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RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 92-019-00:on 921210,determined that postulated fault could cause loss of emergency power sys due to design deficiency.C/A included mods to Keowee control circuitry to preclude postulated failure.W/930111 ltr.

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January 11, 1993

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Subject: Oconee Nuclear Site
Docket Nos. 50-269, -270, -287
LER 269/92-19

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 269/92-19, concerning a postulated single failure that could result in the loss of the emergency power system.

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,

NB Rainon for

J. W. Hampton
Vice President

/ftr

Attachment

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NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

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.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit One	05000 269	1 OF 08

TITLE (4) Postulated Single Failure That Could Result In The Loss Of Emergency Power System As Result Of A Design Deficiency

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
									Oconee, Unit Two	05000 270
12	10	92	92	-- 19 --	00	01	11	93	Oconee, Unit Three	05000 287

OPERATING MODE (9)	N
POWER LEVEL (10)	100%

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
	20.405(a)(1)(i)		50.36(c)(1)	X	50.73(a)(2)(v) (D)		73.71(c)
	20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		OTHER
	20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		(Specify in Abstract below and in Text, NRC Form 366A)
	20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
	20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
S. G. Benesole, Safety Review Manager	(803) 885-3518

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

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

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

On December 10, 1992 at 1200 hours, Oconee Nuclear Station Units 2 and 3 were operating at 100 percent Full Power and Unit 1 was at cold shutdown conditions. Because of a Self Initiated Technical Audit recommendation, a single failure analysis for the Keowee Emergency Power System was being performed. Oconee Engineering determined that a postulated fault could cause the Keowee Hydro Units (KHU) to isolate from the overhead path and cause the loss of auxiliary power to the KHU aligned to the underground path. This would render the KHU aligned to the underground and the overhead emergency power path inoperable. The root cause of this event is classified as Design Deficiency (Unanticipated interaction of System or Component - Design Oversight). In response to an unrelated event, corrective action was taken on October 22, 1992 that required the auxiliary power source for the underground KHU to be aligned to the transformer, CX, which is supplied from Oconee Nuclear Station Unit 1 and the auxiliary power source for the overhead path KHU was aligned to the normal source, which is supplied by the overhead path KHU. This action eliminated the possibility of this scenario. Additional actions will be to implement a system modification to allow return to normal configuration, and to continue the evaluation of the single failure analysis.

BACKGROUND

The Keowee Emergency Power System (EIIS:EK) consists of two hydroelectric generators that provide an emergency on-site power source for Oconee Nuclear Station via two separate and independent paths. One path is the underground feeder through transformer CT-4 (EIIS:XFMR) and the Standby Buses (EIIS:EB) and the other is the overhead path through the 230 KV Switchyard (EIIS:FK).

Either Keowee Hydro Unit (KHU) can be tied to the underground or overhead power path. The normal lineup is to dedicate one KHU to the underground emergency power path by closing Air Circuit Breakers (ACB) -3 or 4 and to align the other KHU to the overhead power path through ACB-1 or 2 (See Attachment 1).

The Keowee 600 VAC Load Centers 1X and 2X will provide power to the Keowee auxiliary loads. Keowee's Auxiliary Load Centers 1X and 2X receive their normal, non-emergency power from the 230 KV switchyard via Keowee's Main Step-up Transformer through ACB-5 and ACB-6. An alternate power source is provided to 1X and 2X Load Centers from Oconee Unit 1's 4160 VAC Switchgear (1TC) through Keowee's CX Transformer and the Alternate Feeder Breakers ACB-7 and ACB-8. Each Keowee Unit can start and accelerate without AC power from either of its auxiliary sources. This condition is known as a "Black Start."

A network of current transformers, differential relays and lockout relays are employed to monitor and isolate faults on the Keowee electrical distribution buses. Faults are detected by comparing the conditions of various zones within the electrical distribution system. If a fault is detected, the fault detection system trips the necessary breakers to isolate the fault from the rest of the system. The relays are set to accomplish this fault detection and clearing as rapidly as possible, to limit the damage resulting from the fault. The relay schemes are also designed to minimize equipment outage by de-energizing only the smallest section of the system necessary to clear the fault.

