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SUBJECT: LER 88-004-00:on 880222,emergency power switching logic retransfer to startup logic defeated.

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NRC Form 366
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LICENSEE EVENT REPORT (LER)

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

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TITLE (4) Emergency Power Switching Logic Retransfer To Startup Logic Defeated Due To Design 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 2	2 2	8 8	8 8	0 0 4	0 0	0 4	0 6	8 8	Oconee, Unit 2	0 5 0 0 0 2 7 0
									Oconee, Unit 3	0 5 0 0 0 2 8 7

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 6 5	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)	73.71(c)
		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)	X 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)

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Philip J. North - Licensing	7 0 4 3 7 3 - 4 5 6

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

ABSTRACT

On February 22, 1988, Design Engineering identified a condition which prevented the Emergency Power Switching Logic (EPSL) from performing a part of its safety function. Specifically, the isolation of the Keowee Standby Bus Transformer, CT-4, normally required the removal of the supply breakers and their associated control power fuses. The removal of these control power fuses defeated the Retransfer to Startup Logic portion of the EPSL. This was in violation of Technical Specification 3.7.2(b). When this incident was discovered, Unit 1 and Unit 3 were at 65 and 100 percent full power respectively, while Unit 2 was shutdown for refueling.

Design Engineering's immediate corrective action was to contact the Operations Group at the station to inform them of the problem. Operations assured all the breakers and control power fuses associated with the EPSL were in place and operational.

The root cause of this incident is classified as Design Deficiency, because during the design of the EPSL, Design Engineering failed to consider the man/machine interface associated with the EPSL circuitry. Specifically, the conventional method of removing the SK breakers from service defeated the retransfer to startup portion of the EPSL.

IE22
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Background

The purpose of the Emergency Power Distribution System (EIIS:EK) is to provide the required electrical equipment and power sources to assure continuous operation of essential station equipment under emergency conditions. The Emergency Power Switching Logic System is designed to assure power is supplied to the unit's Main Feeder Buses (EIIS:BU). Using Unit 1 as an example, each Main Feeder Bus can receive power from the 230 KV switchyard through the startup transformer (EIIS:XMFR) (CT1) and startup breakers E1 and E2. The normal power source for a running unit ($\leq$ 200 MWe) is through its main step-up transformer (1T) and its normal breakers (EIIS:BRK) N1 and N2.

The Main Feeder Bus can also be powered from the 4160 V Standby Bus and breakers S1 and S2. The Standby Bus can receive on-site emergency power from Keowee Hydro Station, through the underground feeder, transformer CT-4 and Keowee Standby Breakers SK1 and SK2. The Standby Bus can also receive power through transformer CT-5 and Lee Standby Breakers SL1 and SL2, from a combustion turbine generator at Lee Steam Station or the Central Switchyard. The Main Feeder Buses can receive power from the on-site emergency power source (Keowee Hydro Station via the Keowee Overhead).

Three important parts of the logic for the Emergency Power System are the Main Feeder Bus Monitor Panels (MFBMP), the Emergency Power Switching Logic (EPSL) and the Retransfer to Startup Logic (RSL). The MFBMP's are designed to assure a reliable source of power to the Main Feeder Buses within 31 seconds during non-LOCA loss of power events. During a LOCA, a concurrent loss of power would unnecessarily delay corrective actions if the MFBMP actuation is required to recover power. To prevent this, the EPSL will perform essentially the same functions as the MFBMP, but within 11 seconds of the power loss. The RSL senses that emergency power switching logic has or has attempted to transfer power for the essential loads to the Standby Bus during an accident situation. The RSL logic provides the capability to retransfer the essential loads back to the startup power source if power on the Standby Bus is lost for greater than 10 seconds and the startup source becomes available.

The power for part of the circuitry of the RSL is supplied by the control power fuses (EIIS:FU) for the SK breakers. If the control power fuses for the SK breakers are removed, the RSL will not function automatically as designed.

Technical Specification 3.7.2(b) states that the Emergency Power Switching Logic (EPSL) shall be operable as specified by Table 3.7-1. If the conditions of this table cannot be met, the unit shall be placed in hot shutdown within 12 hours.

Sequence of Events

December 15, 1987

- o LER 269/87-09 was issued, which required Design Engineering to review a Technical Specification (TS) Interpretation regarding the Emergency Power Switching Logic.

