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SUBJECT: LER 89-010-02:on 890608,central switchyard used as unacceptable offsite power source due to mgt deficiency.

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DUKE POWER

August 15, 1989

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

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 269/89-10, Revision 2

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 269/89-10 concerning the use of the Central Switchyard as an unacceptable offsite power source. This revision corrects a typographical error in the heading of the LER.

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,

M. S. Tuckman

M. S. Tuckman
Station Manager

SWB/ftr

Attachment

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NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	1 OF 0 7

TITLE (4) Central Switchyard Was Used As An Unacceptable Offsite Power Source As A Result Of A Management Deficiency

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 6	0 8	8 9	8 9	0 1 0	0 2	0 7	1 0	8 9	Oconee, Unit 2	0 5 0 0 0 2 8 7
									Oconee, Unit 3	0 5 0 0 0 2 8 7

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
N		20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)		20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
1 0 0		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		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
	AREA CODE
Henry Lowery, Chairman OSRG	8 0 3 — 8 8 5 - 3 0 3 4

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 fifteen single-space typewritten lines) (16)

On June 8, 1989, with Unit 1 and 3 at 100% full power and Unit 2 in a refueling outage, it was determined that the Central Switchyard could not be used as an offsite power source because it does not meet the Nuclear Regulatory Commission's requirements for degraded grid protection. This condition was discovered by Design Engineering during a follow-up item for the Lee Gas Turbine review in which the Central Switchyard was analyzed as an offsite power source. The root cause of this incident was determined to be a Management Deficiency, Deficient Communication. Immediate corrective actions included issuing a training package to all Operations personnel and revising OP/0/A/1107/03 (100 kv Power Supply) procedure eliminating Central Switchyard as a power source to the Standby Buses.

BACKGROUND

Final Safety Analysis Report (FSAR) Section 8.2.1.3 states that each Oconee unit is provided with two physically independent offsite power sources. One is the circuit from the 230 kv switchyard through the Startup (CT) transformer. The second is backcharging the Main transformer from the 230 kv switchyard through the Auxiliary (T) transformer to the Main Feeder Buses (MFB) [EIIS:EA].

Before 1981, there were no Nuclear Regulatory Commission (NRC) requirements for degraded grid protection although the Oconee switchyard was equipped with such protective relaying. In 1982, an NRC bulletin questioned Duke's protective relaying on these offsite power sources due to problems experienced at other utilities. A design evaluation to address these questions was initiated and a response submitted to prove that there was no possibility of spuriously tripping these offsite power sources due to degraded voltage conditions. The only sources considered were the two offsite power sources as stated in the FSAR. Central Switchyard was not considered as a part of this analysis.

Oconee has an undervoltage relaying system which can separate the auxiliaries from analyzed offsite supplies if they experience degraded conditions. This system is the External Grid Trouble Protection (EGTP) system. The EGTP monitors the voltage and frequency of both the red and yellow 230 kv buses in the Oconee switchyard. When a degraded voltage or frequency condition is sensed, the system isolates the switchyard from the system grid, starts both Keowee units, and aligns the switchyard to distribute power from the appropriate Keowee unit to the unit Startup transformers through the 230 kv overhead line.

The Standby Buses supply 4160 volt power to the MFBs when power from the Main or Startup transformers [EIIS:XFMR] is unavailable. The Standby Buses can receive power from either transformers CT-4 or CT-5. Transformer CT-4 receives power from a Keowee hydro [EIIS:EK] unit via the underground feeder path. Transformer CT-5 receives power from either the Lee Gas Turbines [EIIS:EK] or the Central Switchyard. Lee Gas Turbines are connected to CT-5 via a 100 kv transmission line. This single 100 kv circuit from Lee is connected to the 100 kv transmission system through the substation at Central. When needed, the 100 kv line from Lee Steam Station can be manually isolated from the transmission system at Central to supply power to Oconee.

During refueling outages, the Standby Buses can be charged via the CT-5 transformer from the Central Switchyard to power the MFBs allowing work on the units' Auxiliary (T) transformers and certain electrical tests.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	8 9	— 0 1 0	— 0 2	0 3 OF 0 7

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

EVENT DESCRIPTION

On December 1, 1981, the Nuclear Regulatory Commission (NRC) requested additional information from Duke Power Company regarding the adequacy of station electrical distribution system protective relaying. Duke's response to this letter addressed concerns of degraded voltage relaying on the Unit's Auxiliary (T) transformer, the Startup transformer (CT), the Main Feeder Buses, and the Standby Buses. This response did not include an investigation or review of the Central Switchyard's protective relaying. This was the result of DE assuming that the Central Switchyard was not used as an acceptable offsite power source while Oconee personnel used the option of powering the Standby Buses from Central Switchyard as an accepted source of offsite power during limited periods.