Technical Specification 3.7 requires both Keowee units and both power paths from Keowee to be operable. The Keowee station auxiliary transformers (1X and 2X) and alternate auxiliary transformer (CX) are included in this requirement. One Keowee unit may be removed from service for 72 hours. Both Keowee units may be inoperable for up to 72 hours for planned reasons if the standby buses are first energized from CT-5 using the dedicated line from the Lee Gas Turbines. This last limiting condition for operation is reduced to 24 hours if both Keowee units are inoperable for unplanned reasons and the Lee Gas Turbine is aligned to the Standby Bus within 1 hour.

EVENT DESCRIPTION

On May 15, 1992, a Self-Initiated Technical Audit of the Emergency Power systems at Oconee Nuclear Station recommended a formal single failure analysis be documented for the conditions where both Keowee Hydro Units (KHU) are generating to the grid.

On October 22, 1992, an event occurred which required a "dedicated alignment" be established concerning the Auxiliary Power system at Keowee. The "dedicated alignment" included aligning alternate auxiliary power (CX) to the KHU connected to the underground. The other KHU was aligned to receive auxiliary power via the main step-up transformer, through Air Circuit Breaker (ACB) -5 or 6. The transfer logic was placed in manual. This event was reported under LER 270/92-04.

On December 10, 1992, at 1200 hours, with Oconee Nuclear Station Units 2 and 3 operating at 100 percent Full Power and Unit 1 at cold shutdown conditions, Oconee Engineering was in the process of performing the single failure analysis. It was discovered that, during a Loss of Coolant Accident concurrent with a degraded grid event, a postulated fault between the Load Center side of the Normal Supply breaker (ACB-5 or ACB-6) and the Load Center (1X or 2X) for the KHU aligned to the underground could have affected the operability of both KHUs prior to entering the "dedicated alignment" on October 22, 1992. This postulated fault would have been detected by the transformer fault detection relaying (87T1X or 87T2X) and the supply breakers' (ACB-5, 6, 7, and 8) overcurrent device, which picks up auxiliary bus lockout relays (86S/1X or 86S/2X). The 87T1X or 87T2X relays would actuate the Main Transformer Lockout Relay (86T) locking out the overhead power path by opening both KHU's overhead breakers (ACB-1 and ACB-2) and the Oconee 230 KV Switchyard tie breakers (PCB-8 and 9). The 86S/1X or 86S/2X relays would actuate to lock out the 1X or 2X Normal Feeder breakers (ACB-5 or ACB-6), the Alternate Feeder breakers (ACB-7 or ACB-8) and block automatic swapover. The KHU aligned to the underground path would be functional and would "Black Start" if required, providing power through the underground emergency power path for a limited time. However, it would be considered inoperable due to the loss of its Auxiliary Load Center power supply. The other KHU would remain functional, but could not generate to the overhead or the underground paths because its overhead breaker would be locked open and it's underground breaker would not automatically close. Manual alignment via the Keowee and/or the Oconee Control Rooms were available.

From December 10 through December 15, 1992, the credibility of this postulated fault was evaluated. At 1600 hours, on December 15, Oconee Engineering determined that the postulated fault was credible, but only

during breaker movement. ACB-5 and ACB-6 are required to cycle during a Loss of Coolant Accident for Oconee units 2 or 3 coupled with a degraded grid situation. Therefore, in the past, all three ONS units have been in operation while this vulnerability existed. Presently, the Keowee Auxiliary power system is in a "dedicated alignment", which does not require breaker movement for the KHU connected to the underground path and thus precludes any credible fault from affecting both emergency power paths. For this reason, no Limiting Condition for Operation was entered upon discovery of this problem.

On December 15, 1992 at 1732 hours, the NRC was notified of this potential past operability.

CONCLUSIONS

The design of the Keowee Hydro Units (KHU) included safety provisions to ensure their reliability as the emergency power source for Oconee Nuclear Station (ONS). Protective relaying is a standard electrical design, however, single failure criteria was not properly applied to the protective zone between the Load Center incoming breaker and the Load Center itself. Therefore, the root cause of this event is classified as Design Deficiency (Unanticipated Interaction of System or Component - Design Oversight).

The establishment of the "dedicated alignment" of the Keowee Auxiliary Power system on October 22, 1992 removed the possibility of this postulated failure occurring. If this postulated fault were to occur on either Load Center (1X or 2X) while in this alignment, an overhead or underground path would be available to supply emergency power to ONS.

