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NORTH,P.J. Duke Power Co.
TUCKER,H.B. Duke Power Co.
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SUBJECT: LER 89-004-00:on 890123,deviation from FSAR cable separation criteria due to design deficiency.

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APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

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)
Deviation from FSAR Cable Separation Criteria 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 1	2 3	8 9	8 9	0 0 4	0 0	0 3	2 9	8 9	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)	1 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	X 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)	
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ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On January 23, 1989, with Unit 1 in a refueling outage and Units 2 and 3 at 100% power, it was discovered that two sets of redundant Main Feeder Bus control cables for lockout relaying were inappropriately routed through the same cable trays. This routing was the Design Engineering originated routing as specified on the cable sheets for one of the inappropriately routed cables and the result of incorrect field routing of the remaining cable. Subsequent investigation revealed that the same problem existed on Units 2 and 3, however the cables on Units 2 and 3 had been routed per the Design Engineering issued cable sheets which did not maintain required cable separation. The initial discovery was made during work on the 1TA switchgear. Since the cables were routed per the Design issued cable sheets in all cases except for one of the Unit 1 cables, this event is classified as a Design Deficiency, Electrical Equipment Configuration Deficiency. The subsequent corrective actions were to reroute the control cables through different cable trays and to perform a random inspection of selected safety related cables throughout the plant.

IE22

☆U.S.GPO:1984-0-454-481/18759

INTRODUCTION

On January 23, 1989, with Unit 1 in a refueling outage and Units 2 and 3 at 100% power, it was discovered that two sets of redundant Main Feeder Bus control cables for lockout relaying were inappropriately routed through the same cable trays. This routing was the Design Engineering originated routing as specified on the cable sheets for one of the inappropriately routed cables and the result of incorrect field routing of the remaining cable. Subsequent investigation revealed that the same problem existed on Units 2 and 3, however the cables on Units 2 and 3 had been routed per the Design Engineering issued cable sheets which did not maintain required cable separation. The initial discovery was made during work on the 1TA switchgear. Since the cables were routed per the Design issued cable sheets in all cases except for one of the Unit 1 cables, this event is classified as a Design Deficiency, Electrical Equipment Configuration Deficiency. The subsequent corrective actions were to reroute the control cables through different cable trays and to perform a random inspection of selected safety related cables throughout the plant.

SEQUENCE OF EVENTS

1970	_	Cable routing sheets for the Unit 1 Main Feeder Bus (MFB) control cables were issued.
	_	Redundant lockout relay control cables for the MFB for 1TE 4160 V switchgear were installed in routes different from the cable sheets.
	_	Incorrect routing led to lack of separation for redundant cables.
1972	_	Cable sheets for 1TD 4160 V switchgear MFB control cables were revised but did not maintain cable separation.
	_	Redundant lockout relay control cables for the MFB for 1TD 4160 V switchgear were installed per the Design issued cable sheets.
1971-1973	_	Cable routing sheets for Unit 2 and 3 MFB cables were issued but did not maintain cable separation.
January 3, 1989	_	Fire occurred in 1TA 6900 V switchgear.
	_	Rebuild of 1TA switchgear commenced.
January 23, 1989	_	Redundant Unit 1 MFB control cable routing lack of cable separation was discovered.
	_	Problem Investigation Report 1-089-0011 was written on lack of cable separation for MFB redundant control cables.
January 24, 1989	_	Investigation of Unit 2 and 3 4160 V MFB control cables discovered that lack of cable separation

January 24, 1989 (continued) — for redundant control cables also existed.

January 25, 1989 — Design Engineering wrote Operability Evaluation which approved present routing due to multiple factors.

February 7, 1989 — Nuclear Station Modification (NSM) 12803, Part AL1 deleted existing control cables for Unit 1 4160 V MFB.

— NSM 12803, Part AL1 pulled new cables for Unit 1 4160 V MFB which met separation criteria.

BACKGROUND

Each Main Feeder Bus (MFB) [EIIS:EA] is protected from faults by a bus differential/lock-out relay [EIIS:RLY] scheme. This scheme protects the zone which extends from the line side of each MFB supply breaker [EIIS:52] to the bus side of each 4160V switchgear [EIIS:SWGR] section incoming breaker.

The Bus differential lock-out relay can also be operated by a breaker failure logic from the individual protective relay schemes of the MFB supply breakers and 4160V switchgear incoming breakers. This "back up" protection is provided to clear faults which are not initially interrupted by the individual breakers protective relaying.

