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Southern Nuclear Operating Company
the southern electric system

10 CFR 50.73

June 13, 1994

Docket No.: 50-348

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

Joseph M. Farley Nuclear Plant - Unit 1
Licensee Event Report No. 94-001-00

Ladies and Gentlemen:

Joseph M. Farley Nuclear Plant, Unit 1, Licensee Event Report No. 94-001-00 is being submitted in accordance with 10 CFR 50.73. If you have any questions, please advise.

Respectfully submitted,

Dave Morey

EFB/clt:BKRSPLER.DOC

Attachment

cc: Mr. S. D. Ebneter
Mr. B. L. Siegel
Mr. T. M. Ross
Dr. D. E. Williamson

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NRC FORM 366 (6-89) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

# LICENSEE EVENT REPORT (LER)

| FACILITY NAME (1) | DOCKET NUMBER (2) | PAGE (3) |
|---|---|---|
| Joseph M. Farley Nuclear Plant - Unit 1 | 0 5 0 0 0 3 4 8 | 1 OF 6 |

TITLE (4)
1A CCW Pump Failure to Start Due to Supply Breaker Prop Latch Spring Detachment

| 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 | |
| 0 5 | 2 1 | 9 4 | 9 4 | - 0 0 1 | - 0 0 | 0 6 | 1 3 | 9 4 | J.M. Farley Unit 2 | 0 5 0 0 0 3 6 4 |

| OPERATING MODE (9) | 1 | 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) | 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)

| NAME | TELEPHONE NUMBER |
|---|---|
| R.D. Hill, General Manager - Nuclear Plant | AREA CODE 2 0 5 8 9 9 - 5 1 5 6 |

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 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B | E B | B K R | S 1 8 8 | Y | | | | | | | |
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| 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 5/21/94, the 1A component cooling water pump (B-train) failed to start when being placed in service to allow sampling of that train of component cooling water (CCW) for chemical analysis. An investigation revealed that the supply breaker (1-DG04) would not close because the spring charging motor did not charge the closing springs following the previous breaker closure. For approximately 6 days the B-train of CCW was inoperable due the uncharged springs on the B-train pump and the fact that the swing pump was aligned to the other train. Thus, the 72 hour limiting condition for operation for CCW was not met. This event occurred because both prop latch springs on 1-DG04 had become detached, which resulted in the closing linkages not fully resetting. FNP has experienced previous problems with prop latch springs on these type breakers, with three other cases impacting breaker closing. FNP developed a comprehensive program that has determined the root causes of prop latch spring detachments, and is implementing permanent corrective action on all Siemens type MA350-C breakers. Corrective actions have been completed on breaker 1-DG04. Overall breaker operability is not compromised by this problem due to the fact that, out of 133 breakers in service with a total of approximately 42,463 cycles, there have been only 4 breakers that failed to close as a result of prop latch spring problems. The breaker tripping function does not rely on the prop latch springs and has therefore not been affected in any of these cases. However, as an additional precaution for the interim, FNP is periodically verifying the closing springs are charged on ESF breakers.

Plant and System Identification

Westinghouse -- Pressurized Water Reactor
Energy Industry Identification System codes are identified in the text as [XX]

Summary

A failure of the 4160 volt Siemens type MA350-C supply breaker [EB] for the 1A CCW pump to recharge its closing springs following the previous breaker closure, resulted in that train of CCW being inoperable longer than the limiting condition for operation as specified by Technical Specifications.

Description of Event

On May 21, 1994, at 0340 the 1A component cooling water pump (B train pump) failed to start when being placed in service to allow Chemistry to obtain a sample of that train of component cooling water (CCW) for chemical analysis. An investigation revealed that the supply breaker (1-DG04) would not close because the spring charging motor did not charge the closing springs following the previous breaker closure. The previous closure of this breaker occurred on May 2, 1994 at 2120. Thus, the breaker was in a condition that would not have allowed it to close and supply the 1A CCW pump motor had it been called upon subsequent to the breaker being opened as in the case of a loss of site power. This condition of the springs being uncharged for the B-train pump existed for approximately 18 days. During this 18 day period the swing pump was aligned to the B-train for approximately 12 days (5/2/94 at 2120 until 5/15/94 at 0100) and thus the B-train was operable. However, for approximately 6 days the B-train of CCW was inoperable due to the combination of the springs in the 1A CCW pump breaker not being charged, and the swing pump (1B) being aligned to the A-train. This 6 day period is longer than the 72 hours as allowed by the limiting condition for operation of Technical Specification 3.7.3 for the CCW system.

Cause of Event

An inspection of breaker 1-DG04 revealed that both prop latch springs in the closing mechanism had become detached such that the closing linkage and prop latch did not fully reset following the previous breaker closure (each time this type breaker closes it is supposed to immediately re-charge its closing springs in preparation for the next breaker closure.). This prevented the prop latch check switch from closing. Therefore, the charging motor could not charge the closing springs.

The prop latch springs' primary function is to help align the breaker closing mechanism linkage for the charging and closing operations. FNP has experienced 19 previous occurrences of prop latch springs becoming detached, with 3 previous cases resulting in the breaker charging and closing function being impaired. In two of these cases, a prop latch spring detached and became caught in the charging mechanism causing it to bind. In the other case, both prop latch springs were found detached which most probably caused the breaker not to charge. The other 16 instances involved prop latch springs becoming detached and/or damaged, but with no resulting problems with the charging or closing mechanisms. The breaker tripping function does not rely on the prop latch springs and has not been impaired in any of the occurrences. The breaker closing function is not impaired once the closing springs successfully charge.

