



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**  
REGION II  
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April 4, 2013

Mr. Kelvin Henderson  
Site Vice President  
Duke Energy Corporation  
Catawba Nuclear Station  
4800 Concord Road  
York, SC 29745-9635

**SUBJECT: CATAWBA NUCLEAR STATION UNIT 1 - NRC SUPPLEMENTAL  
INSPECTION REPORT 05000413/2013008 AND ASSESSMENT  
FOLLOWUP LETTER**

Dear Mr. Henderson:

On March 21, 2013, the U. S. Nuclear Regulatory Commission (NRC) completed a supplemental inspection pursuant to Inspection Procedure 95001, "Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area," at Catawba Unit 1. The enclosed inspection report documents the inspection results which were discussed on March 21, 2013, with Mr. T. Simril and other members of your staff. Jonathan Bartley conducted a regulatory performance meeting with you on March 20, 2013, to discuss your corrective actions associated with the finding.

In accordance with the NRC Reactor Oversight Process Action Matrix, this supplemental inspection was performed to follow-up on a low to moderate safety significance (White) finding which occurred in the second quarter of 2012. This finding was previously documented and assessed in NRC Inspection Reports 05000413, 414/2012009 and 05000413, 414/2012010. The NRC was informed of your readiness for this inspection on February 25, 2013.

The objectives of the supplemental inspection were to provide assurance that (1) the root causes and the contributing causes of risk-significant issues were understood; (2) the extent of condition and extent of cause the issues were identified; and (3) the licensee's corrective actions were or will be sufficient to address and prevent repetition of the root and contributing causes.

The NRC has determined that the stated inspection objectives have been met. Therefore, in accordance with the guidance in Inspection Manual Chapter (IMC) 0305, "Operating Reactor Assessment Program," the White finding will only be considered in assessing plant performance for a total of four quarters. As a result, the NRC determined the performance at Catawba Unit 1 to be in the Licensee Response Column of the ROP Action Matrix as of April 1, 2013.

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K. Henderson

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In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure 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 Agencywide Document Access and Management 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  
Projects Branch 1  
Division of Reactor Projects

Docket No.: 05000413  
License No.: NPF-35

Enclosure: Inspection Report 05000413/2013008

cc w/encl.: (See page 3)

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Letter to Kelvin Henderson from Jonathan H. Bartley dated April 4, 2013

SUBJECT: CATAWBA NUCLEAR STATION UNIT 1 - NRC SUPPLEMENTAL INSPECTION  
REPORT 05000413/2013008 AND ASSESSMENT FOLLOWUP LETTER

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RidsNrrPMCatawba Resource

ROP Assessment

**U. S. NUCLEAR REGULATORY COMMISSION**

**REGION II**

Docket Nos.: 50-413

License Nos.: NPF-35

Report Nos.: 05000413/2013008

Licensee: Duke Energy Carolinas, LLC

Facility: Catawba Nuclear Station, Unit 1

Location: York, SC 29745

Dates: March 18, 2013, through March 21, 2013

Inspector: Curt Rapp, Senior Project Engineer

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

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## SUMMARY OF FINDINGS

Inspection Report 05000314/2013008; March 18-22, 2013; Catawba Nuclear Station, Unit 1; Inspection Procedure 95001, Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area

This inspection was conducted by a senior project engineer. No findings 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.

### Cornerstone: Initiating Events

This supplemental inspection was performed in accordance with Inspection Procedure 95001, "Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area," to assess the licensee's evaluations associated with an improper generator protection modification that caused a loss of offsite power (LOOP) on April 4, 2012. The inspector determined that the licensee performed a comprehensive root cause evaluation (RCE) to determine the root and contributing causes and to identify any causes common to other programs or processes. The licensee developed adequate corrective actions to preclude recurrence.

Given the licensee's acceptable performance in addressing the improper generator protection modification, the White finding associated with this issue will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in IMC 0305, "Operating Reactor Assessment Program."

