J. R. Johnson
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SOUTHERN COMPANY
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November 14, 2008

Docket Nos.: 50-348
50-364

NL-08-1712

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Joseph M. Farley Nuclear Plant – Unit 1 and 2
Revision to Licensee Event Report 2007-003-01
Component Cooling Water Pump Breaker Failures

Ladies and Gentlemen:

By letter dated October 19, 2007 Southern Nuclear Operating Company (SNC) provided Licensee Event Report (LER) 2007-003-00, "Component Cooling Water Pump Breaker Failure'" for Joseph M. Farley Nuclear Plant (FNP) Units 1 and 2 (ML072990364). In this LER, SNC detailed an event in which the 4160 volt Cutler-Hammer breaker failed to operate on demand which resulted in the Component Cooling Water (CCW) system being inoperable. SNC determined that the failure of the Cutler-Hammer breaker was due to a combination of depressing the breaker foot pedal inappropriately and inadequate linkage margin caused by the setup of the breaker linkage in the trip latch plunger interlock.

In LER 2007-003-00, SNC presented as one of the corrective action the following:

> "To provide additional reliability margin and assurance of breaker closure for reliable operation, the breaker linkage setup specifications were revised. Cutler-Hammer breakers in safety related applications will be verified to be within the revised linkage setup specifications by November 30, 2008 (end of Unit 2 Refueling Outage 19)."

SNC has determined that it will not be able to complete this inspection on 13 of 80 Cutler-Hammer breakers in safety related applications by November 30, 2008. SNC has scheduled the remaining inspections for completion by August 31, 2009. The revised LER 2007-003-01 is provided in the enclosure and includes the basis for this extension.

This letter contains no NRC commitments. If you have any questions, please advise.

Sincerely,

J. R. Johnson
Vice President – Farley

JRJ/CHM

Enclosure: Licensee Event Report 2007-003-01

cc: Southern Nuclear Operating Company
Mr. J. T. Gasser, Executive Vice President
Mr. J. R. Johnson, Vice President – Farley
Mr. D. H. Jones, Vice President – Engineering
RTYPE: CFA04.054; LC # 14856

U. S. Nuclear Regulatory Commission
Mr. L. A. Reyes, Regional Administrator
Mr. K. D. Feintuch, NRR Project Manager – Farley
Mr. E. L. Crowe, Senior Resident Inspector – Farley

Joseph M. Farley Nuclear Plant – Unit 1 and 2
Revision to Licensee Event Report 2007-003-01
Component Cooling Water Pump Breaker Failures

Enclosure

Licensee Event Report 2007-003-01

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2010

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Joseph M. Farley Nuclear Plant – Unit 1	05000 348	1 of 7

4. TITLE
Component Cooling Water Pump Breaker Failures

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER 05000
09	05	2007	2007	- 003 -	01	11	14	2008	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE: 1

10. POWER LEVEL: 100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☒ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
J. R. Johnson – Vice President	334-899-5156

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
E	EB	52	A180	Y	B	EB	52	C770	Y

14. SUPPLEMENTAL REPORT EXPECTED		15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)*	☒ NO				

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

From September 4, 2007 at 17:00 until September 5, 2007 at 00:15, the Farley Unit 1 Component Cooling Water (CCW) system [CC] was inoperable due to failures of two different types of breakers, concurrent with a planned maintenance outage on the swing pump. Although Pump 1A (B Train pump) was in fact in operation during this period, no assurance of CCW pump capability to start on demand existed. The 1C (A Train) CCW pump breaker and the 1A (B Train) CCW pump breaker failed to start on independent start demands, associated with a period in which the 1B CCW (swing) pump was out of service for maintenance. The 1A CCW pump breaker was an Allis-Chalmers breaker scheduled for replacement which failed due to wear related degradation. The 1C CCW pump breaker was a new Cutler-Hammer breaker recently installed which failed due to a combination of operator manipulation of the breaker foot pedal and inadequate linkage margin caused by the setup of the breaker linkage.

