actions include inspecting and repairing if necessary other MG-6 type relays at Oconee.

**LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION**

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

BACKGROUND

In the event of an accident and the simultaneous loss of the external transmission grid, the Keowee Hydro (KH) units [EIIS:EK] become the primary emergency power source.

The KH Station contains two generating units. Power from KH to the Oconee units can be supplied through two separate and independent paths.

One path is an overhead 230 Kv transmission line to the 230 Kv switchyard yellow bus [EIIS:FK] at Oconee which supplies each unit's start-up transformer. The overhead transmission line is arranged with parallel double air circuit breakers (ACB 1 & ACB 2) so that it can be connected to either KH unit.

The second path is an underground cable feeder to the Oconee transformer CT-4 [EIIS:XFMR] which supplies the redundant standby power buses. The underground feeder is arranged with parallel air circuit breakers (ACB-3 & ACB-4) so that it, too, can be connected to either KH unit (See Attachment 1). This underground feeder is connected, at all times, to one KH generator [EIIS:GEN] on a predetermined basis and is energized along with CT-4 whenever the associated KH unit is in service. The underground feeder and associated transformer (CT-4) are sized to carry full engineered safeguards loads of one Oconee unit plus the auxiliary loads required for safe shutdown of the other two Oconee units.

Each KH unit is provided with its own automatic start-up equipment. Both units undergo a simultaneous automatic start on a loss of the grid, an engineered safeguards actuation on any of the three Oconee units or an extended loss of voltage on any unit's main feeder bus. On an emergency automatic start-up, the unit connected to the underground feeder supplies that feeder. If there is a grid disturbance, the other unit is automatically connected to the Oconee 230 Kv switchyard yellow bus only after the yellow bus is automatically isolated from the grid. Therefore, in the event of a Loss of Coolant Accident and the simultaneous loss of the grid, emergency power is available from either KH unit through the underground feeder or the overhead transmission line.

If power is not available from the grid or the KH units, power can be made available to the standby power buses from one of the Lee Steam Station combustion turbines (CT). The power is provided through a 100 Kv transmission line from the Lee CT's via the Central switchyard to Oconee's CT-5 transformer. If an emergency occurs that would require the use of this 100 Kv line it can be isolated from the balance of the transmission system in order to supply power to Oconee. One of the Lee CT's can be started and supply power within one hour.

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Technical Specification 3.7 requires both KH units and both power paths from KH to be operable. One KH unit may be removed from service for 72 hours if the other KH unit is tied to the underground power path and proven operable. Both KH units may be inoperable for up to 72 hours for planned reasons if the standby buses are first energized from CT-5 transformer using the dedicated line from the Lee CT's. This last limiting condition for operation is reduced to 24 hours if both KH units are inoperable for unplanned reasons and the Standby Bus is energized from a dedicated Lee CT within 1 hour.

EVENT DESCRIPTION

On May 15, 1992 a Self-Initiated Technical Audit was completed for the Electrical Distribution System at Oconee Nuclear Station. The audit team was comprised of Duke Power personnel and Contractor personnel. A section of this audit covered the Keowee Hydro Generators that supply emergency power to Oconee. A recommendation was made that engineering develop a formal single failure analysis of the Keowee Hydro (KH) Units operating in parallel with the off site network to ensure that all possible scenarios are reviewed and properly evaluated with formal calculations.

On August 25, 1992, engineering was in the process of performing the single failure analysis. It was concluded that during a design basis event of a Loss of Coolant Accident/Loss of Off site Power, a single failure could cause the overhead path Air Circuit Breaker (ACB) 1 or 2, for the unit aligned to the underground, to close. This would tie the two KH Units together, possibly out of phase. The KH Units were declared inoperable on August 26, 1992. This event was documented in LER 269/92-11. Corrective actions included modifying the ACB's control circuitry to preclude the postulated failure.

