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SOUTHERN COMPANY

JUL 1 0 2015

Docket Nos.: 50-366

NL-15-1230

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

Edwin I. Hatch Nuclear Plant
Licensee Event Report 2015-004-00
Safety Relief Valves As Found Settings Resulted in Not Meeting Tech Spec Surveillance Criteria

Ladies and Gentlemen:

In accordance with the requirements of 10 CFR 50.73(a)(2)(i)(B) Southern Nuclear Operating Company hereby submits the enclosed Licensee Event Report.

This letter contains no NRC commitments. If you have any questions, please contact Greg Johnson (912) 537-5874.

Respectfully submitted,

C. R. Pierce

C. R. Pierce
Regulatory Affairs Director

CRP/jcm

Enclosure: LER 2015-004-00

cc: Southern Nuclear Operating Company
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**<u>Edwin I. Hatch Nuclear Plant</u>**

**Enclosure**

**Licensee Event Report 2015-004-00**

**Safety Relief Valves As Found Settings Resulted in Not Meeting Tech Spec Surveillance Criteria**

NRC FORM 366 (02-2014) U.S. NUCLEAR REGULATORY COMMISSION

# LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)



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| Edwin I. Hatch Nuclear Plant Unit 2 | 05000 366 | 1 OF 5 |

**4. TITLE**

Safety Relief Valves As Found Settings Resulted in Not Meeting Tech Spec Surveillance Criteria

| 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 |
| 05 | 11 | 2015 | 2015 | - 004 - | 00 | 07 | 10 | 2015 | FACILITY NAME | DOCKET NUMBER |

**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**

| LICENSEE CONTACT | TELEPHONE NUMBER *(Include Area Code)* |
|---|---|
| Edwin I. Hatch / Carl Collins – Licensing Supervisor | 912-537-2342 |

**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 |
|---|---|---|---|---|---|---|---|---|---|
| B | SB | RV | T020 | 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)*

On May 11, 2015 at approximately 0923, Unit 2 was at 100 percent rated thermal power (RTP) when the "as-found" testing results of the 2-stage main steam safety relief valves (SRVs) were received which indicated that two of eleven of the Unit 2 SRVs had experienced a setpoint drift during the previous operating cycle which resulted in their failure to meet the Technical Specification (TS) opening setpoint of 1150 +/- 34.5 psig percent as required by TS Surveillance Requirement (SR) 3.4.3.1.

The root cause of the SRV setpoint drift is attributed to corrosion-induced bonding between the pilot disc and seating surfaces. This conclusion is based on previous root cause analyses and the repetitive nature of this condition at Hatch and within the BWR industry. All 2-stage SRVs with platinum coated pilot seats were removed from Unit 2 during the 2015 refueling outage and replaced with 3-stage SRVs with a modified pilot. 3-stage SRVs typically do not exhibit set point drift and the modified pilot reduces instances of vibration induced spurious openings and leak-by.

A 3-stage SRV with a similar modified pilot was installed on Unit 2 during the 2013 refueling outage. Based upon "as-found" testing results, it was seen that pressure lift setpoints were maintained during plant operation.

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 May 11 2015, at approximately 0923, with Unit 2 at 100 percent rated thermal power (RTP), “as-found” testing of the 2-stage main steam safety relief valves (SRVs) (EIIS Code RV) showed that two of the ten main steam SRVs that were tested had experienced a drift in pressure lift setpoint during the previous operating cycle such that the allowable technical specification (TS) surveillance requirement (SR) 3.4.3.1 limit of 1150 +/- 34.5 (+/- 3%) psig had been exceeded. Below is a table illustrating the as found testing results of Unit 2 SRVs that were removed from service during the Spring 2015 refueling outage and replaced with 3-stage SRVs.

| MPL | Pilot Serial No. | Lift Pressure | Percent Drift |
|---|---|---|---|
| 2B21-F013B | 1006 | 1155 | 0.40% |
| 2B21-F013C | 1231 | 1172 | 1.90% |
| 2B21-F013D | 303 | 1184 | 3.00% |
| 2B21-F013E | 315 | 1210 | 5.20% |
| 2B21-F013F | 1189 | 1179 | 2.50% |
| 2B21-F013G | 302 | 1174 | 2.10% |
| 2B21-F013H | 1230 | 1190 | 3.50% |
| 2B21-F013K | 1229 | 1164 | 1.20% |
| 2B21-F013L | 1228 | 1163 | 1.10% |
| 2B21-F013M | 1008 | 1179 | 2.50% |