To ensure proper operation of Cutler-Hammer breakers, operator guidance for breaker pre-start checks has been revised. Both the failed Cutler-Hammer breaker and the failed Allis-Chalmers breaker were replaced. All Allis Chalmers 4kv breakers supplying safety related loads were replaced by March 31, 2008. To provide increased reliability margin, all installed Cutler Hammer breakers in safety related applications will be verified to be within revised linkage setup specifications by August 31, 2009. All Cutler Hammer breakers scheduled for installation in safety related applications will be verified to be within revised linkage setup specifications prior to installation.

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

Description of Event

From September 4, 2007 at 17:00 until September 5, 2007 at 00:15, the Farley Unit 1 Component Cooling Water (CCW) system [CC] was inoperable due to failures of two different types of breakers, concurrent with a planned maintenance outage on the swing pump. Although Pump 1A (B Train pump) was in fact in operation, no assurance of CCW pump capability to start on demand existed. This condition is reportable under 10 CFR 50.73(a)(2)(v)(B) and (a)(2)(v)(D). This conclusion is based on results of investigation of the events described below.

Farley Nuclear Plant is currently in the process of replacing its obsolete Allis-Chalmers 4kv safety related breakers [EB] with Cutler-Hammer breakers. At the time of this event, the 1A (B Train) CCW pump was supplied by an Allis-Chalmers breaker, and the 1C (A Train) CCW pump was supplied by a Cutler-Hammer breaker. The Cutler-Hammer breaker had been installed on July 19, 2007 and had been closed successfully three out of three times in the course of normal operational activities.

On September 4, 2007 at 03:14 the Component Cooling Water (CCW) Pump 1A (B Train pump) was started in support of a planned maintenance outage on CCW Pump 1B, the swing pump, which can be aligned manually to either train. The breaker was in fact closed and the pump was in operation, but, as the investigation determined, due to a wear-related degradation of this Allis-Chalmers breaker, it may not have re-closed on demand in the event of a Loss of Site Power (LOSP).

On September 4, 2007 at 03:24, the tagout of CCW Pump 1B, which had been supplying the B Train, for scheduled maintenance commenced, and was completed at 04:57.

On September 4, 2007 at 17:00, the System Operator depressed the foot pedal for the CCW Pump 1C (A Train pump) feeder breaker DF-04 (new Cutler-Hammer breaker) due to a misapplication of procedure requirements as part of a pre-start breaker check. Based on results of investigation, this action in combination with inadequate linkage margin caused by the setup of the breaker linkage rendered the breaker incapable of closing on demand. Later, at 18:49, the CCW Pump 1C failed to start on demand due to breaker DF-04 having tripped free. The breaker was replaced, the pump restarted, and CCW Pump 1C (A Train) declared OPERABLE on September 5, 2007, at 00:15.

On September 5, 2007 at 02:33 the CCW Pump 1B was started following maintenance and CCW Pump 1A was stopped.

On September 5, 2007 at 03:42, CCW pump 1A breaker DG-04 (Allis-Chalmers breaker) failed to close resulting in pump failure to start. Although 1A CCW pump was inoperable at this point, the B train was OPERABLE since post maintenance testing of 1B pump was satisfactory.

On September 5 at 16:04, after development of a troubleshooting plan, a manual restart of CCW pump 1A breaker DG-04 was attempted and the breaker closed successfully in the undisturbed condition. However, this breaker was subsequently replaced to allow investigation of the breaker which had failed. Based on results of subsequent investigation, a duty cycle and wear related degradation mechanism - misalignment of the closing latch to the latch roller and bending of a roll pin associated with the closing latch – was present in the breaker at the time.

Cause of Event

This event was caused by failures of two different types of breakers, concurrent with a planned maintenance outage on the swing pump.

The failure of the Cutler-Hammer breaker was due to a combination of depressing the foot pedal due to misapplication of procedural requirements, and inadequate linkage margin caused by the setup of the breaker linkage in the trip latch plunger interlock. All 4kv breakers of both types have an interlock plunger that must drop into a notch in the guide rail in the switchgear, to ensure that the breaker mechanically cannot close unless it is fully racked in. Both types of breakers have a foot pedal mechanically connected to this plunger and the breaker mechanical linkage, used in lifting the plunger when racking the breaker in or out.

