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U. S. Nuclear Regulatory Commission
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Joseph M. Farley Nuclear Plant, Unit 2
Reply to a Notice of Violation; EA-07-173
NRC Inspection Report 05000348,364/2007011

Ladies and Gentlemen:

By letter dated August 2, 2007, the Nuclear Regulatory Commission (NRC) staff notified Southern Nuclear Operating Company (SNC) of an Apparent Violation and Preliminary Yellow Finding for the failure to promptly identify and correct a condition which resulted in the Farley Nuclear Plant (FNP), Unit 2, Residual Heat Removal (RHR) train A containment sump suction valve failing to stroke full open on April 29, 2006 and January 5, 2007.

On September 12, 2007, SNC attended a regulatory conference at NRC Region II to present its position on the Unit 2 RHR train A valve stroke issue. During the regulatory conference, SNC also presented lessons learned from an independent assessment commissioned by the FNP Site Vice President and discussed continuing efforts to focus on and improve equipment reliability, the overall quality of cause investigations, and the corrective action program.

By letter dated October 31, 2007, the NRC staff provided SNC the final results of its significance determination, issuing FNP a Yellow Finding and Notice of Violation. Pursuant to the provisions of 10 CFR 2.201, SNC submits its response to the violation as an Enclosure to this letter. SNC accepts the violation and has elected not to appeal the staff's final significance determination.

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

Sincerely,

J. R. Johnson
Vice President - Farley

JRJ/JSL/phr

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cc: Southern Nuclear Operating Company
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Mr. J. R. Johnson, Vice President – Farley
Mr. D. H. Jones, Vice President – Engineering
Ms. M. Caston, Vice President and General Counsel
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U. S. Nuclear Regulatory Commission
Mr. V. M. McCree, Acting Regional Administrator
Ms. K. R. Cotton, NRR Project Manager – Farley
Mr. E. L. Crowe, Senior Resident Inspector – Farley

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Restatement of Violation 05000364/2007011-01

In its Final Significance Determination for a Yellow Finding and Notice of Violation, issued October 31, 2007, the NRC Region II staff cited Farley Nuclear Plant (FNP) for a violation of NRC requirements, as follows:

10 CFR 50, Appendix B, Criterion XVI, requires that measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and non-conformances are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition.

Contrary to the above, the licensee failed to promptly identify and correct a significant condition adverse to quality that resulted in Unit 2 encapsulated valve Q2E11MOV8811A (containment sump suction to Residual Heat Removal pump 2A) failing to stroke full open during testing on April 29, 2006, and again on January 5, 2007. The licensee did not assure that the causes of the condition, including rust/corrosion accumulation on valve components in the valve encapsulation dating back to 2001, were determined and corrective action taken to preclude repetition.

Southern Nuclear Operating Company (SNC) does not contest the violation.

1. Reason for the Violation

On April 29, 2006, FNP Unit 2 MOV 8811A (the A-Train Residual Heat Removal (RHR) pump suction valve) failed to stroke fully open, on the first attempt, during routine surveillance testing. The plant operator and shift supervisor repeated the valve maneuver, and the valve stroked to the full open position on the third attempt (the "April 2006 Unit 2 Occurrence").

In response to the April 2006 Unit 2 Occurrence, the site generated a condition report (CR), conducted an apparent cause evaluation and executed a work order to troubleshoot the valve function issue. The following corrective actions were completed: (1) MOV diagnostic testing (MCC testing) was performed, with no abnormalities noted; and (2) the valve was stroked several times and functioned per design on each stroking.

Based on the satisfactory results of these additional diagnostic tests and valve function checks, the site determined that removal of the encapsulation vessel was not needed following the April 2006 Unit 2 Occurrence. The site did, however, initiate planning for the removal of the encapsulation and replacement of the torque switch during the next Unit 2 refueling outage. The site also instituted compensatory measures to provide added assurance of continued valve functionality. Specifically, the site increased the surveillance frequency to weekly during the following month (May 2006), then monthly for

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the next two months (June and July 2006). Because all tests during this period were satisfactory, the site returned to a quarterly surveillance frequency, with the next test occurring in October 2006. That test was also satisfactory.