The 2-stage SRVs that were installed on Unit 2 during the previous cycle (Cycle 23) utilized platinum coated pilot discs. The 3-stage SRVs currently installed on Unit 2 have a modified pilot that helps reduce the possibility of inadvertent lift and leak by due to system vibration. The one 3-stage SRV that was installed on Unit 2 during Cycle 23 was recently successfully tested and found to be within the allowable TS SR pressure lift setpoint limit of 1150 +/- 34.5 (+/- 3%) psig.

CAUSE OF EVENT

The root cause of the SRV setpoint drift is attributed to corrosion-induced bonding between the pilot disc and its seating surface. This conclusion is based on previous root cause analyses and the repetitive nature of this condition at Plant Hatch and in the industry. In General Electric (GE) Service Information Letter (SIL) 196, Supplement 16, GE determined that condensation of steam in the pilot chamber of Target Rock 2-stage SRVs can cause oxygen and hydrogen dissolved in the steam to accumulate. As steam condenses in the relatively stagnant pilot chamber, the dissolved gases are released. In a volume such as the pilot chamber which is normally at approximately a 1000 psig

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pressure and a temperature of 545 degrees F, the total pressure consists primarily of water vapor partial pressure because 544.6 degrees F is the saturation temperature at 1000 psig. This wet, hot, high-oxygen atmosphere can be very corrosive and can increase the likelihood of corrosion-induced bonding of the pilot disk to its seat. It was also noted that proper insulation minimizes the accumulation rate of non-condensable gases and the steady-state oxygen partial pressure. Despite improvements made in maintaining the integrity of insulation for the previously installed 2-stage SRVs and installing new platinum coated pilots, the corrosion-induced bonding continued to occur as evidenced by the test results from this most recent outage.

REPORTABILITY ANALYSIS AND SAFETY ASSESSMENT

This event is reportable in accordance with 10 CFR 50.73(a)(2)(i)(B) because a condition occurred that is prohibited by TS Surveillance Requirement (SR) 3.4.3.1. Specifically, an example of multiple test failures is given in NUREG-1022, Revision 3, "Event Reporting Guidelines 10 CFR 50.72 and 50.73" which describes the sequential testing of safety valves. This example notes that "Sometimes multiple valves are found to lift with set points outside of technical specification limits."

NUREG-1022 further states in the example that "discrepancies found in TS surveillance tests should be assumed to occur at the time of the test unless there is firm evidence, based on a review of relevant information (e.g., the equipment history and the cause of failure), to indicate that the discrepancy occurred earlier. However, the existence of similar discrepancies in multiple valves is an indication that the discrepancies may well have arisen over a period of time and the failure mode should be evaluated to make this determination." Based on this guidance and the fact that the development of the corrosion occurred over a period of time of plant operation, the determination was made that this "as found" condition is reportable under the reporting requirements of 10 CFR 50.73(a)(2)(i)(B).

There are eleven SRVs located on the four main steam lines within the drywell in between the reactor pressure vessel (RPV) (EIIS Code RPV) and the inboard main steam isolation valves (MSIVs) (EIIS Code ISV). These SRVs are required to be operable during Modes 1, 2, and 3 to limit the peak pressure in the nuclear system such that it will not exceed the applicable ASME Boiler and Pressure Vessel Code Limits for the reactor coolant pressure boundary. The SRVs are tested in accordance with TS surveillance requirement 3.4.3.1 in which the valves are tested as directed by the In-Service Testing Program to verify lift set points are within their specified limits to confirm they would perform their required safety function of overpressure protection. The SRVs must accommodate the most severe pressurization transient which, for the purposes of demonstrating compliance with the ASME Code Limit of 1375 psig peak vessel pressure, has been defined by an event involving the closure of all MSIVs with a failure of the direct reactor protection system trip from the MSIV position switches with the reactor ultimately shutting down as the result of a high neutron flux trip (a scenario designated as MSIVF).

