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

May 11, 2007

Carolina Power and Light Company
ATTN: Mr. James Scarola
Vice President
Brunswick Steam Electric Plant
P. O. Box 10429
Southport, NC 28461

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT - NRC SUPPLEMENTAL INSPECTION REPORT NO. 05000325/2006008, 05000324/20060008

Dear Mr. Scarola:

On April 12, 2007, the US Nuclear Regulatory Commission (NRC) completed a supplemental inspection at your Brunswick Plant facility. The enclosed report documents the inspection findings, which were discussed on April 12, 2007, with you and other members of your staff.

As required by the NRC Reactor Oversight Process Action Matrix, this supplemental inspection was performed in accordance with Inspection Procedure 95001. The purpose of the inspection was to examine the causes for and actions taken related to the performance indicator for the Mitigating Systems Performance Index (MSPI) for the emergency AC power systems for Units 1 and 2 crossing the threshold from Green (very low risk significance) to White (low to moderate risk significance) in the second quarter of 2006. This supplemental inspection was conducted to provide assurance that the root causes and contributing causes of the events resulting in the White performance indicator are understood, to independently assess the extent of condition, and to provide assurance that the corrective actions for risk significant performance issues are sufficient to address the root causes and contributing causes and to prevent recurrence. The inspection consisted of selected examination of representative records and interviews with personnel.

Based on the results of this inspection, no findings of significance were identified. However, the inspector noted that since the MSPI for the emergency AC power sources became White in the second quarter of 2006, additional emergency diesel generator failures have occurred, including a failure of emergency diesel generator number one on November 2, 2006. These additional failures are being inspected and addressed via additional NRC inspection procedures and will be discussed in future NRC reports. The inspector also noted that at the time of this 95001 inspection, several corrective actions were in the planning stage and not yet fully defined or implemented.

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 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/

Randall A. Musser, Chief
Reactor Projects Branch 4
Division of Reactor Projects

Docket Nos.: 50-325, 50-324
License Nos.: DPR-62, DPR-71

Enclosure: Inspection Report 05000325/2006008, 05000324/20060008
w/Attachment: Supplemental Information

cc w/encl: (See page 3)

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 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/

Randall A. Musser, Chief
Reactor Projects Branch 4
Division of Reactor Projects

Docket Nos.: 50-325, 50-324
License Nos.: DPR-62, DPR-71

Enclosure: Inspection Report 05000325/2006008, 05000324/20060008
w/Attachment: Supplemental Information

cc w/encl: (See page 3)

☐ PUBLICLY AVAILABLE ☐ NON-PUBLICLY AVAILABLE ☐ SENSITIVE ☐ NON-SENSITIVE

ADAMS: ☐ Yes ACCESSION NUMBER:_____

OFFICE	RII:DRP	RII:DRP					
SIGNATURE	RXM /RA/	RXM /RA for/					
NAME	RMusser:rcm	POBryan					
DATE	05/11/207	05/11/2007	May 14, 2007	May 14, 2007	May 14, 2007	May 14, 2007	May 14, 2007
E-MAIL COPY?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO

OFFICIAL RECORD COPY DOCUMENT NAME: C:\FileNet\ML071310391.wpd

cc w/encls:
Benjamin C. Waldrep, Director
Site Operations
Brunswick Steam Electric Plant
Carolina Power & Light Company
Electronic Mail Distribution

James W. Holt, Manager
Performance Evaluation and
Regulatory Affairs PEB 7
Carolina Power & Light Company
Electronic Mail Distribution

Terry Hobbs, Plant Manager
Brunswick Steam Electric Plant
Carolina Power & Light Company
P. O. Box 10429
Southport, NC 28461

Paul Fulford, Manager
Performance Evaluation and
Regulatory Affairs PEB 5
Carolina Power & Light Company
P. O. Box 1551
Raleigh, NC 27602-1551

Edward T. O'Neil, Manager
Training
Carolina Power & Light Company
Brunswick Steam Electric Plant
Electronic Mail Distribution

Randy C. Ivey, Manager
Support Services
Carolina Power & Light Company
Brunswick Steam Electric Plant
Electric Mail Distribution

Garry D. Miller, Manager
License Renewal
Progress Energy
Electronic Mail Distribution

Annette H. Pope, Supervisor
Licensing/Regulatory Programs
Carolina Power and Light Company
Electronic Mail Distribution

David T. Conley
Associate General Counsel - Legal Dept.
Progress Energy Service Company, LLC
Electronic Mail Distribution

James Ross
Nuclear Energy Institute
Electronic Mail Distribution

John H. O'Neill, Jr.
Shaw, Pittman, Potts & Trowbridge
2300 N. Street, NW
Washington, DC 20037-1128

Beverly Hall, Chief, Radiation
Protection Section
N. C. Department of Environment
and Natural Resources
Electronic Mail Distribution

Peggy Force
Assistant Attorney General
State of North Carolina
Electronic Mail Distribution