Due to previous corrective action for breaker failures in Allis-Chalmers breakers associated with the plunger being bound in a not full down position, guidance and training had been implemented the previous week for operators racking in breakers to verify that the plunger was full down and free to move, by checking the foot pedal. (The plunger interlock works similarly in both Allis-Chalmers and Cutler-Hammer breakers). Depressing the foot pedal relieves the play in the linkage, which can operate the trip latch, independently of the plunger. This action was appropriate when racking the breaker in, to ensure safe racking, but was not appropriate for pre-start checks in other circumstances, since it slightly changed the position of the breaker mechanical linkage. (Lifting the foot pedal resets the linkage to its proper position). In combination with the inadequate linkage margin caused by the setup of the breaker linkage, depressing the foot pedal caused the breaker to trip free when demanded to close. Procedure guidance did not provide necessary detail to perform the foot pedal manipulation only when racking in the breaker.

The failure of the Allis-Chalmers breaker was due to a failure mechanism, not previously seen, of misalignment of the closing latch to the latch roller and bending of a roll pin associated with the closing latch, which deflected the breaker operating linkage from its correct position. This resulted in intermittent failure of the breaker to close. This misalignment and bending is believed to be due to cumulative aging and wear of the breaker. Aging and wear had previously been identified as a cause of declining reliability of Allis-Chalmers breakers. An expedited program for replacement of the Allis-Chalmers breakers with Cutler-Hammer breakers was in progress, and replacement of this breaker had been scheduled, but not performed, as of the time this failure occurred.

Safety Assessment

FNP Unit 1 operated at 100 percent power in steady state throughout this event. System function would not have been lost unless an LOSP had occurred, since the 1A CCW pump was in fact already running. Based on subsequent troubleshooting, the failure of the 1A CCW pump breaker was an intermittent failure. The next close attempt for the breaker, with it undisturbed following the failure, was successful. Existing emergency procedures for an LOSP require a manual start attempt in the event of an automatic start failure. This indicates that the likelihood of successful manual restoration of system function from the control room was high. The total time system function would not have been available in the event of an LOSP was 7 hours and 15 minutes. An LOSP did not occur; system function other than auto-start was not lost, and therefore the health and safety of the public were unaffected by this event.

Cutler-Hammer breaker reliability: This was the first demand failure of a Cutler-Hammer breaker at FNP due to breaker problems and followed the changed operating practice in foot pedal manipulation. Investigation determined that mechanical linkage was set up with inadequate margin on this breaker. In conjunction with the incorrect linkage specification, the slight movement of the mechanical interlock induced by the foot pedal caused the breaker to fail to close on demand.

Allis-Chalmers breaker reliability: FNP has a project in progress to replace all safety related Allis-Chalmers breakers with Cutler-Hammer breakers due to their aging and obsolescence.

Corrective Action

Both breakers were replaced and functionally tested satisfactorily.

Operations night orders were issued and procedures revised to eliminate manipulation of the foot pedal during pre-start breaker checks, and to lift the foot pedal following racking to properly reset the mechanical interlock linkage. This action ensures proper breaker operation.

To provide additional reliability margin and assurance of breaker closure for reliable operation, the breaker linkage setup specifications were revised. Cutler-Hammer breakers in safety related applications will be verified to be within the revised linkage setup specifications by August 31, 2009. Section "Bases for Corrective Action Completion Data Extension" provides additional information.

Cutler-Hammer breakers scheduled for installation will be verified to be within revised breaker linkage setup specifications prior to installation. The installation procedure has been revised to reflect the revised specifications and in accordance with the existing maintenance procedure development program will be incorporated into applicable new breaker PM procedures when they are developed.

All Allis-Chalmers 4kv breakers supplying safety related loads were replaced by March 31, 2008.

Additional Information

The following LER has been submitted in the last two years on 4kv breaker issues:

LER 2007-001-00 Units 1 and 2 Technical Specification 3.8.1 Violation Due to Failure of Breaker / Mechanism-Operated Cell Switch

The NRC has conducted an Augmented Inspection in response to this event.

Bases for Corrective Action Completion Date Extension

Completion Date Change Description

In LER 2007-003-00, SNC presented as one of the corrective actions:

"To provide additional reliability margin and assurance of breaker closure for reliable operation, the breaker linkage setup specifications were revised. Cutler-Hammer breakers in safety related applications will be verified to be within the revised linkage setup specifications by November 30, 2008 (end of Unit 2 Refueling Outage 19)."