February 22, 1988

- Design Engineering performed a review of a Technical Specification Interpretation that was sent from Oconee Operations.
- Design Engineering discovered a problem with the removal of the control power fuses for the SK1 and SK2 breakers.
- Design Engineering contacted the station to inform them of the problem.
- The Operations Group ensured the SK breakers were in service and their control power fuses installed.
- The incident was reported via the Emergency Notification System at 15:20 pursuant to 10 CFR 50.72.

Description of Incident

On September 21, 1978, the Keowee Standby transformer, CT-4 was isolated. This isolation included the racking-out of the Keowee Standby breakers SK1 and SK2. The control power fuses for these breakers were removed. There were two reasons to pull the control power fuses. First, pulling the control power fuses blocked any reclose signal to the SK breakers. This prevented the SK breakers from automatically closing in if a reclose signal was sent due to either operator action or control logic. If the SK breakers were to close while the operator was trying to rack-out the breakers, there would be an electrical flash that could seriously injure the operator. This was considered a good safety practice. Another reason to pull the control power fuses was to eliminate the status indication in the control room for those breakers. If the fuses were left in, the SK breaker indication would show the breakers to be open. However, no control would be present for the SK breakers from the control room. To prevent from giving the operator a false sense that he had control over the racked-out SK breakers, the control power fuses were pulled.

The method of pulling the control power fuses for these breakers was common practice and was part of the training given to operators. The Operations Group was not aware of the fact that pulling these fuses defeated the Retransfer to Startup Logic. Later that same day, the SK breakers were returned to service and their control power fuses were installed. This returned the Retransfer to Startup circuitry to operation.

The same isolation of CT-4 was performed on August 10, 1981; July 17, 1983; March 12, 1986 and September 24, 1987. During each isolation, the EPSL was returned to service in less than 24 hours. Transformer CT-4 was also isolated three other times. However, these isolations were somewhat different and the Retransfer to Startup Logic was not inhibited.

In 1981, the procedure for removal and restoration of station equipment procedure was changed to include an enclosure for the removal and restoration of 600/4160/6900 V breakers. There was no cross-disciplinary review of this procedure.

On December 15, 1987, LER 269/87-09 was submitted concerning two functional units of the emergency power switching logic taken out of service.One of the corrective actions involved establishing a Technical Specification Interpretation regarding the EPSL. Operations submitted a draft of the Interpretation to Design Engineering for approval. On February 22, 1988, during Design's evaluation, it was discovered that the Retransfer to Startup Logic defeated whenever CT-4 was taken out of service. Design Engineering personnel immediately contacted the Operations Group to inform them of the condition. Operations ensured the SK breakers were in service and their control power fuses installed.

As a result of this incident, Oconee Nuclear Station was operated outside of its design basis, and Technical Specification 3.7.2(b) was violated. Thus this incident is reportable per 10 CFR 50.73(a)(2)(i)(B) and 50.73(a)(2)(v)(D). While the SK breakers were racked out and their respective control power fuses removed, the Retransfer to Startup portion of the EPSL was inhibited. The emergency power system is designed to supply emergency power to all three units in the event of a loss of off-site power concurrent with a LOCA to one unit. However, with the SK breakers racked out and their respective control power fuses removed, the LOCA unit would not receive emergency power automatically as designed for the EPSL. Furthermore, it would take operator action to restore power to the LOCA unit. The other two units would not be affected by this incident and would receive power through the Main Feeder Bus Monitor Panel Logic.

Cause of Occurrence

The root cause of this incident was determined to be a design deficiency due to the lack of consideration of human factors when the EPSL was developed. For most breakers at Oconee Nuclear Station, removing the control power fuses affects only the breaker being de-energized. The procedure for removal of all 6900/4160/600V breakers instructed the operator to pull the control power fuses prior to racking-out the breaker. This is considered a good safety practice to protect the individual operating the breaker.

When the EPSL was designed, the circuitry for the Retransfer to Startup Logic was routed through the control power fuses for the Sk breakers. Station personnel were not made aware of this fact. Therefore, the circuitry of the EPSL was designed such that there was a conflict between the operability of the EPSL and a good safety practice. Thus, in order to ensure the EPSL was operational during the isolation of transformer CT-4, the standard method of performing this isolation could not be used.

Based on the above, the conflict between a safe work practice and operability of the EPSL led to a violation of Technical Specification 3.7.2(b). When Design Engineering designed the EPSL, they did not anticipate the interaction of the system with the human factor/safety consideration.

