



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**  
REGION II  
SAM NUNN ATLANTA FEDERAL CENTER  
61 FORSYTH STREET, SW, SUITE 23T85  
ATLANTA, GEORGIA 30303-8931

September 21, 2009

Mr. David A. Baxter  
Site Vice President  
Duke Energy Carolinas, LLC  
Oconee Nuclear Station  
7800 Rochester Highway  
Seneca, SC 29672

**SUBJECT: OCONEE NUCLEAR STATION - NRC SUPPLEMENTAL INSPECTION  
REPORT 05000269/2009008**

Dear Mr. Baxter:

On September 3, 2009, the U.S. Nuclear Regulatory Commission (NRC) completed a supplemental inspection pursuant to Inspection Procedure 95001, "Inspection for One or Two White Inputs in a Strategic Performance Area," at your Oconee Nuclear Station, Unit 1. The enclosed inspection report documents the inspection results, which were discussed at the exit meeting on September 3, 2009, with you and other members of your staff.

As required by the NRC Reactor Oversight Process Action Matrix, this supplemental inspection was performed because a finding of low to moderate safety significance (White) was identified in the 4th quarter of 2008. This issue was documented previously in NRC Inspection Report 05000269,270,287/2009007. The NRC was informed on May 7, 2009, of your staff's readiness for this inspection.

The objectives of this supplemental inspection were to provide assurance that: (1) the root causes and the contributing causes for the risk-significant issues were understood; (2) the extent of condition and extent of cause of the issues were identified; and (3) corrective actions were or will be sufficient to address and preclude repetition of the root and contributing causes. The inspection consisted of examination of activities conducted under your license as they related to safety, compliance with the Commission's rules and regulations, and the conditions of your operating license.

The inspector determined that, in general, the problem identification, root cause analysis, and corrective actions were adequate. As stated in your staff's evaluation, the identified primary root cause of the issue was a failure to recognize an unanticipated system interaction between the AVR trip circuitry and the backcharge power path, which resulted in a loss of reactor coolant system inventory while on decay heat removal. Based on the results of this inspection, no findings of significance were identified.

DEC

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In accordance with the Code of Federal Regulations 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of the NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

***/RA/***

Jonathan H. Bartley, Chief  
Reactor Projects Branch 1  
Division of Reactor Projects

Docket Nos.: 50-269  
License Nos.: DPR-38

Enclosure: Inspection Report 05000269/2009008  
w/Attachment: Supplemental Information

cc w/encl: (See page 3)

DEC

2

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DEC

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Letter to David A. Baxter from Jonathan H. Bartley dated September 21, 2009

SUBJECT: OCONEE NUCLEAR STATION - NRC SUPPLEMENTAL INSPECTION  
REPORT 05000269/2009008

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**U.S. NUCLEAR REGULATORY COMMISSION**

**REGION II**

Docket No.: 50-269

License No.: DPR-38

Report No.: 05000269/2009008

Licensee: Duke Energy Carolinas, LLC

Facility: Oconee Nuclear Station, Unit 1

Location: Seneca, SC 29672

Dates: August 31, 2009 - September 3, 2009

Inspector: E. Stamm, Project Engineer

Approved by: Jonathan H. Bartley, Chief  
Reactor Projects Branch 1  
Division of Reactor Projects

Enclosure

## SUMMARY OF FINDINGS

Inspection Report (IR) 05000269/2009008; 08/31/2009 - 09/03/2009; Oconee Nuclear Station, Unit 1; Supplemental Inspection for a White Finding

This inspection was conducted by a project engineer. No findings of significance were identified. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 4, dated December 2006.

### **Cornerstone: Initiating Events**

This supplemental inspection was performed in accordance with Inspection Procedure (IP) 95001, "Inspection for One or Two White Inputs in a Strategic Performance Area," to assess the licensee's evaluation associated with a White inspection finding involving a loss of reactor coolant system inventory while on decay heat removal. The NRC staff previously characterized this issue as having low to moderate safety significance (White) as documented in NRC IR 05000269,270,287/2009007.

Based on the results of this inspection, the inspector determined that the cause evaluations were generally adequate and corrective actions were comprehensive and properly prioritized. The licensee's root cause evaluations for the loss of inventory event identified the primary root cause of the loss of backcharge power to be a failure to recognize an unanticipated system interaction between the automatic voltage regulator (AVR) trip circuitry and the backcharge power path. In addition, the primary root cause of the failure of motor control center (MCC) 1XP to re-energize following the transfer of power sources was identified as a human error during the last breaker preventative maintenance which failed to restore the breaker trip setpoint to the as-found HI setting. Corrective actions for this event included a change to the procedure to isolate the AVR input signal to the generator lockout relay, a review and analysis of all unnecessary trips that should be isolated while on backcharge, a change to the procedure development and revision process, a review of all protective relay and breaker procedures for critical steps, and additional training for all applicable employees. The licensee also has corrective actions to complete its review of current breaker settings for incorrect settings, and to perform a coordination study for all non-safety MCCs to verify normal and emergency feeder breaker settings are designed optimally.