On September 29, 1992, at 1029 hours a Limiting Condition for Operation (LCO) was entered, to perform a modification on ACB(s) 1 and 2. The modification included installing interlocks so that ACB 1 and ACB 2 could not be closed simultaneously.

On September 29, 1992 at 2200 hours, Oconee Units 1 and 2 were operating at 100 percent Full Power and Unit 3 was operating at 30 percent Full Power and increasing. During the performance of post-modification testing, it was discovered that ACB 2 did not close immediately after opening ACB 1 as the procedure required. An investigation was initiated immediately to determine the reason ACB 2 did not close as required. The investigation revealed that relay 27T2X (Westinghouse MG-6 style 289B360A22, 115 volts, 60 hertz) had a one half inch gap instead of the seven sixteenths inch gap as specified by manufacturer. The plastic armature stop nut broke apart

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while the technician was adjusting the gap between contacts. This relay was unaffected by the modification. The relay was repaired by installing a new armature stop nut and adjusting the contacts in accordance with the manufacturers bulletin. The post-modification testing was performed again as required by procedure and ACB 2 operated as required.

A subsequent investigation into other MG-6 relays at Keowee to verify stop nut condition and proper armature gap, revealed two other relays with the plastic armature stop nut missing. These relays were tested and functioned as required. Work Orders were written to replace the plastic stop nut on these relays.

On September 30, 1992 at 1236 hours, it was concluded that KH Unit 2 overhead power path had been inoperable for an undetermined amount of time due to the failure of relay 27T2X.

On September 30, 1992 at 1402 hours, the KH overhead power path was declared operable after completing modifications and testing. KH returned to a normal alignment with KH Unit 2 aligned to the underground power path and KH Unit 1 aligned to the overhead power path.

CONCLUSIONS

The root cause of Keowee Unit 2's overhead power path inoperability is Equipment failure. The failure of the relay associated with Air Circuit Breaker 2 resulted in the inability of Keowee Unit 2 to energize the overhead power path. The failure of the relay is mechanical rather than electrical. The relay was repaired and retested and performed its required function. The manufacturer recommends cleaning the contacts periodically, however, they do not recommend verifying the gap. The relays are shipped from the factory correctly adjusted, and it should not be necessary to disturb the adjustment. Oconee Nuclear Station utilizes this type relay in many applications throughout the plant and at Keowee. Many of these relays have been in place for approximately 20 years. The failures noted in this LER appear to be age related. Of the seven relays inspected three were identified with the armature stop nut in a degraded state. Therefore it is concluded that, in order to address this problem all MG-6 relays should be inspected and the results of this inspection be used to develop an appropriate Preventive Maintenance program. It should be noted that a pre-operational functional test (Auto Emergency Startup of Keowee) was successfully completed on February 16, 1972, but no requirement existed for subsequent periodic testing. The Keowee Design Basis Document recognized this deficiency and established a requirement for additional testing. The Degraded Grid and Switchyard Isolation Functional test was successfully completed in May 1993 and will be performed periodically.

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A review of Oconee Problem Investigation Reports over the last years revealed several events had occurred which involved equipment failures. However, none of these equipment failures were found that were related to age. Therefore, this event is considered non-recurring.

The equipment failure of Westinghouse relay MG-6 style 289B360A22 is NPRDS reportable. This event did not involve radioactive releases, exposures to radiation, or personnel injuries.

CORRECTIVE ACTIONS

Immediate

1. The relay was repaired by replacing the plastic stop nut, adjusting the gap according to manufacturer's bulletin and retesting the relay to ensure the operability.