Subsequently, during the next quarterly surveillance test, on January 5, 2007, the FNP Unit 2 MOV 8811A again failed to stroke fully open on the first attempt. Again, the valve opened on the third attempt (the "January 2007 Unit 2 Occurrence"). In response to the January 2007 Unit 2 Occurrence, the site generated a CR, assigning it a higher priority due to the repeat nature of the occurrence, and initiated a root cause evaluation and associated work orders. The initial root cause evaluation identified corrosion due to moisture inside the encapsulation as the likely root cause of the failure of the open torque switch causing the valve to fail to stroke fully open on the first attempt.

The following corrective actions were taken: (1) the encapsulation vessel was opened and the torque switch was electrically removed from the opening circuit; (2) the valve was stroked several times and functioned per design; (3) the material condition of the encapsulation was examined and it was determined that it could be improved; and (4) plans were initiated to refurbish the inside of the encapsulation vessels during the upcoming April 2007 Unit 2 outage.

During the April 2007 outage, the Unit 2 encapsulation vessels were opened, inspected, cleaned, and new coatings applied to the accessible portions of the interior of the encapsulations. In a further attempt to identify the cause for the torque switch preventing full valve opening, the MOV 8811A torque switch and motor were removed and sent offsite for detailed physical inspection. As a preventative measure, the torque switch bypass was set to approximately 95% via the design change process for all Unit 2 encapsulated valves. The motor for MOV8811A was replaced. In addition, SNC engaged outside engineering / original equipment manufacturer (OEM) support in its continuing root cause evaluation.

Because equivalent RHR and containment spray sump suction valves for Unit 1 are located in encapsulation vessels similar to those of the Unit 2 valves, SNC conservatively took the following preventative measures on Unit 1: (1) prior to the Fall 2007 Unit 1 outage, SNC increased stroke testing frequency to monthly; (2) in June and July 2007, each Unit 1 encapsulation vessel was opened and the torque switch bypass setting was adjusted to approximately 95% via the design change process; and (3) SNC initiated a program to assess moisture intrusion in the encapsulations.

Subsequently, based on the additional analysis performed by the OEM and the independent physical examination of the valve and motor, the root cause analysis was revised to conclude that the following were the root cause factors.

Root cause RC 1

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C2G Design Configuration and Analysis/Design Analysis/System or component functional design deficiency

In that the Unit 2 MOV 8811A (unique among the encapsulated valves) has a hammer blow actuator that introduces a sufficient opening torque transient to momentarily open the torque switch. This feature, in conjunction with the pitting on the torque switch open contact finger support bracket, allowed the torque switch contacts to "hang-up" and not reclose. The cause of the pitting is not fully understood and investigations are continuing.

Root cause RC2

C2G Design Configuration and Analysis/ Design Analysis/System or component functional design deficiency

In that the torque switch bypass limit switch LS13 was set to open at approximately 20% of valve travel. The torque switch is designed to protect the valve/operator from overtorque into the open stop with a misadjusted limit switch, and therefore only needs to be set below the full open position (e.g. 90-95%). Since the risk significance function of this valve is to open while maintaining its pressure boundary, a component protective setpoint more restrictive than necessary is inappropriate.

2. Corrective Steps Taken and Results Achieved

- a) The design of the MOV torque switch bypass valve opening circuits for encapsulated valves was revised to bypass the torque switches until the valves are near full open to allow the valves to pass full flow prior to the possibility of the torque switch inhibiting valve opening.
- b) The torque switch bypass design change was implemented on all four Unit 1 and Unit 2 encapsulated valves.
- c) Inspections were performed of all Unit 1 and Unit 2 encapsulated valve limit switch enclosures/torque switches for corrosion of torque switch contact finger springs, and the mechanism of "hang-up." No additional torque switch was found to be hanging open.
- d) Specific inspections needed to identify and prevent the subject failure mechanism for Unit 1 and Unit 2 have been included in a revised procedure.
- e) The inspection procedure was revised to specifically monitor for adverse effects resulting from rust or corrosion. The new requirements have been completed on Unit 1 and Unit 2.
- f) A program to monitor water intrusion into encapsulations has been implemented and appropriate actions are being taken when water is found.