The control circuit will be modified to preclude this postulated failure from affecting both KHUs before restoring the Keowee Auxiliary system to automatic transfer mode.

Oconee Engineering will complete the documentation of the single failure analysis of KHUs' electrical distribution system.

A review of past Problem Investigation Reports for the last two years indicates several problems which potentially result in the inoperability of the KHUs. Several of these problems involved design deficiencies from a failure to anticipate interaction of components. On October 12, 1992 at 1810 hours, the single failure analysis discovered a similar postulated fault within the zone protection overlap region of the KHU output breakers [Air Circuit Breaker (ACB) -1 or 2]. This event was reported under LER 269/92-016. KHU-2 was aligned to the underground path and the disconnects for the overhead power path were opened. This removed the differential

relay overlap region and essentially prevented the ACB from closing and prohibited the KHU tied to the underground from supplying power to the overhead path. The other KHU would automatically align to the overhead path. Based on this review, this problem is considered recurring. As with the problem addressed in this report, many of these deficiencies were discovered as a result of an ongoing review of the Keowee electrical system by Oconee Engineering. Because this problem existed since the initial design of the Keowee electrical system, the corrective actions for previously identified problems could not have prevented this situation. Enhancements in the design process since the original design should prevent this type of design oversight in future designs.

This postulated event did not involve equipment failure and therefore was not NPRDS reportable.

CORRECTIVE ACTIONS

Immediate

1) Confirmed that the existing lineup of the Keowee Hydro Units, which was being administratively maintained for other reasons, would also preclude this postulated event.

Subsequent

1) None

Planned

1) Implement modifications to the Keowee breaker control circuitry to preclude the postulated failure as described in this report.

SAFETY ANALYSIS

A fault occurring in the area protected by the transformer differential relay and the Load Center supply breaker overcurrent protection device (between Normal supply breaker and the Load Center) on the unit aligned to the underground path, would result in a trip and lockout of the auxiliary Load Center's Normal and Alternate Feeder breakers, the overhead path breakers, and the Oconee Switchyard Tie breakers. A similar postulated fault on the unit aligned to overhead power path would affect the overhead unit only.

FSAR Section 8.1 describes an alternate power alignment for emergency off site power that would connect the 100 Kv transmission line from Lee Steam Station's Combustion Turbines (CT) to Oconee's standby power buses. If the CT's are not running when they are needed, a period of about 15 to 60 minutes would elapse before power could be obtained from the CT's. Otherwise, the alternate power alignment would be from the Central Switchyard. This time to establish an alternate power source to the Oconee standby buses is within the estimated time frame for operability of the Keowee batteries and air accumulators. The KHU would have been able to operate for an indeterminate time (estimated at 60 minutes). Therefore, the KHU should be available to power the LOCA unit with power until the CTs are connected to the standby power buses.

Although, this event includes a degraded grid it is bounded by the following analysis. FSAR Section 15.8.3 addresses a LOOP event on all three units. This analysis shows that natural circulation of the reactor coolant system [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 from the reactor coolant system without off site 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 have elapsed before the boil off will start to uncover the core". Therefore, the 106 minutes given in the FSAR for core uncovering is well beyond the 60 minute time frame for establishing emergency power from the CT's.

Another alternative for mitigating the consequences of the loss of power to units not subject to a LOCA would be the Standby Shutdown Facility (SSF). The SSF has the capability to bring the units to hot shutdown without on-site or off-site power available.