Another point that contributed to this incident was Design Engineering's failure to inform the station of the interface between the control power fuses for the SK breakers and the EPSL circuitry. The station was not aware that the Retransfer to Startup Logic was routed through the SK breaker's control power fuses.

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

Therefore, no effort was made to ensure the EPSL was operational because the station was not aware that the isolation of CT-4 with the SK breakers defeated the retransfer to Startup Logic.

Another opportunity to realize the isolating of CT-4, with the SK breakers, impaired the EPSL was during the development of Enclosure 3.3 to the removal and restoration of station equipment procedure. This procedure was not cross-disciplinary reviewed. However, during the construction of Oconee Nuclear Station, the EPSL was not required to be in service, but the 4160 V buses were utilized. Isolation of 4160V breakers were performed routinely by removing the control power fuses. Since the station did not receive any instructions on how to perform this work practice when Technical Specification 3.7.2(b) became required, no changes were made. Therefore when the procedure for the removal of the 4160 V breakers was developed, no cross-disciplinary review was deemed necessary.

To prevent the EPSL from being taken out of service while isolating transformer CT-4, special measures must be taken. These measures should include ensuring Technical Specification 3.7.2(b) is met without posing a safety hazard.

A review has been conducted over the past three years to determine how often the on-site power sources were taken out of service outside the guidelines of Technical Specifications. This review revealed no incidents that were documented. There were five incidents found in which Technical Specification 3.7.2(b) was violated. However, as this report already indicates, there have been two incidents in which the SK breakers were opened and their control power fuses pulled within the past three years. A further review shows that this practice of isolating transformer CT-4 was utilized back to 1978. There were five incidents found in which Technical Specification 3.7.2(b) was violated. However, the station did not realize that isolating CT-4 with the SK breakers, and pulling the control power fuses to these breakers inhibited the Retransfer to Startup portion of the EPSL. Based on the above, this incident is considered recurring.

Since there were no equipment failures as a result of this incident, it is not NPRDS reportable. There was no release of radioactive materials, radiation exposure, or personnel injuries as a result of this incident.

Corrective Actions

The immediate corrective action was for Design Engineering to contact Oconee Nuclear Station Operating Group to inform them of the problems associated with pulling the control power fuses on the SK breakers. The Operations Group verified the power fuses were in place and the SK breakers were operational.

The subsequent corrective action is for the Switchyard Coordinator, along with his two designees to approve all work that relates to the N, E, S, SK and SL breakers. This will be an interim measure to ensure the EPSL stays intact, until Design Engineering can complete a review of the procedures associated with the EPSL.

Planned corrective actions are for:

- Oconee Operations to develop a separate procedure for the 4160 V breakers that effect the EPSL. This procedure will provide a proper method of removing these breakers from service safely while not impairing the EPSL;

- Oconee Operations, along with Design Engineering support, to perform a study to determine if there is a practical way to re-route the EPSL circuitry outside the control power fuses. This would allow the control power fuses to be pulled without defeating the EPSL;

- Oconee Operations to issue a training package to all licensed operators on the proper way to remove the 4160 V breakers, that could effect the EPSL, from service;

- Design Engineering to perform a Cross-Disciplinary review of all the procedures that involve 4160V breakers that affect the EPSL. The results of this study will be forwarded to station management for implementation;

- A self-initiated internal Quality Assurance Audit has been scheduled for the third and fourth quarters of this year. This audit will evaluate the Emergency Power Distribution System. During this audit, the EPSL will be evaluated to determine if any other problems exists;

- A Design Engineering Section has been assigned to each of Duke Power's Nuclear Stations. These Design Engineers will be stationed at the stations and should help overcome the interface problems that have been encountered.

Analysis of Occurrence

The estimated maximum time the control power fuses were removed from the Standby Bus Keowee Feeder Breakers (SK_1 and SK_2) is 24 hours. The scenario of concern is to have a simultaneous single unit LOCA and loss of offsite power during this 24-hour period. The probability of such a LOCA and loss of offsite power that would also include the loss of the 100 kV transmission line from Lee Steam Station is extremely low.