In October of 1988, a Design Engineering calculation (OSC-3290) revealed that a less than adequate voltage profile may exist on the Standby Bus when powered from the Lee Steam Station during certain Loss of Coolant Accidents (LOCA) and Loss of Offsite Power (LOOP) scenarios. The results of these calculations impacted the station in situations where the Standby Buses were energized via the Lee Steam Station through the 100 kv transmission lines under the provisions of Technical Specifications 3.7.4 through 3.7.8. In these situations, the voltage drop associated with starting currents of the loads that transferred to the Standby Buses would decrease the voltage on the bus to the point where some equipment could trip on overcurrent while starting and possible equipment damage could occur; therefore, Lee Steam Station was deemed inoperable reference LER 269/88-13. This situation was identified as a result of a Duke initiated review of electrical calculations following the Oconee Safety System Functional Inspection (SSFI) conducted by the NRC. Nuclear Station Modification (NSM) 52799 was completed on June 9, 1989 which allowed Lee Steam Station to be considered operable again.

Design Engineering, as a follow-up item for the Lee Steam Station review and after realizing that Oconee used Central infrequently as an offsite power supply, analyzed the Central Switchyard as an offsite power source. A part of this analysis involved investigating the concerns of the protective relaying at the Central Switchyard itself. For an offsite power source to satisfy NRC requirements, special relay protection must be present to protect needed plant auxiliaries in the event of system grid degradation of voltage. This will allow the offsite power source to trip and allow the onsite emergency power sources to supply power. This relay protection is provided in the Oconee 230 kv switchyard by the Grid Protection System (switchyard isolation circuitry) however, the Central Switchyard has no such protective relaying.

From this investigation, it was discovered on June 8, 1989, at 1500 hours, that a potential scenario had existed when the Central Switchyard was tied to the Standby Buses. This typically occurred during portions of refueling outages when work was done on CT transformers and certain electrical tests. In this condition a system grid degradation could occur which would isolate the Oconee switchyard (loss of offsite power) but only cause degraded voltage at Central. In this scenario, any Oconee unit with a LOCA would close in to the Standby Bus and due to a potential degraded voltage at Central experience damage or loss of essential equipment due to this degraded voltage condition. In this scenario manual operator action would be required to align the units to an acceptable power source.

Based on the historic low voltage at Central, analysis indicated that the voltage level on the Standby Bus at that time was always adequate to support design basis accident loads.

CONCLUSIONS

It is concluded that the root cause of this incident was a management deficiency due to a miscommunication between Design Engineering (DE) and Oconee personnel concerning the usage of Central Switchyard as an offsite power source. DE calculations performed as a follow-up item to the Lee Steam Station review from the SSFI conducted by the NRC indicated that the Central Switchyard did not meet the NRC's requirements for protective relaying necessary to be used as an offsite power source. The conclusion from this finding is that the Central Switchyard cannot be used as a viable offsite power source although AP/1700/11 (Loss of Power) procedure will still contain guidance for closing in Central as a last resort to restore power to the Main Feeder Buses if all other alternatives have been exhausted.

A review of events occurring during the past 12 months revealed no other events with the same root cause. Therefore, this event is classified as nonrecurring. No radioactive material releases, radiation exposures, or personnel injuries occurred as a result of this incident. The health and safety of the public were not compromised. This incident did not involve any component failure; therefore, it is not NPRDS reportable.

CORRECTIVE ACTIONS

Immediate

1. Oconee was advised by Design Engineering not to use Central Switchyard as an offsite power source.

2. A red phone notification to the NRC was made.

Subsequent

1. Operating instructions, in the form of a training package, were issued to Operations shift personnel.

2. Operating procedure OP/0/A/1107/03 (100 kv Power Supply) has been revised to delete the instructions that allow placing Central Switchyard on the Standby Buses.

Planned

1. Operations and Performance will review procedures and revise them as necessary to ensure that any time the standby buses are energized, they will be energized from appropriate emergency power sources.

2. This report will be reviewed by Design Engineering and Operations staff with emphasis placed on the importance of good communication between Design and station personnel.

SAFETY ANALYSIS

If the Central Switchyard is tied to the Standby Buses, potential scenarios exist where essential station auxiliaries may not receive sufficient power. A system grid degradation could occur concurrently with a LOCA or a single failure which would isolate the Oconee switchyard but only cause degraded voltage at Central. In order to evaluate the impact of this grid degradation, various scenarios need to be assessed.