Given the licensee's comprehensive evaluation addressing the loss of inventory event, the White finding will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in Inspection Manual Chapter (IMC) 0305, "Operating Reactor Assessment Program." The implementation and effectiveness of the licensee's corrective actions will be reviewed during future inspections.

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## REPORT DETAILS

### 4. OTHER ACTIVITIES

#### 4OA4 Supplemental Inspections

##### .1 Inspection Scope

This supplemental inspection was performed in accordance with IP 95001 to assess the licensee's evaluation of a White finding which affected the Initiating Events cornerstone objective in the Reactor Safety strategic performance area. The White finding was associated with a loss of reactor coolant system inventory. On April 15, 2008, a failure to implement an adequate AVR maintenance procedure resulted in a slow transfer of power from the normal power source to the startup power source, and ultimately led to a loss of reactor coolant system inventory while on decay heat removal. The finding was characterized as having low to moderate safety significance based on the results of a Phase 3 risk analysis as discussed in NRC IR 05000269,270,287/2008010. The licensee informed the NRC on May 7, 2009, that they were ready for this supplemental inspection. The inspection objectives were to:

- provide assurance that the root and contributing causes of risk-significant issues were understood;
- provide assurance that the extent of condition and extent of cause of risk-significant issues were identified; and
- provide assurance that the licensee's corrective actions for risk-significant issues were or will be sufficient to address the root and contributing causes and to preclude repetition.

The inspector reviewed two root cause evaluations associated with Problem Investigation Process reports (PIPs) O-08-02056 and O-08-02086. These root cause evaluations were performed to identify weaknesses that existed in various organizations, which allowed for a risk-significant finding, and to determine the organizational attributes that resulted in the White finding. The inspector reviewed corrective actions that were either taken or planned to address the identified root and contributing causes. The inspector also held discussions with licensee personnel to ensure that the root and contributing causes and the contribution of safety culture components were understood and corrective actions taken or planned were appropriate to address the causes and preclude repetition.

##### .2 Evaluation of the Inspection Requirements

###### 2.01 Problem Identification

- a. Determine that the evaluation documented who identified the issue (i.e., licensee-identified, self-revealing, or NRC-identified) and under what conditions the issue was identified

The inspector determined that the event evaluations were sufficiently detailed to identify who and under what conditions the issue was identified.

Enclosure

On April 15, 2008, Unit 1 was on backcharge (power being fed from the electrical grid back through the main transformer to power specific plant loads) when a slow transfer from the normal source of backcharge (via the Main Step-up Transformer through the normal (N) breakers) to the startup source (via startup transformer CT-1 through the startup (E) breakers) occurred. At the time of the event, AVR preventative maintenance (PM) was being performed under procedure IP/0/B/2005/001. This PM involved replacing the measuring unit board (MUB) for each AVR channel. During the first power up sequence of a MUB, a momentary signal was generated that actuated the K31 tripping relay within the AVR. The K31 relay actuated the generator lockout which opened power circuit breakers (PCBs) 20 and 21 and the N breakers (B1T-3 and B2T-11). After a 1.8 second delay, the E breakers (B1T-1 and B2T-13) closed aligning power to the Unit 1 auxiliary loads via CT-1. Following the slow transfer, MCC 1XP lost power and did not re-energize as expected. The 1.8 second slow power transfer and subsequent loss of MCC 1XP caused solenoid valves in the low pressure injection (LPI) purification line to fail closed. When the 1A and 1B LPI pumps automatically restarted, a relief valve in the purification line opened causing a loss of inventory to the high activity waste tank. Operations entered AP-26 (Loss of Decay Heat Removal) due to the inventory decrease. Makeup was provided from the borated water storage tank. 1LP-96 was closed per AP-26 which stopped the leak. During the event, reactor coolant system level decreased from 70 inches to 54 inches.

- b. Determine that the evaluation documented how long the issue existed and prior opportunities for identification

The inspector determined that the evaluations for the event documented how long the issue existed and prior opportunities for identification.