Subsequent

1. The Degraded Grid and Switchyard Isolation Functional Test was performed May 1993.

Planned

1. Inspect and repair other MG-6 type relays at Oconee Nuclear Station and Keowee.
2. Based on the results of planned action 1 develop and implement an appropriate Preventive Maintenance program for MG-6 relays.
3. (Moved to subsequent corrective action number 1)

SAFETY ANALYSIS

Keowee Hydro Station provides an emergency power source to Oconee Nuclear Station for scenarios which involve a Loss of Offsite Power (LOOP). As mentioned earlier in this report, Keowee can feed Oconee through either an overhead or an underground path. Additionally, in the event both Keowee Units are unavailable, the busses connected to the underground path can be supplied from the Central Switchyard or from Lee Steam Station (Lee) Gas Turbines via dedicated lines.

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Each Keowee Unit shall be capable of starting and accelerating without AC power to either of its auxiliaries. A review of the Final Safety Analysis Report (FSAR) indicates that the worst case accident for this event is a LOOP affecting all three Oconee units and a concurrent Loss of Coolant Accident (LOCA) on one unit.

FSAR 15.8.3 addresses a simultaneous LOOP event on all three units. This analysis shows that natural circulation of the Reactor Coolant System (RCS) [EIIS:AB], Turbine Driven Emergency Feedwater System [EIIS:BA], Condenser Circulating Water gravity induced flow, and gravity insertion of the control rods [EIIS:ROD] are among the design features provided to ensure the removal of decay heat for the RCS without offsite power being available. Additionally, FSAR Section 15.8.3 states that "Each reactor can sustain a complete electrical power loss without emergency cooling for about 23 minutes before the steam volume in the pressurizer is filled with reactor coolant" and that "beyond this time reactor coolant will boil off, and an additional 83 minutes will elapse before the boil off will start to uncover the core." Therefore, even without cooling from the Turbine Driven Emergency Feedwater Pump or the Standby Shutdown Facility, the FSAR states that core uncover will not occur for 106 minutes after the initial loss of power.

In a scenario involving a LOOP affecting all three Oconee units and a concurrent LOCA on one unit, Emergency Feedwater and/or the SSF would not be able to assist in mitigating the LOCA. FSAR 15.14.3.3.6 states that "The failure of transformer CT-4 has been identified as a more limiting single failure for the large break LOCA. With the assumed LOOP, this single failure results in a 48 second delay until Emergency Core Cooling System fluid is delivered to the RCS." If an event had occurred that would have rendered the normal power source to 1X and 2X inoperable, the alternate power source could have been aligned by the manual operation of ACB-8 or ACB-7 breaker. Several factors allow time for this manual operation to occur: 1) ACB-8 and ACB-7 are manually operable, 2) Keowee Station is manned 24 hours per day, 3) Keowee Batteries can carry the DC loads for approximately one hour, 4) Keowee Alarm Response Manual directs the operator on a loss of voltage to the 600 VAC Switchgear (1X and 2X) to verify feeder breaker tripped and close the alternate breaker, 5) the Keowee governor controls can be operated four and one half full cycles of the wicket gates before depleting the accumulator pressure (1 1/2 to 2 cycles are required for start-up, then minor changes afterwards). During a normal start the accumulator low trip of 250 psi will trip the Unit, but during a emergency start this trip is bypassed. Therefore, power can be regained manually to 1X or 2X within a short time once the event is recognized.

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However, even though technically inoperable, Keowee would still have been able to respond in a significant manner. Even in the condition described in this event, if a LOOP or LOCA/LOOP had occurred, Keowee Unit 2 would have responded to an emergency start signal by starting up with all necessary support systems powered by the Keowee DC Battery System and compressed air stored in an accumulator. Keowee would have been able to operate for an indeterminate time, during which the Keowee operator on duty should have time to diagnose the loss of AC power with the use of existing Abnormal Procedures and manually close ACB-8 to connect to the alternate power source.

The probability of core damage (per year) from the inoperability of Keowee Unit 2's overhead power path, as described in this report, is very small (around 5.0E-08).

As described above, emergency power would have been available, and even if a LOCA/LOOP had occurred during this time, the health and safety of the public would not have been endangered.

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ATTACHMENT 1