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## REPORT DETAILS

### 4. OTHER ACTIVITIES

#### 4OA3 Event Follow-up

(Closed) Licensee Event Report (LER) 05000413, 414/2012-001-00, -01, Unit 1 Automatic Reactor Trip Due to Faulted Reactor Coolant Pump Motor Cable Resulted in Zone G Relay Lockout and Subsequent Loss of Offsite Power and Emergency Diesel Generator Automatic Start for Both Units, Revisions 00 and 01

On April 4, 2012, Unit 1 tripped from 100% power due to the trip of the 1D reactor coolant (NC) pump. Shortly after the Unit 1 generator power circuit breakers opened, the generator (Zone G) protective relaying system unexpectedly actuated on an instantaneous underfrequency condition which opened the switchyard breakers causing a LOOP. At the time of the trip, Unit 2 was in Mode 5 with both of its essential busses aligned to Unit 1 offsite power. Therefore, Unit 2's essential busses also lost power as a result of the Unit 1 LOOP. Both emergency diesel generators (EDGs) on each unit automatically started and powered their respective essential busses. Approximately five and one-half hours later, after confirming that the sources of the fault were cleared, offsite power was restored to one essential bus on each unit. The Unit 1 LOOP occurred as a result of inadequate design input specification and insufficient control over vendor outsourcing in conjunction with a modification installed during the previous Unit 1 refueling outage. The inspector reviewed both revisions of the LER, the RCE performed for the LOOP, and the corrective actions completed or planned. No additional findings were identified.

#### 4OA4 Supplemental Inspection

##### .01 Inspection Scope

The inspector performed this supplemental inspection in accordance with IP 95001 to assess the licensee's evaluation of the Unit 1 LOOP occurring on April 4, 2012, which affected the Initiating Events cornerstone. 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 performance issues were identified
- 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 licensee entered the Regulatory Response Column of the NRC's Action Matrix for Unit 1 in the second quarter of 2012 as a result of a White finding due to an improper modification to Zone G protective relaying (NRC Inspection Reports 05000413, 414/2012009 and 05000413, 414/2012010). The licensee performed a RCE, documented in PIP C-12-3403, Revision 4, to identify process or program weaknesses and to determine the organizational attributes that resulted in the White finding. The licensee also completed a safety culture review as part of the RCE.

The inspector reviewed corrective actions that were completed 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 preclude repetition.

## .02 Evaluations of the Inspection Requirements

### 02.01 Problem Identification

- a.) IP 95001 requires that the inspection staff determine the licensee's evaluation of the issue documents who identified the issue (i.e., licensee-identified, self-revealing, or NRC-identified) and the conditions under which the issue was identified.

The licensee's RCE documented that the LOOP was self-revealing as a result of the reactor trip when the 1D NC pump lost power. The RCE documented that the failure to include a generator underfrequency block as part of the generator (Zone G) protective relaying modification resulted in unintended opening of the switchyard breakers. The inspector concluded the RCE documented who identified the issue and the conditions under which the issue was identified.

- b.) IP 95001 requires that the inspection staff determine the licensee's evaluation of the issue documents how long the issue existed and prior opportunities for identification.

The licensee's RCE included a timeline of the Zone G protective relaying modification. The modification was installed during the April 2011 Unit 1 refueling outage. Testing of the modification during Unit 1 startup in June 2011 did not identify any problems and the Zone G relaying operated as expected during two subsequent unit shutdowns prior to the LOOP. The licensee's RCE documented there were several barriers that would have identified the problem prior to installation. These barriers included providing proper specifications to the vendor, oversight of vendor work, independent verification of work product, and proper post modification testing. The inspector concluded the RCE documented how long the issue existed and prior opportunities for identification.

- c.) IP 95001 requires that the inspection staff determine the licensee's evaluation documents the plant specific risk consequences, as applicable, and compliance concerns associated with the issue.

Both Unit 1 and Unit 2 emergency diesel generators started and powered safety-related loads for the duration of the LOOP. The plant responded as expected with core cooling provided by natural circulation and cycling of the steam generator relief valves. The licensee determined the Unit 1 LOOP was of moderate to low safety significance (White). The inspector concluded the RCE documented the plant specific risk consequences of the Unit 1 LOOP.



The compliance concerns associated with the Technical Specification requirements for off-site power circuits were documented in PIP C-12-08719. This PIP referenced the corrective actions for the RCE. The inspector concluded that the associated compliance concerns were addressed.

d.) Findings

No findings were identified.

02.02 Root Cause, Extent of Condition, and Extent of Cause Evaluation

- a.) IP 95001 requires that the inspection staff determine the licensee evaluated the issue using a systematic methodology to identify the root and contributing causes.

