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SOUTHERN COMPANY

February 10, 2012

Docket Nos.: 50-366

NL-12-0300

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

Edwin I. Hatch Nuclear Plant – Unit 2
Licensee Event Report 2011-003 Revision 1
Manual Reactor Scram During Startup Due to
Too Few Operable Intermediate Range Monitors

Ladies and Gentlemen:

In accordance with the requirements of 10 CFR 50.73(a)(2)(i)(A) and 10CFR 50.73(a)(2)(iv)(A), Southern Nuclear Operating Company (SNC) is submitting the enclosed revised licensee event report (LER) concerning a required reactor shutdown accomplished with a manual reactor scram due to having too few intermediate range monitors (IRMs) operable. This revision provides additional detail regarding the cause of the subject event and the associated corrective actions which were applied.

This letter contains no NRC commitments. If you have any questions, please contact Doug McKinney at (205) 992-5982.

Respectfully submitted,

Mark J Ajluni

M. J. Ajluni
Nuclear Licensing Director

MJA/WEB

Enclosure: LER 2011-003-1

IE22
NRR

cc: Southern Nuclear Operating Company
Mr. S. E. Kuczynski, Chairman, President & CEO
Mr. D. G. Bost, Executive Vice President & Chief Nuclear Officer
Mr. D. R. Madison, Vice President – Hatch
Mr. B. L. Ivey, Vice President – Regulatory Affairs
RType: CHA02.004

U. S. Nuclear Regulatory Commission
Mr. V. M. McCree, Regional Administrator
Mr. E. D. Morris, Senior Resident Inspector – Hatch
Mr. P. G. Boyle, NRR Senior Project Manager-Vogtle, Hatch

Edwin I. Hatch Nuclear Plant – Unit 2
Licensee Event Report 2011-003-1

Enclosure to NL-12-0300

Manual Reactor Scram During Startup Due to Too Few Operable Intermediate Range Monitors

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

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

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 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resources@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)

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4. TITLE

Manual Reactor Scram During Startup Due to Too Few Operable Intermediate Range Monitors (IRMs)

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
10	24	2011	2011	- 003 -	1	2	12	2012	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE

2

10. POWER LEVEL

0

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

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Edwin I. Hatch / Steven Tipps – Principal Engineer – Licensing	912-537-5880

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

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On October 24, 2011, at approximately 0% power during startup from a scheduled maintenance outage, the 'A' IRM signal showed increasing levels of electrical noise while on Range 1. A spike in the signal resulted in a half-scram signal that prompted Operations personnel to bypass the 'A' IRM and declare it inoperable. The 'C' IRM subsequently began exhibiting erratic behavior and slowly drifted downscale while on Range 7. Operations personnel "ranged" down the 'C' IRM. Its signal continued to display the same behavior. Operations personnel declared the 'C' IRM inoperable, resulting in no operable IRM channel in one quadrant of the reactor core. Further control rod withdrawal to maintain the core critical was prohibited. Operations personnel were then directed to insert a manual scram signal.

Testing revealed the direct cause to be degraded signal cable shielding at under-vessel connectors in six of eight IRM channels allowing electrical noise to couple to the signal conductor. The noise was caused by a consistent low frequency signal on the preamplifier signal input and output cables and by degraded connectors. PM intervals were previously based on time rather than on duty cycle resulting in unidentified connector degradation.

Connectors were replaced and post maintenance testing confirmed noise had been reduced to acceptable levels. PM frequency changed based on duty cycle.

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NARRATIVE

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor
Energy Industry Identification System codes appear in the text as (EIIS Code XX).

DESCRIPTION OF EVENT

On October 24, 2011, while in Mode 2 (startup) at approximately 0% power, following a Unit 2 scheduled maintenance outage, the 'A' intermediate range monitor (IRM) signal exhibited increasing levels of electrical noise while on Range 1. A spike in the signal resulted in a half-scram signal that prompted Operations personnel to bypass the 'A' IRM and declare it inoperable. The noise slowly subsided as control rods were pulled to achieve criticality, and as reactor power sensed by the IRMs increased. During this time the 'A' IRM remained bypassed and inoperable.

Approximately three hours later, the 'C' IRM subsequently developed erratic behavior and slowly drifted down scale while on Range 7. Operations personnel "ranged" down the 'C' IRM in an attempt to maintain it on scale; however, its signal continued to display the same erratic behavior. Operations personnel then declared the 'C' IRM inoperable, resulting in no operable IRM channel in one quadrant of the reactor core. The station's Technical Requirements Manual (TRM) prohibits control rod withdrawal with no operable IRM channels in a core quadrant. As a result, further control rod withdrawal to counter the negative reactivity effect from the increasing reactor coolant temperature and maintain the core critical was prohibited. Operations personnel were directed to insert a manual scram signal to comply with the Technical Specifications 3.3.1.1, Action G.1, requiring the reactor to be placed in Mode 3 within 12 hours of loss of both IRMs in the affected quadrant.