The loss of backcharge source during the AVR PM was a result of an inadequate AVR maintenance procedure which failed to recognize the interaction between the AVR trip circuitry and the backcharge power path. The failure of MCC 1XP to re-energize when power was transferred from 1T to CT-1 was a result of an improper magnetic trip setting on breaker 1XP-F3A following maintenance performed on the breaker 17 months prior to the event. No prior opportunities existed to identify the issues since the AVR PM was conducting first-time work and there was no work history identified on the 1XP-F3A breaker following the maintenance performed in November 2006.

- c. Determine that the evaluation documented the plant-specific risk consequences, as applicable, and compliance concerns associated with the issues

The inspector determined that the evaluations for the event adequately documented the risk consequences and compliance concerns.

The licensee implemented several corrective actions to address risk including a corrective action to prevent recurrence (CAPR) to ensure high risk work, that could interrupt power to MCC 1XP, was not performed while the purification system is in service, a CAPR to review and identify all unnecessary trips that should be isolated while on backcharge, a corrective action (CA) to prevent purification from being in service

during periods of reduced inventory, and a CA to revise the work window associated with generator outage work. There were no compliance concerns associated with this event.

d. Findings

No findings of significance were identified

2.02 Root Cause, Extent-of-Condition, and Extent-of-Cause Evaluation

a. Determine that the problem was evaluated using a systematic methodology to identify the root and contributing causes

The inspector determined that the systematic methods used were adequate for both root cause evaluations.

- Root Cause Analysis Report (RCAR) #1 (PIP O-08-02056): Events and Casual Factors Analysis, Why Diagram
- RCAR #2 (PIP O-08-02086): Why Diagram, Barrier Analysis

b. Determine that the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem

The inspector determined that the level of detail was adequate for both root cause evaluations.

- RCAR #1: This evaluation reviewed the loss of backcharge source during AVR maintenance which resulted in a main generator lockout and a slow power transfer from the normal source to the startup source. The licensee determined the root cause of this event to be a failure to recognize an unanticipated system interaction between the AVR trip circuitry and the backcharge power path.
- RCAR #2: This evaluation reviewed the failure of MCC 1XP to re-energize when power transferred from the normal source to the startup source which resulted in a loss of reactor coolant system inventory. The licensee determined the root cause of this event to be a failure to restore the breaker setting to the as-found HI setting following preventative maintenance in 2006.

c. Determine that the root cause evaluation included a consideration of prior occurrences of the problem and knowledge of prior operating experience

The inspector determined that the evaluations for the event considered prior occurrences and operating experience.

- RCAR #1: A PIP database search revealed that Oconee has experienced four loss of power events during refueling outages in the last five years. Two of the four events resulted in a loss of decay heat removal and loss of reactor coolant system

inventory. As a result of this conclusion, Oconee has developed an outage strategy that will more effectively protect the unit power supply during Refueling outages. The most significant failed opportunity to prevent the current event was related to an unanticipated transfer of power during electrohydraulic control (EHC) testing which occurred in 2003. This was the result of an improperly prepared modification test procedure in which backcharge and lockout actuation was not considered. The reviewer incorrectly assumed that the test would not affect the plant during shutdown.

- RCAR #2: A PIP database search revealed three PIPs related to incorrect breaker settings. However, the corrective actions for these three PIPs would not have prevented the loss of inventory event. In addition, twelve events were identified related to procedure steps not being performed, verified, signed off, or double verified. Similarly, a review of corrective actions did not identify any that would have impacted the loss of inventory event. The most significant item revealed a trend in the I&E maintenance area where human performance behaviors contributed to significant events. This trend was identified two months prior to this event and would not have prevented the loss of 1XP because the human performance error that caused MCC 1XP not to re-energize occurred in November 2006.

In addition, both root cause analysis reports concluded that there was no specific external operating experience that would have benefited Oconee in preventing the event.

d. Determine that the root cause evaluation addressed the extent of condition and the extent of cause of the problem

The inspector determined that the evaluations for the event adequately addressed extent of condition and extent of cause.

- RCAR #1: The licensee's extent of condition review focused on outage related power sources and considered protective trip signals to power sources relied on during outages. The licensee determined that isolating unnecessary trips from the backcharge and startup transformer power paths improves the reliability of power to the plant. The licensee's extent of cause evaluation recognized that the event involved a knowledge-based human error during the procedure development and review processes.
- RCAR #2: The licensee's extent of condition review focused on the protective relay and breaker area. Incorrect settings on protective devices can cause equipment damage or spuriously trip equipment when needed. A review of all MCC normal and emergency feeder breaker settings was identified as a needed corrective action to determine any suspect incorrect settings. The licensee's extent of cause evaluation considered that, although a human error can not be eliminated from occurring, human performance tools to reduce the likelihood of errors should be used. Those include procedure enhancements such as place keeping and double verification.