With the control power fuses pulled on the "SK" breakers during a simultaneous single unit LOCA and loss of offsite power, emergency power would still be supplied to the non-LOCA-units from the Keowee Hydro Units via the overhead path through the units' startup transformers as the result of a Main Feeder Bus Monitor Panel (MFBMP) signal initiated by undervoltage for 20 seconds on two out of three phases on both Main Feeder Buses (MFBs). Emergency power to the LOCA-unit would be routed through transformer CT-4 via the underground path; however, emergency power would not be supplied because of the control power fuses being removed on the "SK" breakers. Also because of these fuses being pulled, the Emergency Power Switching Logic could not complete the Retransfer to Startup

logic to transfer power back to the startup source (i.e., the automatic closure of the "E" breakers to provide power to the Main Feeder Buses from the startup transformer would be prohibited). Therefore, with the control power fuses pulled on the "SK" breakers during a simultaneous single unit LOCA and loss of offsite power, automatic emergency power would not be available to the LOCA-unit.

Another method of supplying the Standby Bus is through transformer CT-5. In the above case, the loss of power procedure would instruct the operator to supply power to the Main Feeder Buses from this normally energized transformer. This action can be taken from the control room in a relatively short period of time. Transformer CT-5 is equivalent in capacity to the CT-4 transformer and is the Technical Specification required backup power source when both Keowee Hydro Units are unavailable.

Automatic emergency power would be available for the scenarios of one event followed by the other (i.e., LOCA followed by loss of offsite power or visa versa). If a loss of offsite power were to occur first, emergency power would automatically be provided from Keowee via the overhead path through the startup transformers; thereby, bypassing the "SK" breakers. A subsequent LOCA would have emergency power available and uninterrupted.

If a LOCA were to occur first, emergency power would be available to the LOCA-unit if a loss of offsite power is initiated approximately 20 to 25 seconds after the Engineer Safeguard (ES) (EIIS:JE) signal generated by the LOCA. When the ES signal is generated both Keowee units automatically start. FSAR Chapter 8.3 states that the Keowee units reach full speed at 23 seconds from receipt of the start signal; however, the actual time to full speed is approximately 17 to 19 seconds. If a loss of offsite power were to begin after the Keowee units reached full speed, emergency power would be fed through the startup transformers after the automatic isolation of the 230 kV Yellow Bus. (The isolation is necessary before the Keowee unit supplying the overhead path can be connected. This isolation of the Yellow Bus and connection of the Keowee unit would be accomplished before the Emergency Power Switching Logic could complete its 11 second delay to provide emergency power through transformer CT-4 via the underground path.) This particular scenario would bypass the "SK" breakers and emergency power would be available.

A post-LOCA loss of offsite power occurring before the Keowee units reach full speed would allow the Emergency Power Switching Logic to complete it 11 second delay and attempt to provide power through the "SK" breakers which has been shown to render automatic emergency power unavailable. Since the vulnerable time period of having emergency power unavailable is about 20 to 25 seconds, the occurrence of a LOCA and loss of offsite power within such a time period is considered simultaneous and extremely improbable.

Automatic emergency power would not be available after a concurrent LOCA and loss of offsite power and operator action would be required. Manually closing the "E" breakers from the control room to provide a path from the startup transformer to the Main Feeder Buses would not be successful due to the sustained trip status of the "E" breakers resultant from the blocked Retransfer to Startup logic. The alternatives would be for personnel to:

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(1) Operator action per the loss of power procedure to close CT-5 (if available) onto the Standby Buses from the Control Room.

(2) Replace the control power fuses in the "SK" breakers, allowing the completion of the Retransfer to Startup Logic, which would close the "E" breakers.

(3) Manually defeat the trip circuit logic of the "E" breakers. Items (2) and (3) require operator responses that are not dictated by an emergency procedure.

Even if proper operator response would be identified and implemented to restore emergency power, the pulling of the "SK" breaker control power fuses still places the emergency power distribution configuration in an unanalyzed condition. The design basis of a LOCA/loss of offsite power is analyzed in FSAR Chapter 15 and requires emergency power to be initiated 25 seconds after a LOCA (obviously, not enough time to dispatch personnel to implement any corrective action).

At no time during the removal of the fuses did a LOCA occur or a loss of offsite power take place; therefore, the health and safety of the public were not affected and no releases of radiation resulted from this incident.

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HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

TELEPHONE
(704) 373-4531

April 6, 1988

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 269/88-04

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report (LER) 269/88-04 concerning Emergency Power Switching Logic retransfer to startup logic. By letter dated March 23, 1988 Duke informed the NRC of the delay in submitting this report.

This report is submitted in accordance with §50.73(a)(2)(i)(B) and §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,

Hal B. Tucker

PJN/11027/sbn

Attachment

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