The inspector determined that the licensee evaluated the LOOP using the following a systematic methods to identify root and contributing causes.

- hazard-barrier-target analysis
- event and causal factors chart
- “Why” tree
- MORT analysis
- change analysis
- organizational and programmatic review

- b.) IP 95001 requires that the inspection staff determine the licensee’s RCE was conducted to a level of detail commensurate with the significance of the issue.

The licensee used the analysis tools listed in section 02.02 a. to assess the LOOP. The licensee also conducted a review of recent modifications that involved vendor provided work products and found no deficiencies. The licensee’s RCE documented the root cause of the finding to be weaknesses in the licensee’s design control processes which resulted in not defining critical design inputs in sufficient detail and less than adequate review of vendor supplied design change products. The licensee determined that the contributing causes included inadequate vendor oversight, ineffective design process barriers, and inadequate vendor self-checking. The inspector concluded that the RCE was conducted to a level of detail commensurate with the significance of the problem.

- c.) IP 95001 requires that the inspection staff determine the licensee’s RCE included a consideration of prior occurrences of the issue and knowledge of Operating Experience (OE.)

The RCE included a comparison of this LOOP to a LOOP that occurred in 2006. The 2006 LOOP was caused by an improper relay setting and occurred when switchyard current transformers failed. These conditions were fundamentally different from the conditions which caused the current LOOP. The RCE documented a review of both

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internal and external OE to identify prior occurrences. The licensee determined there was relevant industry OE related to vendor products; however, none were applicable to the Zone G modification. As a result, the licensee determined the LOOP was not OE preventable. The inspector concluded that the licensee's RCE included a consideration of prior occurrences of the problem and knowledge of prior OE.

- d.) IP 95001 requires that the inspection staff determine that the licensee's RCE addresses the extent of condition and extent of cause of the issues.

The RCE included an extent of condition (EoCo) analysis of the LOOP to examine the licensee's response. There were two EoCos documented in the RCE. The event and causal factor chart showed that procedural guidance on specifying vendor deliverables and vendor oversight were the primary factors. The licensee reviewed engineering changes (ECs) for the previous five years associated with these EoCos and did not identify any deficiencies. To assess Extent of Cause (EoCa), the licensee evaluated if the root causes actually or had the potential to impact other units, other processes, equipment, or human performance. The licensee reviewed ECs with vendor products over the previous five years and pending ECs and did not identify any deficiencies. The inspector concluded that the licensee's RCE addressed both the EoCo and the EoCa.

- e.) IP 95001 requires that the inspection staff determine that the licensee's root cause, extent of condition, and extent of cause evaluations appropriately considered the safety culture components as described in IMC 0310.

The licensee conducted a review of the four areas of safety culture. The licensee determined if a component applied to root or contributing cause and the basis for that determination. The EoCo and EoCa were addressed through the review of the root and contributing causes. The inspector concluded that the licensee had effectively considered the safety culture components in the RCE.

- f.) Findings

No findings were identified.

### 02.03 Corrective Actions

- a.) IP 95001 requires that the inspection staff determines that (1) the licensee specified appropriate corrective actions for each root and/or contributing cause, or (2) an evaluation that states no actions are necessary is adequate.

The inspector determined the licensee had identified appropriate corrective actions to prevent recurrence (CAPRs) for the two identified root causes; design control processes did not require definition of critical design inputs to an appropriate level of detail and design control processes for specification of vendor services were inadequate to ensure a required design feature was incorporated. The licensee identified the following CAPRs for root cause 1.

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- revise EDM-601, Engineering Change Manual, to include specific direction related to identifying and validating all design functions (CAPR 1)
- revise EDM-101, Engineering Calculations/Analyses, to ensure all critical design inputs are clearly documented, describe the responsibilities of the Checker, determine the minimum actions required for a non-QA calculation, and ensure adequate technical review of a vendor calculation (CAPR 3)

The licensee identified the following CAPR to address root cause 2.