CAUSE OF EVENT

Testing by a third-party vendor revealed the direct cause for the introduction of the electrical noise into the signal cable to be the degraded signal cable shielding at under-vessel connectors in six of the eight IRM channels. The degraded shielding allowed electrical noise to couple to the signal conductor rather than being shunted to ground as designed. The noise appeared to be a consistent, low frequency signal that was not blocked by ferrite beads since they primarily filter high frequency signals. These ferrite beads had been previously installed on the preamplifier signal input and output cables for that purpose. The IRM preamplifiers increased the signal noise (as well as the neutron flux signal) and transmitted it to the rest of the IRM signal processing circuit.

The IRM channels performed acceptably during three previous unit startups in 2011; thus, it appears the signal cable shielding degraded, at least in part, from stresses and wear experienced during those three startups. Historically, testing to detect and repair shielding degradation was performed during each refueling outage (once every two years) but was not required prior to each startup. The root cause determination concluded that inadequate preventive maintenance (PM) measures had been taken to prevent the electrical noise from affecting the IRM neutron flux signal since the PM intervals were based on chronological time rather than duty cycle on the IRM detectors. This allowed degradation to go uncorrected on the under vessel connectors during the previous two shutdowns. Additionally, there was no PM to check the coupling between the HN connectors and its field cables.

REPORTABILITY ANALYSIS AND SAFETY ASSESSMENT

This event is reportable in accordance with 10CFR50.73(a)(2)(iv)(A), which requires the licensee to report any event or condition that resulted in a manual or automatic actuation of any Engineered Safety Feature (ESF), including the reactor protection system (RPS). Additionally, when IRMs 'A' and 'C' became inoperable, both IRMs in the same quadrant of the reactor core were inoperable. The required action by the Technical Specifications was to be in Mode 3 within 12 hours. Completion of the shutdown required by the Technical Specifications is reportable in accordance with 10CFR50.73(a)(2)(i)(A).

The IRMs monitor neutron flux levels from the upper range of the source range monitor (SRM) to the lower range of the average power range monitors (APRMs). The IRMs are capable of generating trip signals that can be used to prevent fuel damage resulting from abnormal operating transients in the intermediate power range. In this power range, the most significant source of reactivity change is due to control rod withdrawal. The IRMs support the mitigation of control rod withdrawal error events and are diverse from the rod worth minimizer (RWM), which monitors and controls the movement of control rods at low power. The IRM System is divided into two groups of IRM channels, with four IRM channels inputting to each trip system. An analysis performed by General Electric (GE) assumes that one channel in each trip system is bypassed. However, a more recent analysis performed by GE in April 2002 revealed that, even with two IRMs operable per trip system, adequate protection is provided for reactivity events in the intermediate range. This trip is active in each of the 10 ranges of the IRM, which must be selected by the operator to maintain the neutron flux within the monitored level of an IRM range.

The IRM scram function provides for reactor protection during startup, shutdown, and low power operations. Because the subject IRM "high-high" neutron flux trips were due to electrical noise introduced to the instrumentation, no actual over power event occurred. The safety function of the IRM's was not diminished. There were no safety consequences as a result of this event. All control rods (EIIS Code AA) inserted and plant systems operated as expected following the scram. There were no systems or components inoperable during the event that could have contributed to the event. The reactor scram posed no safety consequences to the health and safety of the general public or plant personnel.

Based on this analysis, it is concluded that this event had no adverse impact on nuclear safety. This analysis is applicable to all power levels and operating modes in which a LOCA is postulated to occur.

CORRECTIVE ACTIONS

Maintenance personnel replaced the six degraded under-vessel connectors for the affected IRMs. Post maintenance testing confirmed that the noise coupling to the signal conductor had been reduced to acceptable levels. The reactor resumed startup activities on October 28, 2011 with only a minor noise problem remaining on the 'A' IRM signal. Actions continue to find and eliminate the low frequency noise on the 'A' IRM channel.

Signal path testing for the Unit 2 IRMs was performed prior to startup from a maintenance outage that occurred in December 2011.

Long-term corrective actions include testing the SRM and IRM signal paths prior to each startup to ensure service-based deterioration that might occur between scheduled testing is discovered and corrected prior to the SRM and IRM instruments being needed. Current plans are to perform reverse time domain reflectometry (RTDR) testing on SRM/IRMs to confirm signal cable integrity prior to starting up Unit 1 and 2 from each unit outage, rather than performing this testing only during refueling outages. Specific PM is being developed that will check the coupling between the field cables and the HN connectors associated with signal cables for Unit 1 and 2 SRMs on a periodic basis.

ADDITIONAL INFORMATION

Other Systems Affected: None

Failed Components Information: None

Commitment Information: This report does not create any new permanent licensing commitments.

Previous Similar Events:
LER 1-2009-004 was reported June 19, 2009, in which an IRM signal spike due to electrical noise the

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resulted in a reactor scram. The cause of the signal spike was high frequency electrical noise coupled to the IRM signal conductors through degraded connector shielding.

Degraded cables and connections were replaced, improvements made on the grounding of the neutron monitoring system and ferrite beads were installed on each cable entering and/or exiting the preamplifier NEMA enclosures on each of the eight channels.

No actions such as IRM signal path testing prior to each startup or increased monitoring of IRM signals prior to startup to detect the presence of noise were put into place for this event. The need for increased PM based on duty cycle also was not realized in previous conditions involving noise related issues with the IRMs. There is a potential that implementation of additional actions for this event in 2009 could have precluded entry into this condition in 2011.