In addition, the inspector determined that both root cause analysis reports contained corrective actions which addressed the extent of condition and extent of cause evaluations.

- e. Determine that the root cause, extent of condition, and extent of cause evaluations appropriately considered the safety culture components as described in IMC 0305

The inspector determined that the safety culture components were appropriately considered and reviewed for the event.

An initial safety culture assessment was conducted immediately following the conclusion of the root cause analysis report while a more thorough assessment was performed in August 2009. The more recent safety culture assessment was conducted using additional tools and a more thorough approach. The licensee plans to develop more formalized guidance for conducting future assessments.

- f. Findings

No findings of significance were identified.

## 2.03 Corrective Actions

- a. Determine that appropriate corrective actions are specified for each root and contributing cause or that the licensee has an adequate evaluation for why no corrective actions are necessary

The inspector determined that appropriate root and contributing causes were specified and that corrective actions were appropriate for the identified root and contributing causes for both root cause evaluations.

- RCAR #1: Corrective actions included:
  - Revised procedures to isolate the AVR input signal to the generator lockout during AVR maintenance. This procedure has been used successfully during the recent Unit 2 and Unit 3 outages.
  - Identify all unnecessary trips that should be isolated while on backcharge.
  - Changed the procedure development and revision process to ensure reviewers evaluate any signals that affect other systems and ensure they are properly removed from service.
  - Reviewed and revised outage work schedules to ensure high risk work, which could cause an unnecessary trip, was not scheduled while a unit was on backcharge.
- RCAR #2: Corrective actions included:
  - The 1XP-F3A breaker magnetic trip setting was returned to HI.
  - The procedure was changed to add additional human performance tools. Additionally, a study was done to document all MCC breaker settings and identify and correct any suspected incorrect settings.

- A coordination study for all non-safety MCCs was also performed to verify normal and emergency feeder breaker settings were designed optimally.

b. Determine that corrective actions have been prioritized with consideration of risk significance and regulatory compliance

The inspector determined that the corrective actions for the event were appropriately prioritized.

The inspector noted that PIP O-08-02086, CA #5 was initially coded with a priority of "2d" (corrective routine work) instead of the required "11a" (corrective action to prevent recurrence) code for a root cause CAPR. This error was identified by the licensee in August 2009 and the CA was updated to reflect the proper category. In this case, the CAPR was actually performed, however, the incorrect coding could have led to the CA being closed without action or could have allowed an individual to modify the due date without Corrective Action Review Board approval. PIP O-09-06212 was created to address this issue.

c. Determine that a schedule has been established for implementing and completing the corrective actions

The inspector determined that the corrective actions for the event have been scheduled or completed.

d. Determine that quantitative or qualitative measures of success have been developed for determining the effectiveness of the corrective actions to prevent recurrence

The inspector determined that qualitative measures of success were developed for determining the effectiveness of the corrective actions to prevent recurrence.

The scheduled due date for the CAPR Effectiveness Review for PIP O-08-02086 was not met due to initially evaluating the wrong CAPRs. This error was identified by the licensee in August 2009 and a subsequent review was performed on the correct CAPRs. Although the expected review was conducted, there was no guarantee that the error would have been caught or that other similar errors don't exist. PIP O-09-05535 had already been created by the licensee, at the time of this inspection, to address this issue.

e. Determine that the corrective actions planned or taken adequately address a Notice of Violation (NOV) that was the basis for the supplemental inspection, if applicable

This finding did not involve a violation of regulatory requirements.

f. Findings

No findings of significance were identified.

4OA6 MANAGEMENT MEETINGS

.1 Exit Meeting Summary

The inspector presented the results of the supplemental inspection to you and members of your staff on September 3, 2009. The inspector confirmed that no proprietary information was provided or examined during the inspection.

ATTACHMENT: SUPPLEMENTAL INFORMATION

Enclosure

## **SUPPLEMENTAL INFORMATION**

### **KEY POINTS OF CONTACT**

#### **Licensee Personnel**

S. Batson, Engineering, Manager  
D. Baxter, Site Vice President  
J. Burchfield, Reactor and Electrical Systems (RES), Manager  
D. Deatherage, Work Control, Nuclear Support Section Manager  
P. Gillespie, Station Manager  
R. Glover, Nuclear Plant Projects, General Manager  
T. King, Security, Manager  
R. Matheson, Performance Improvement Team, Engineer  
R. Meixell, Regulatory Compliance, Manager (acting)  
D. Phelps, RES, Supervisor  
S. Severance, Regulatory Compliance, Engineer  
J. Smith, Regulatory Compliance, Licensing Administrator  
T. Smith, RES, Engineer  
R. Vassey, Performance Improvement Team, Nuclear Site Root Cause Program Owner