- revise EDM-141, Procurement Specifications for Services, to ensure all design inputs are specified and testing verifies all aspects of the design and describe the vendor Checker's responsibilities (CAPR 2)

The corrective actions for the contributing causes relied mainly on these three CAPRs. The licensee had previously begun a company-wide review to identify improvements in the design change process. Selected corrective actions from this review were also credited as corrective actions for the LOOP. The inspector concluded that the identified corrective actions were adequate to address both the root and contributing causes.

- b.) IP 95001 requires that the inspection staff determine that the licensee prioritized corrective actions with consideration of risk significance and regulatory compliance.

The licensee's corrective actions to address the root and contributing causes were prioritized as documented in the RCE. The inspector noted that most of the corrective actions had been completed. The inspectors determined that the corrective actions were prioritized with consideration of the risk significance and regulatory compliance.

- c.) IP 95001 requires that the inspection staff determine that the licensee established a schedule for implementing and completing the corrective actions.

The inspector concluded that the licensee established a reasonable schedule for implementing and completing corrective actions. Most of the corrective actions, including all the CAPRs, were completed at the time of the inspection. The remaining corrective actions were scheduled to be completed by January 31, 2014.

- d.) IP 95001 requires that the inspection staff determine that the licensee developed quantitative and/or qualitative measures of success for determining the effectiveness of the corrective actions to preclude repetition.

The licensee established effectiveness assessments for the CAPRs. These assessments included:

- A review of engineering changes to verify proper identification of design inputs, logic, testing, and checking requirements.

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- A review of specifications for vendor products to verify critical design inputs and checker requirements were incorporated.
- A review of calculations to verify critical design inputs, and checker and minimum non-QA requirements were incorporated.

The licensee entered these effectiveness assessments into their corrective action program with a due date of about one year after the CAPRs had been implemented. The inspector determined that appropriate success criteria had been developed for determining the effectiveness of the CAPRs.

- e.) IP 95001 requires that the inspection staff determine that the licensee's planned or taken corrective actions adequately address a Notice of Violation (NOV) that was the basis for the supplemental inspection, if applicable.

Although a notice of violation was issued for inoperable off-site power circuits exceeding the TS allowed outage time limit, it was not the basis for this inspection. The violation is dispositioned in section 4OA5.

- f.) Findings

No findings were identified.

#### 4OA5 Other

##### (Closed) Violation 05000413/2012009-01, Failure to Provide Vendor with Accurate Design Information

As documented in PIP C-12-08719, the licensee credited the RCE and associated CAPRs for the White finding to address both the cause and the corrective actions for this violation. The inspector reviewed the PIP and determined that RCE and CAPRS adequately addressed the cause of the violation and the corrective actions to restore compliance and prevent recurrence.

#### 4OA6 Meetings, Including Exit

On March 21, 2013, the inspector presented the inspection results to Mr. T. Simril, Plant Manager, and other members of his staff, who acknowledge there were no findings. Proprietary information provided by the licensee was handled in accordance with NRC policy for proprietary information.

ATTACHMENT: SUPPLEMENTAL INFORMATION

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## **SUPPLEMENTAL INFORMATION**

### **KEY POINTS OF CONTACT**

#### Licensee personnel

T. Hamilton, Engineering Manager  
R. Hart, Regulatory Compliance Manager  
K. Henderson, Site Vice-President  
P. McIntyre, Design Engineering Supervisor - Electrical  
P. Simbrat, Senior Operations Specialist - Regulatory Affairs  
T. Simril, Plant Manager

#### NRC personnel

J. Bartley, Chief, Projects Branch 1, Division of Reactor Projects

### **LIST OF REPORT ITEMS**

#### Closed

LER 05000413/2012-001-00 and -01	Manual Reactor Scram During Startup Due to Multiple Control Rod Insertion (Section 4OA3.1)
Violation 05000413/2012010-001	Failure to Provide Vendor with Accurate Design Information (Section 4OA5)

### **LIST OF DOCUMENTS REVIEWED**

#### **Section 4OA3, Event Follow-up**

LER 05000413, 414/2012-001-00 and -01, Automatic Reactor Trip Due to Faulted Reactor Coolant Pump Motor Cable Resulting in Zone G Relay Lockout and Subsequent Loss of Offsite Power and Emergency Diesel Generator Automatic Start for Both Units

#### **Section 4OA4, Supplemental Inspection**

PIPs C-12-03494, C-12-5142, C-12-5866, G-12-0712, and G-12-1431