Whenever a MFB lock-out relay is actuated (either from the differential relay or breaker failure logic) all sources of power to that bus are tripped and blocked from reclosure. If the lock-out relays for both MFBs are concurrently in the actuated (tripped) position, all 4160V switchgear sections for that unit will become de-energized.

Cable [EIIS:CBL] routing sheets are issued by Design Engineering when a plant modification or change is to be performed. These sheets give the route in which the cable will be run from the beginning termination point to the final termination point by referencing cable tray sections through which the cable will be routed. This route is provided by Design Engineering so that factors such as loading limitations and other factors for specific cable tray sections will not be exceeded. These cable sheets are maintained as permanent drawings and revised as other modifications or changes occur.

The Final Safety Analysis Report (FSAR) gives criteria for cable separation. FSAR 8.3.1.4.6.2 states "Our criteria for routing cables requires that mutually redundant safety related cables be run in separate trays."

DESCRIPTION OF EVENT

In 1970, cable sheets for the pulling of the Unit 1 Main Feeder Bus (MFB) control cables were issued. These cable sheets gave routes to be used for the lockout relay control cables on the 4160 V switchgears (1TC, 1TD, 1TE). The cable sheets for the lockout relay cables on 1TE listed the route for redundant cable A through cable tray section B-105 and for redundant cable B through cable tray section B-106. Due to some unknown cause, both cables A and B were incorrectly field routed through cable tray section B-104.

In 1972, the cable sheets for 1TD were revised. The cable sheet for 1TD listed the routes for redundant cables C and D from the lockout relays as proceeding through cable tray section B-105. Control cables C and D for the lockout relays were subsequently pulled as listed on the cable sheets.

In the time period from 1971 through 1973, cable sheets were issued for Unit 2 and 3. These sheets gave the routes for each of the 4160 V switchgear control cables on both units. The cable sheets routed each of the redundant lockout relay cables through the same cable tray sections for each switchgear. These cables were subsequently pulled as listed on the cable sheets.

On January 3, 1989, a fire occurred in the 1TA 6900 V switchgear (this event was reported in LER 269/89-02). This fire resulted in damage to cables in the cable tray sections which ran above the switchgear. During the evaluation and replacement of damaged cables, it was discovered that the redundant safety cables for the lockout relays of the 4160 V switchgear were routed through the same cable tray sections. Problem Investigation Report 1-089-0011 was issued as a result of the deviation from the cable separation criteria. An investigation of the Unit 2 and 3 cables was also undertaken. On January 24, it was determined that the Unit 2 and 3 cables also did not meet the Final Safety Analysis Report criteria for safety related cable separation.

On January 25, as a result of the problems discovered, Design Engineering generated an Operability Evaluation which provided justification for continued operation of Units 2 and 3. The basis for the justification is as follows:

1) All cables in question are grounded armored cables;

2) The basis of the FSAR separation criteria is to guard against the internal fault propagation from one cable to another in a common tray. Although the physical separation distance is not provided, the purpose of this separation is accomplished in an alternate fashion when the cables in question are of the armored type. This is based on a

destructive test performed by Duke on armored cables. The results of this test indicate that the armor provides adequate protection against an electric fault propagating into an adjacent cable in the same tray. The results of this test are documented in Test Report MCM-1354.00-0029;

3) The effects of a fire were considered in this evaluation as a single event that could damage cables in all cable trays within a common fire area. It was determined that postulated cable damage resulting from fire is enveloped by the existing Appendix R analyses;

4) The cable trays in question (and adjacent structures) are designed and installed with appropriate seismic considerations. Therefore, the impact of a seismic event on these cables will not be changed due to this deviation from the separation criteria;

5) The present FSAR commitment requires a minimum of 10 inches (bottom to bottom) vertical separation between trays (credit for armored cable is not assumed in this criteria). Although it is recognized that the intent of the separation criteria is to provide a reasonable degree of assurance that a single event will not affect mutually redundant cables, the potential of a single event to damage two cables in a single tray is essentially the same as other situations allowed by the separation criteria;

6) Effects of a high energy line break have been analyzed and are not changed by this deviation from FSAR criteria.

As a result of the discovery on Unit 1, Nuclear Station Modification 12803 Part AL1 was revised to delete the existing redundant safety cables for the lockout relays and pull new cables which met the cable separation criteria as listed in the FSAR.

Between January 25, 1989 and February 7, 1989 an inspection was conducted to verify that a random sample of safety-related cables are routed correctly as specified by the cable routing sheets. Of 116 safety-related cables inspected, five discrepancies were discovered. All discrepancies were not determined to be safety significant.