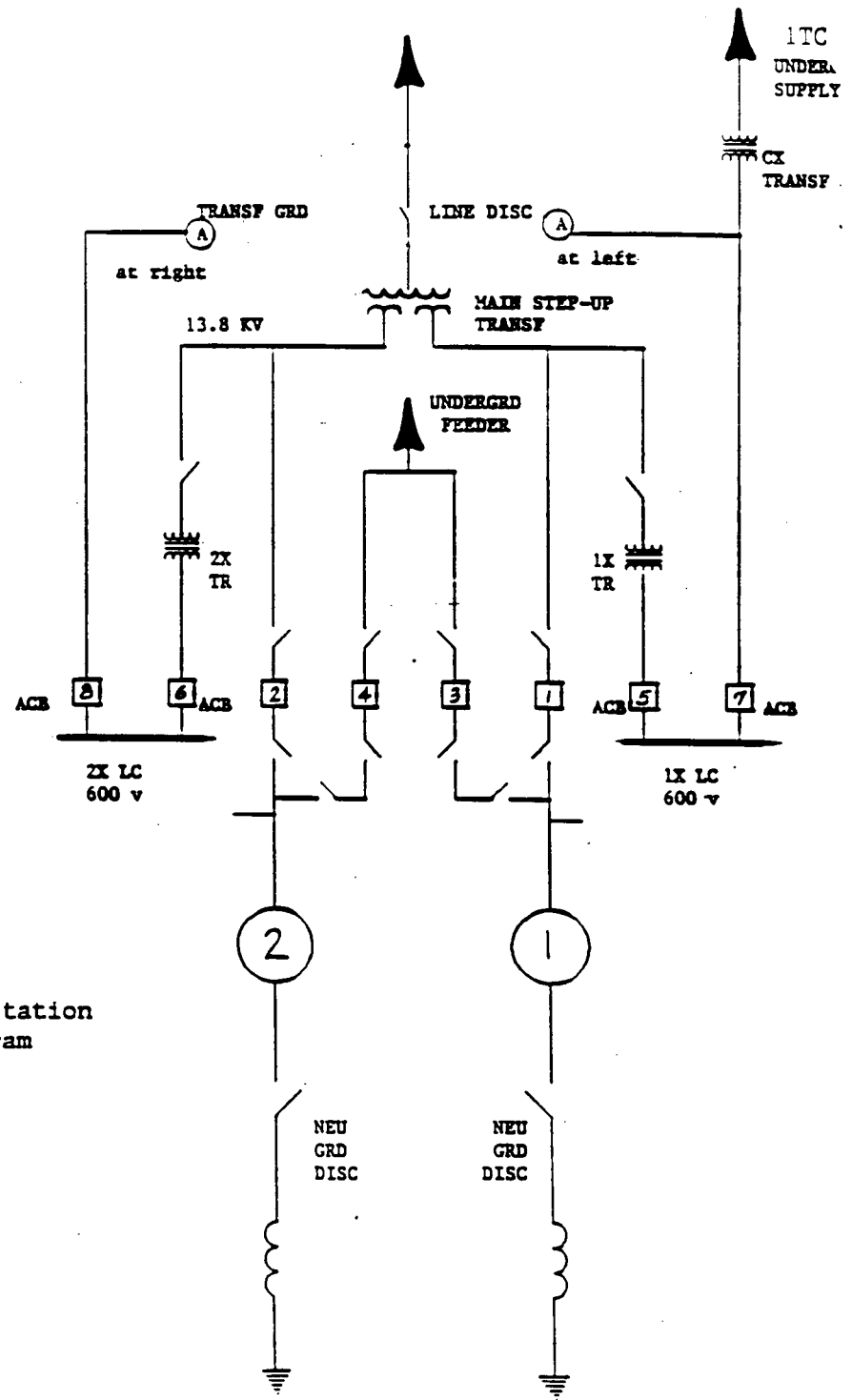
In a scenario involving a Loss of Offsite Power (LOOP) affecting all three Oconee units and a concurrent Loss of Coolant Accident (LOCA) on one unit, Final Safety Analysis Report (FSAR) 15.14.3.3.6 states that "With the assumed LOOP, this single failure results in a 35 second delay until Emergency Core Cooling System fluid is delivered to the RCS." If a LOCA/LOOP occurred, the KHU tied to the underground would respond to an emergency start signal by starting with all necessary support systems powered by the Keowee DC battery System and compressed air stored in an accumulator.

The event can be further mitigated by manual operation by the Keowee Operator and the Oconee Control Room Operator. They should have time to diagnose the loss of AC power at Keowee and manually close Air Circuit Breaker (ACB) -3 or 4 to energize the underground power path.

The frequency of a LOCA/degraded grid scenario with a simultaneous postulated fault within the region of concern is considered extremely low, well below the 6.0 E-08 threshold considered in Probability Risk Assessments. This type of failure has not occurred with these breakers or their control circuits.

As described above, emergency power should have been available, even if a LOCA/degraded grid had occurred during this time. Therefore, the health and safety of the public were not compromised by this postulated failure. There were no releases, radiation exposures, or injuries associated with this event.

ATTACHMENT 1



Keowee Hydro Station
One-line Diagram
AC system