1. LOCA

During a LOCA, the Oconee unit will trip and the switchyard will align itself to provide power from the system grid through the Startup (CT) transformer and the E (startup) breakers. Simultaneous with this action, the generated Engineered Safeguards (ES) [EIIS:JE] signal starts the Keowee hydro units in case they are needed. If Central Switchyard had become degraded and the Oconee switchyard was unaffected, then a LOCA on the units not being supplied by the Standby Bus would have been mitigated as designed and be bounded by Final Safety Analysis Report (FSAR) Section 15.14. The LOCA unit would have tripped and aligned itself to the Oconee switchyard to receive power which would have been available. A LOCA on the unit being supplied from Central Switchyard is not assumed because this infrequent alignment usually only occurs with the unit at cold shutdown.

2. LOCA/LOOP

In the event of a LOCA on one unit simultaneously with a LOOP caused by degraded grid problems, the Oconee units will trip and the switchyard will align itself to provide power from the Keowee overhead path through the Startup transformers and the E (startup) breakers. Simultaneous with this action, the generated Engineered Safeguards [EIIS:JE] (ES) signal starts the Keowee Hydro units. The EPSL would first seek power from the Startup source but none would be available from this source because the switchyard would be isolated. Before the Keowee unit comes up to speed, the EPSL will lock out the E breakers and look at the Standby Bus for voltage. The LOCA unit will then tie into the Standby Bus and be powered from the Central Switchyard, which may have degraded voltage due to the degraded grid problems. The consequences of the LOCA unit tieing into a power source with degraded voltage could result in the loss or damage to essential equipment, such as High Pressure Injection (HPI) pumps [EIIS:BQ], due to this condition. Depending upon the size of the break, restarting the necessary tripped equipment may not prevent damage to the core.

While auto transfer is prohibited due to the EPSL sensing voltage on the Standby Bus, a manual operator option exists to restore sufficient voltage to the Main Feeder Buses. The operators must manually de-energize the SL (Lee) breakers allowing the EPSL to automatically close in the SK (Keowee) breakers to provide power from the Keowee underground feeder and the CT-4 transformer. The expected response time of this manual operator action can not be predicted with any degree of accuracy. It is expected that this action will take place quickly due to operators ability to promptly recognize the degraded voltage conditions on the Standby Bus due to current fluctuations or loss of running equipment and the need for prompt action during such situations. The operators will still need to restore loads and restart tripped equipment but this evolution will most likely be completed in a timely manner to minimize the consequences of this incident. The time for the required manual operator action is purely speculative. However, even if a loss of power event occurs concurrently with a LOCA, it would be bounded by section 15.15 of the FSAR (Maximum Hypothetical Accident) which shows that the gross release of fission products released from the core to the environment during such an accident will be well below the limits of 10CFR100.

3. LOOP concurrent with a single failure

The LOOP scenario needs to be evaluated with the single failure criteria because this subject alignment was not disallowed by Technical Specifications and the design basis analyses assumes the worst case single failure when the plant is not under a Limiting Condition of Operation (LCO). In the event of a LOOP, due to degraded grid, the Oconee units will trip and both Keowee hydro generators will start as a result of the switchyard isolation signal. The switchyard will try to align itself to provide power from Keowee via the overhead path through the Startup transformers and the E breakers. However, if the LOOP event is concurrent with a single failure of either the overhead path, a Keowee hydro unit, or an individual unit's Startup (CT) transformer, the Main Feeder Bus Monitor Panel (MFBMP) will lock out the E breakers and tie into the Standby Bus which is powered from Central Switchyard. If Central Switchyard is experiencing degraded voltage problems, loss or damage to essential equipment could occur. Therefore, the situation would be the same as that of the LOCA/LOOP scenario above where manual operator action is required to return to a sufficient power supply. If this event would have occurred, the public was protected because FSAR Section 15.8.3 states that in the event of a loss of all power, the Turbine Driven Emergency Feedwater Pump (TDEFWP) [EIIS:BA] and the gravity flow of the Emergency Condenser Cooling Water (ECCW) [EIIS:BS] system will ensure core protection.

It needs to be recognized that the accidents described above are of extremely low probability especially considering the infrequent use of Central Switchyard as an offsite power source. Based on the historic lowest voltage at Central, analysis indicated that the voltage level on the Standby Bus at that time was always adequate to support design basis accident loads. Therefore, the health and safety of the public was not affected by this condition and corrective actions have been taken to ensure that this condition will not reoccur.