In addition, a random sample of cable trays/sections containing safety-related cables was inspected to ensure that safety-related cables of different colors were not run in the same tray without prior analysis and approval. No problems were discovered in this inspection. A sample of approximately one hundred sixteen safety related cables were also checked to ensure that there was not a major problem with lack of cable separation for safety related cables.

CAUSE OF EVENT

It is concluded that the root cause of this event is Design Deficiency, Electrical Equipment Configuration Deficiency. This is due to the fact that all but one set of the cables which were routed in violation of the Final Safety Analysis Report cable separation criteria were routed per the Design Engineering supplied cable routing sheets. The only exception to this is the redundant cables on 1TE lockout relay control cables. Had these cables been routed per the cable sheets, separation criteria would not have been violated for these cables. However, one of the Unit 1 cables and all of the Unit 2 and 3 cables were routed per the cable sheets and did not have the required cable separation.

It is realized that a contributing cause to this event was the incorrect pulling of the Unit 1 cable which was not per the cable sheets. However, since the occurrence of this event, there has been extensive training given to personnel on the need to perform all work per the Design documents and all personnel are aware of the need to obtain permission to deviate from these documents. Therefore it is realized that no feasible corrective action can be determined due to actions taken since the incident such as personnel training and issuance of an installation specification on cable separation.

Similar incidents have occurred in the past (See LER 269/87-02 and LER 269/88-12), therefore this event is listed as a recurring event. However, these incidents occurred after the cables for the lockout relays of the 4160 V switchgear had been pulled and corrective actions from these incidents would not have prevented this incident. It is recognized that since this is the third instance discovered of erroneous cable routing in two years, this area needs additional review. The TOPFORM program that was implemented within Design Engineering in early 1986 should minimize the chance of similar incidents in the future.

CORRECTIVE ACTIONS

The immediate corrective actions were to:

Write a Problem Investigation Report and perform an Operability Evaluation;

Check a sample of safety related cables for all three units to ensure that cable separation criteria had been maintained. Based on the results of this sample, Design Engineering and Compliance determined that there was no need for further inspections.

Subsequent corrective actions were to:

Revise NSM 12803, Part AL1 to route the lockout relay control cables for Unit 1 to achieve compliance with separation criteria;

Issue a Station Problem Report to generate a Nuclear Station Modification to resolve the Unit 2 and 3 cable routing.

Planned corrective actions are for:

Projects to implement an NSM to resolve the Unit 2 and 3 cable routing problems;

Projects to initiate action to tag cable trays to enhance physical verification of cable routes;

Design Engineering to devise a program to incorporate Unit 1 and 2 cable sheets into a computer database;

Design Engineering to make a determination of the need for a Design Study to identify mutually redundant cable in the same tray. This determination will be based on the results of a sample cable sheet search and evaluation.

SAFETY ANALYSIS

The lockout circuits were never inoperable as a result of this incident. The armor jacketed cable prevented the possibility of an electrical fault propagating from one of the redundant cables to the other redundant cable. This analysis is based on a destructive test performed by Duke on armored cables documented in Test Report MCM-1354.00-0029. The effects of a fire were considered in the Operability Evaluation as a single event which could damage cables in a common fire area. The ten inches of cable separation which the FSAR requires would not change the effects of the Appendix R analysis or the analysis of a seismic event. This is because these analyses also assume damage in a common area. The lack of cable separation also did not change the analysis of the effects of a high energy line break.

There were no exposures, radiation releases or injuries associated with this event. It is concluded that the health and safety of the public were not affected by this event.

Duke Power Company
P.O. Box 33189
Charlotte, N.C. 28242

Hal B. Tucker
Vice President
Nuclear Production
(704)373-4531

DUKE POWER

March 29, 1989

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

Subject: **Oconee Nuclear Station**
Docket Nos. 50-269, -270, -287
LER 269/89-04

Gentlemen:

Pursuant to 10CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report (LER) 269/89-04 concerning a deviation from FSAR cable separation criteria.

This report is being submitted on a voluntary basis. 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

Hal B. Tucker

PJN/ler10

Attachment

xc: Mr. S.B. Ebneter
Regional Administrator, Region II
U.S. Nuclear Regulatory Commission
101 Marietta St., NW, Suite 2900
Atlanta, Georgia 30323

Mr. D. Matthews
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Mr. P.H. Skinner
NRC Resident Inspector
Oconee Nuclear Station

American Nuclear Insurers
c/o Dottie Sherman, ANI Library
The Exchange, Suite 245
270 Farmington Avenue
Farmington, CT 06032

INPO Records Center
Suite 1500
1100 Circle 75 Parkway
Atlanta, Georgia 30339

M&M Nuclear Consultants
1221 Avenue of the Americas
New York, NY 10020

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