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The action taken is to periodically (approximately monthly) remove the Unit 1 and Unit 2 RHR and containment spray sump suction valve encapsulation drain caps to capture any water accumulation. Any water collected is analyzed in an attempt to identify the water source (e.g. ground water, condensation, RWST water, etc.). Any continued water intrusion will be entered into the Corrective Action Program.

- g) To resist moisture intrusion from external sources, procedures and work packages/standard planning sequences were revised to ensure the correct gasket is used during Unit 1 and Unit 2 encapsulation reassembly. In addition, the insulation to reduce the condensation onto the encapsulations was added via the design change process to the residual heat removal pump room coolers.
- h) An engineering review was performed to verify that the design of the encapsulation system is adequate to meet design basis.
- i) The removed torque switch for Unit 2 MOV 8811A was inspected/tested by the OEM to determine the switch material condition, electrical characteristics, and freedom of movement for the non-stationary parts. All inspections and tests conducted with the switch assembled were determined to be acceptable. The switch was subsequently disassembled for further inspections. Once disassembled, the open side contact support was noted to have pitting in the area of the normal open side contact finger "closed" position. The open side contact finger was determined to have sustained wear resulting in the loss of the silver plating at the interfacing area with the contact support. The OEM concluded these conditions were non-typical and could have contributed to the open side contact finger failing to return to the made (closed) position following the hammer blow action when stroking MOV8811A open. Additional metallurgical evaluations are ongoing for the affected contact support and contact finger in an attempt to determine the cause of the observed conditions. The conditions noted for the open side contact support and contact finger were not found on the closed side of the torque switch.
- j) The vulnerability to other encapsulated valves was assessed and it was determined that Unit 2 MOV 8811A has a unique valve and actuator design. This hammer blow design is uniquely susceptible in that forces developed during opening are higher for this valve than all other encapsulated valves.
- k) An expectation is in place to ensure if another Unit 1 or Unit 2 encapsulated valve failure to fully open occurs, the valve will remain in the failed condition and the encapsulation removed to observe the torque switch and limit switch in the failed condition.
- l) The normal quarterly stroke surveillance frequency for the Unit 1 and Unit 2 RHR and containment spray sump suction encapsulated valves was increased to monthly and the valves have stroked open properly.

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- m) A corrective action management review board has been established since the initial failure of Unit 2 MOV8811A. This board addresses weaknesses in developing corrective actions that contributed to the second failure by providing additional review of condition report prioritization, investigation, and resolution. Further, a case study on this issue including lessons learned was added to recurring safety culture training associated with the reactor pressure vessel head degradation at Davis-Besse Nuclear Power Station. First line supervision and above recently attended this training. In addition, the management team recently participated in a table top discussion to reinforce and deepen the appropriate consideration of potential consequences when evaluating risk and making decisions.

3. Corrective Steps to be Taken to Avoid Further Violations

- a) An inspection of the pipe chases upstream of the encapsulations will be performed by March 31, 2008 to determine actual conditions in the pipe chases in order to provide input for moisture source elimination or control. Unit 1 MOV8826B (containment sump suction to Containment Spray pump 2B) has been completed.
- b) The vendor pitting evaluation will be reviewed for any required actions beyond the enhanced preventive maintenance program.
- c) The torque switch bypass design change for safety significant non-encapsulated safety related MOV's where the safety function of the valve is to stroke to the open position is ongoing and will be completed by June 10, 2009.

4. Date When Full Compliance Will be Achieved

SNC is in full compliance. Based on inspections and corrective actions completed, SNC has determined that the encapsulated valves will perform their intended function.