SNC has determined that it will not be able to complete this inspection on 13 of 80 Cutler-Hammer breakers in safety related applications by November 30, 2008. SNC has scheduled the remaining inspections for completion by August 31, 2009. All other corrective actions identified in LER 2007-003-00 have been completed.

The 13 remaining breakers are:

Component	Breaker Number
Component Cooling Water Pump 1B	DG05
Component Cooling Water Pump 1C	DF04
Component Cooling Water Pump 2B	DF05
Containment Spray Pump 2B	DG11
Residual Heat Removal Pump 1A	DF09
Service Water Pump 1C (B-Train)	DL05
Service Water Pump 1A	DK03
Service Water Pump 1D	DL03
Service Water Pump 1E	DL04
Service Water Pump 2A	DK03
Service Water Pump 2B	DK04
Service Water Pump 2C (A-Train)	DK05
Service Water Pump 1B	DK04

Reason for Not Completing All Breaker Inspections by November 30, 2008

In September 2007, SNC initiated a program and established an aggressive schedule to perform an enhanced inspection on the Cutler-Hammer breakers in safety related applications at FNP. These enhanced inspections are being performed by a dedicated breaker inspection team. Because of lessons learned after the event discussed in this LER, the enhanced inspection now includes several other breaker parameter checks in addition to the interlock linkage adjustment. Each installed Cutler-Hammer circuit breaker is inspected to ensure the identified parameter checks are addressed. In order to minimize the amount of time that each associated equipment load is out of service, the circuit breaker inspections and adjustments are performed during scheduled equipment outages.

Also, in late 2007 and into spring of 2008, delays were experienced in receiving replacement parts for components within the breakers. Delays also resulted from the breaker vendor failing to complete timely repairs of breakers which SNC had returned for rework due to initial assemble problems. These vendor delays were due to various quality issues, which resulted in inspections by the NRC that are documented in NRC inspection report ML073511425 and vendor response ML080300290. These events forced delays during the inspection and refurbishment schedule of the breakers and have resulted in 13 of 80 Cutler-Hammer breakers, in safety related applications, not being verified to be within the revised linkage setup specification of 2 3/16 inch, prior to November 30, 2008.

Justification for Extension of Completion Date

Since the LER event on September 4, 2007, SNC has completed several actions to improve confidence in the performance of the Cutler-Hammer breakers. As of March 31, 2008, SNC has installed 80 Cutler Hammer breakers in 4160 volt applications that provide power to safety related loads.

As a result of the event in September 2007, the installation procedure was revised such that the linkage specification provided a breaker mechanical trip at a plunger setting of 2 3/16 inch. In accordance with this revised procedure, 47 breakers were installed with a mechanical trip at a plunger setting of 2 3/16 inch. The 33 breakers installed prior to the procedure revision were set at the old specification, which provided a breaker mechanical trip at 2 1/16 inch. These 33 breakers require adjustment in order to meet the revised specification, per the corrective action identified above. By November 30, 2008, 20 of these 33 breakers will have been adjusted to meet the requirements of the revised setting, with 13 breakers still requiring adjustment. SNC has scheduled these remaining breakers for completion by August 31, 2009.

The remaining 13 breakers were subjected to a multi-point inspection during their installation. Two of these checks together provide confidence that the mechanical trip plunger is positioned correctly and the closing circuit will function when called upon. First, a continuity reading was taken on the closing control circuits for the breakers and second, the interlock plunger at the end of the linkage assembly is verified to be properly engaged within the switchgear cubicle guide rail notch whenever the breaker is racked to the connect position. A sample of the breaker population has been re-inspected after the initial multipoint inspections to ensure that the inspection points have remained consistent. The interlock plunger position is also verified after any breaker racking operation to be properly engaged in the guide rail notch. Knowing the proper position of the switch and proper position of the interlock plunger gives assurance the breaker will function as designed.

Therefore, the inspections that have been performed on these 13 breakers, the requirement to verify the interlock plunger position after each racking operation, and the fact that all installed Cutler-Hammer breakers at FNP have functioned properly in over 1,600 demands since December 2007, with no linkage related failures, provide confidence that the current plunger setting of 2 1/16 inch is adequate for these 13 breakers to continue to function properly until August 31, 2009, when the setting adjustment can be made to provide additional margin.