The results from this MSIVF event analysis was performed by the Nuclear Fuels Department in order to bound the "as-found" results of the U2 Cycle 21 2-stage SRVs pressure setpoint drift. The results from this analysis showed a small increase in peak pressures relative to the Hatch-2 Cycle 21 reload licensing analysis (RLA) results. The higher peak pressures were due to the fact that eight of the eleven SRVs opened at pressures higher than that which was assumed in the RLA. It should be noted that in this analysis, the larger actual valve bore size was used in the calculations for nine of the valves rather than the smaller bore size which was conservatively assumed in the RLA. Therefore, higher steam flow capacities than those assumed in the RLA were used in this analysis for those nine valves.

Based on the analysis, the calculated minimum margin to the 1375 psig ASME Boiler and Pressure Vessel Code overpressure limit for peak vessel pressure would have been 27.7 psig and the minimum margin to the 1325 psig Tech Spec Safety Limit for the reactor steam dome pressure would have been 2.9 psig during an MSIVF event during Cycle 21 operation. Therefore, these test results show that in this case, where two of the eleven SRVs would have opened at pressures higher than that which was assumed in the RLA, the peak pressure at the bottom of the vessel would have remained below the ASME Boiler and Pressure Vessel code limit and the peak RPV dome pressure remained within the TS Safety limits.

Additionally, a highly reliable, though non-credited, electrical actuation system serves as a redundant, independent method to actuate the SRVs. During Cycle 23 this redundant electrical logic system was fully functional.

Based on the analyses performed, the overpressure protection system would have continued to perform its required safety function if called upon in its "as found" condition. Therefore, this event had no adverse impact on nuclear safety and was of very low safety significance.

## CORRECTIVE ACTIONS

The 2-stage SRVs with platinum-coated pilot discs were removed from Unit 2 during the 2015 refueling outage and replaced with 3-stage SRVs that have a modified pilot. 3-stage SRVs typically do not exhibit set point drift due to their design. The modified pilots will help reduce spurious openings and leak-by due to system vibration.

## ADDITIONAL INFORMATION

Other Systems Affected: None

Failed Components Information:

Master Parts List Number: 2B21-F013E, H
Manufacturer: Target Rock
Model Number: 7567F
Type: Relief Valve
Manufacturer Code: T020

EIIS System Code: SB
Reportable to EPIX: Yes
Root Cause Code: B
EIIS Component Code: RV

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

## PREVIOUS SIMILAR EVENTS:

LER 1-2014-003, identified multiple SRV setpoint drifts for 5 of the 11 two-stage SRVs installed on Unit 1. The two-stage SRVs with platinum-coated pilot discs were removed from Unit 1 during the 2014 refueling outage and replaced with 3-stage SRVs that have a modified pilot. The modified pilots will help reduce spurious openings and leak-by due to system vibration.

LER 1-2012-004, identified multiple SRV setpoint drift for 8 of the 11 SRVs. Corrective actions included replacement of the 2-stage SRVs with 2-stage SRVs whose pilot discs had undergone a platinum surface treatment which was considered at that time to be the long term fix for this corrosion bonding issue.

LER 2-2011-002, identified multiple SRV setpoint drift for 8 of the 11 SRVs. Corrective actions included replacement of the 2-stage SRVs with 3-stage SRVs during the Unit 2 Spring 2011 refueling outage which was considered at that time to be the long term fix for this corrosion bonding issue. Subsequent to that outage the 3-stage SRVs exhibited signs of unacceptable leakage which resulted in two separate outages that involved changing out four SRVs during the first outage and the remaining seven SRVs during the subsequent outage in May 2012. The 3-stage SRVs were replaced with 2-stage SRVs containing pilot discs that had undergone the platinum surface treatment.

LER 1-2010-001, identified multiple SRV setpoint drift for 5 of the 11 SRVs. Corrective actions included refurbishment of the pilot valves and included the replacement of the pilot discs with discs made from Satellite 21 material. Additionally, the insulation surrounding each SRV was upgraded to improve resistance to corrosion-induced bonding. These were the same actions that were taken following similar failures reported in LER 2-2009-001, since improved results had been seen to some degree in the industry for at least one operating cycle when these actions were implemented.