These instances occurred over a time period from 1986 to 1994, with the number of cycles per breaker at the time of noted problems, ranging from 184 to 621.

At the time of this event, FNP had already developed a comprehensive program that determined root causes of prop latch spring detachments and was implementing permanent corrective action on all Siemens type MA350-C breakers. However, corrective actions had not been completed on breaker 1-DG04.

For the root cause investigation, high speed camera equipment was used to analyze prop latch spring dynamics during the closing operation of a MA350-C breaker. This revealed that, during the closing cycle, the prop latch springs vibrate and move about noticeably. Also, the widest part of the closing linkage (the hinge pin) rotates in an arc in very close proximity to the prop latch springs. Three factors were identified that can cause prop latch spring detachment and possibly result in spring damage and/or interference with breaker closing.

1. If the set screw that holds the hinge pin in position becomes loose from vibration, it can back out of its threaded hole in the hinge pin and allow the hinge pin to drift in either direction. This can result in the hinge pin protruding out of position far enough to come in contact with one of the prop latch springs with subsequent damage and/or detachment of the spring. The majority of the damaged springs indicated elongation and coil separation in the region of the spring where the hinge pin passes in close proximity during a normal breaker closure, indicating that the hinge pin had contacted the spring.

2. The prop latch springs are attached at one end to a fixed location on the breaker frame by a clip. The investigation revealed that many breakers had clips that were constructed in a 90 degree configuration instead of the, presently recommended, 45 degree configuration. The 90 degree clips do not provide as much clearance between the prop latch springs and the hinge pin as the 45 degree clips. This increases the possibility of the hinge pin striking a prop latch spring, even if the hinge pin is in its proper position. Based on maintenance history and knowledge of experienced maintenance personnel, the 90 degree clips are believed to have been installed as part of original design, which has since been revised by the manufacturer.

3. If a prop latch spring is hooked into its rear holding clip from the outside-in, instead of threading the hook into the hole in the clip first (inside-to-outside), the spring can become unhooked due to vibration or contact with the hinge pin. In addition, unless the spring is installed in the holding clip with a slight torque, or "loaded", the hook will tend to rotate in the clip hole toward the outside edge of the clip and shift the spring body closer to the path of the hinge pin.

From the information gathered during the previous root cause investigation and the past maintenance history it is evident that the main contributor to the prop latch spring problems has been the hinge pin being out of position. Recently, the clip angle and the spring orientation were determined to be additional contributors to the problem, making the exact cause of failure difficult to determine. In addition, the vendor manual offered no guidance as to the proper orientation of the prop latch springs, the type of holding clip, or maintenance checks for the hinge pin.

For breaker 1-DG04, the hinge pin had already been inspected in December, 1993. However, the other two contributing factors had not been identified at that time and were found to be responsible for this latest failure. This is based on examining the springs and finding 90 degree spring clips on this breaker.

Safety Assessment and Reportability

The subject breaker had been in a condition that would not have allowed it to close and supply the 1A CCW pump motor (B-train) for approximately 18 days. For 12 of those 18 days, the swing pump (1B) was aligned to the B-train, and thus the B-train was operable. However, the B-train of CCW was inoperable for approximately 6 days due to the combination of the uncharged springs, and the swing pump being aligned to the opposite (A-train) of CCW. This 6 day period is greater than the 72 hours as allowed by Technical Specifications for a train of CCW to be out of service, and is thus reportable under 10CFR50.73(a)(2)(i).

The prop latch springs aid the closing mechanism in making up the circuit logic to permit breaker charging and closure. The loss of safety function (failure of breaker to close) is a result of the possibility of a prop latch spring becoming detached and interfering with charging of the breaker closing mechanism. Two factors have been identified that can cause this. One, a spring becoming lodged in the charging mechanism, or two, both springs becoming detached such that the closing linkage does not fully reset to close the prop latch switch contacts and, thereby, enable spring charging. These factors will not prevent the breaker from opening. However, the next time the breaker receives a close signal, it will not close if the closing springs have not charged.

There are 133 of the MA-350C breakers in operation at FNP, with an approximate total of 42,463 cycles since these breakers have been in service. There have been 4 breakers that failed to close as a result of prop latch spring problems. Although a failure mechanism has been identified, the probability of a failure is sufficiently low such that multiple simultaneous failures would not be expected.

Corrective Action

For this specific event dealing with the 1A CCW pump breaker, 1-DG04, the following immediate corrective actions were taken:

1) The breaker that was in cubicle 1-DG05 was removed and placed into cubicle 1-DG04 to return the 1A CCW pump to operable status.

2) All other ESF related 4160 volt breakers' springs on both units were verified as being properly charged.

3) With respect to the general issue of prop latch springs the following actions are either being taken or have been completed:

The electrical maintenance procedure, which provides instructions for periodic inspection of these breakers, was revised to prevent prop latch spring detachment and possible interference with the breaker charging and closing function. Instructions were added to ensure:

A) proper hinge pin alignment and that the retaining set screw is secure;
B ) the installed prop latch spring mounting clips are of the 45 degree angle type;
C ) the springs are installed to maximize separation from the hinge pin and to ensure they do not detach due to vibration.

Inspections using the revised procedure are being performed on all Siemens type MA350-C breakers for the problems identified by the root cause evaluation. A schedule has been developed with emphasis on completing ESF breakers that must close to perform their safety function. In addition, on an interim basis FNP is periodically verifying the closing springs are charged on ESF breakers.

The 1A CCW pump breaker (1-DG04) prop latch springs were replaced in accordance with the revised procedure and the breaker was returned to service.

Additional Information

It is Southern Nuclear's understanding that the Siemens Type MA 350C breaker has limited safety related use in the nuclear industry.