#### **NRC Personnel**

A. Sabisch, Senior Resident Inspector - Oconee  
K. Ellis, Resident Inspector - Oconee

### **LIST OF ITEMS OPENED, CLOSED, AND REVIEWED**

#### **Closed**

05000269,270,287/2008010-01      FIN      Failure to Implement an Adequate AVR  
Maintenance Procedure (Section 40A4)

### **LIST OF DOCUMENTS REVIEWED**

#### **Procedures**

IP/0/A/4980/081 E, "ABB Type 81 Relay Test," Rev. 011  
IP/0/A/4980/087 F, "ABB/Westinghouse HU and HU-1 Relay Test," Rev. 011  
IP/0/B/4980/701, "SEL Type 701 Relay Test," Rev. 007  
OP/1/A/1107/005, "Backcharging Unit 1 Main and Auxiliary Transformers," Rev. 017  
OP/2/A/1107/005, "Backcharging Unit 2 Main and Auxiliary Transformers," Rev. 015  
OP/3/A/1107/005, "Backcharging Unit 3 Main and Auxiliary Transformers," Rev. 015

#### **Maintenance Work Orders**

WO 01807810, "(Contingency) 1ELBK1XPF3A: Replace Breaker 1XP-F3A," 5/1/08  
WO 01830497, "EC99193 - 1 EL MX 1XE: Replace 1XEF1A & 1XER1A," 8/13/09  
WO 01830498, "EC99193 - 1 EL MX 1XD: Replace 1XDF1A & 1XDR1A," 6/03/09

PIPs

PIP G-07-00873, "2nd Qtr 2007 IPA Gap to Excellence - Procedure Use and Adherence (PU&A)," 10/24/07  
 PIP G-08-00396, "Fleet Procedure Quality Self Assessment," 4/30/08  
 PIP O-06-04892, "Maintenance Human Performance assessment for 1<sup>st</sup> and 2<sup>nd</sup> quarter 2006," 8/02/06  
 PIP O-08-00559, "NRC identified two findings with the same safety culture cross-cutting aspect," 2/04/08  
 PIP O-08-02056, "Unit 1 Loss of Power," 4/15/08  
 PIP O-08-02086, "MCC 1XP lost power and did not re-energize as expected," 4/15/08  
 PIP O-08-02087, "Ops Procedures allowing LPI to be in purification during mid-loop ops need to be evaluated," 4/15/08  
 PIP O-08-02136, "Unit 2 Electrical Generator exceeded its capability curve," 4/16/08  
 PIP O-08-02452, "Electrical Events During Outages," 4/24/08  
 PIP O-08-04398, "Assess Risk of RCS Loss of Inventory Susceptibility (Assessment No: OPS 08009)," 7/22/08  
 PIP O-08-06595, "Outage delay resulting from Backcharging Main Transformer procedure," 10/26/08  
 PIP O-08-06995, "LPSW-260 has no ID tag," 11/05/08  
 PIP O-09-05535, "Root Cause CAPR Effectiveness Reviews are not being documented with sufficient detail," 8/05/09

Miscellaneous

1RTW10, "Work Window for Turbine-Generator," 9/02/09  
 1RTW21, "Work Window for Main Transformer Tagged Out," 9/02/09  
 Cause Analysis Screening Form - Safety Culture  
 EC-99176, "Blocking Device to Clamp AOVs in LPI Purification Path Open," Rev. 000  
 EC-99193, "Change settings on breakers 1XD-F1A and 1XE-F1A," Rev. 000  
 Guidance for Completing Safety Culture Cause Analysis Screening Form  
 MD 4.4.13, "ONS Maintenance and Engineering Change Work Practices for Equipment Configuration Control," Rev. 006  
 NSD-208, Problem Investigation Process (PIP), Rev. 027, 031  
 NSD-212, Cause Analysis, Rev. 016  
 NSD-700, Verification Techniques, Rev. 006  
 NSD-703, Administrative Instructions for Technical Procedures, Rev. 029  
 NSD-705, Instructions for the Verification and Validation of Technical Procedures, Rev. 007  
 STG-GA, "Generator Alterex training lesson plan," 7/14/08

PIPs generated as a result of this inspection

PIP O-09-06212, "PIP 08-2086 CAPR not correctly coded," 9/01/09  
 PIP O-09-06213, "WR intended to be tracked to completion was inadvertently omitted from the CA," 9/01/09  
 PIP O-09-06241, "No corrective actions associated with contributing cause #2 of PIP 09-02086 and no justification provided," 9/02/09