Chairman of the North Carolina
Utilities Commission
c/o Sam Watson, Staff Attorney
Electronic Mail Distribution

Robert P. Gruber
Executive Director
Public Staff NCUC
4326 Mail Service Center
Raleigh, NC 27699-4326

Public Service Commission
State of South Carolina
P. O. Box 11649
Columbia, SC 29211

David R. Sandifer
Brunswick County Board of
Commissioners
P. O. Box 249
Bolivia, NC 28422

Warren Lee
Emergency Management Director
New Hanover County Department of
Emergency Management
P. O. Box 1525
Wilmington, NC 28402-1525

Distribution w/encl: (See page 4)

Letter to James Scarola from Randall Musser dated May 11, 2007

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT - NRC SUPPLEMENTAL INSPECTION REPORT NO. 05000325/2006008, 05000324/20060008

Distribution w/encl:
S. Bailey, NRR
R. Pascarelli, NRR
C. Evans, RII EICS
L. Slack, RII EICS
RIDSNRRDIRS
OE Mail
PUBLIC

U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.s:	50-325/50-324
License No.s:	DPR-71, DPR-62
Report No:	05000325, 324/2006008
Licensee:	Carolina Power and Light (CP&L)
Facility:	Brunswick Steam Electric Plant, Units 1 and 2
Location:	8470 River Road SE Southport, NC 28461
Dates:	October 30, 2006 - April 12, 2007
Inspector:	P. O'Bryan, Senior Resident Inspector, Shearon Harris
Approved by:	R. Musser, Chief Reactor Projects Branch 4 Division of Reactor Projects

Enclosure

SUMMARY OF FINDINGS

IR 05000325, 324/2006-008; 10/30/2006 - 4/12/2007; Brunswick Steam Electric Plant; Supplemental Inspection IP 95001 for a White performance indicator in the Mitigating Systems Cornerstone.

This inspection was conducted by a senior resident inspector. No violations of regulatory requirements were identified. The significance of most findings is identified by their color (Green, White, Yellow, Red) using IMC 0609, "Significance Determination Process" (SDP). Findings for which the SDP does not apply may be Green or be assigned a severity level after NRC management review. 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, 2007.

A. NRC-Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

- The U.S. Nuclear Regulatory Commission (NRC) performed this supplemental inspection in accordance with Inspection Procedure 95001, to assess the licensee's evaluation associated with the Unit 1 and Unit 2 performance indicators in the mitigating systems cornerstone. The mitigating systems performance indicator (MSPI) for emergency AC power systems crossed the threshold from Green (very low risk significance) to White (low to moderate risk significance) in the second quarter of 2006. Specifically, the licensee's emergency AC power systems MSPI value reached 2.01E-6 for Unit 1 and 1.50E-6 for Unit 2. The MSPI becomes White when the value reaches 1.0E-6. The MSPI for Units 1 and 2 consist of an unreliability index based on emergency AC power system function failures and an unavailability index based on emergency AC power system unavailability. Since the vast majority of the contribution to the MSPI for Units 1 and 2 is from the unreliability indexes, the inspection focused on the emergency AC system functional failures.

  The inspector determined that the licensee performed a comprehensive evaluation of the conditions that led to the MSPI exceeding the Green/White threshold. Performance deficiencies were identified by the NRC during previous inspections and are listed in subsequent sections of this report. In addition, the licensee adequately analyzed the circumstances associated with those issues and, where appropriate, took effective immediate corrective action. Also, the licensee developed corrective actions to prevent recurrence. The inspector noted that additional failures of the emergency diesel generators have occurred subsequently to the failures included in the scope of this inspection. These failures will be further evaluated by the NRC outside of this inspection.

B. Licensee-Identified Violations

None.

REPORT DETAILS

01 INSPECTION SCOPE

The purpose of this supplemental inspection was to assess the licensee's evaluation associated with the MSPI for emergency AC power systems that crossed the threshold from Green to White in the second quarter of 2006. Specifically, the licensee experienced six functional failures of emergency diesel generators between July 1, 2003 and June 30, 2006. The cumulative effect of these functional failures was to cause both units' MSPI for emergency AC power systems to cross the threshold from Green to White in the second quarter of calendar year 2006. The inspectors reviewed the licensee's actions associated with these six events and conducted interviews with licensee personnel to ensure that the root and contributing causes of the events were identified, understood, and appropriate corrective actions were initiated. The six unplanned power changes reviewed were as follows;

1. July 24, 2003 - Functional failure of diesel generator number 3 due to a failed printed circuit board in the AC voltage regulator circuitry.

2. January 4, 2004 - Functional failure of diesel generator number 3 due to excessive jacket water leakage. This event was included in NRC inspection report 05000325/2004002 and 05000324/2004002 as an NRC identified apparent violation (AV 05000324/2004-01) of 10CFR50, Appendix B, Criterion XVI for failure to correct the jacket water leakage, and characterized as a White finding and a violation (VIO) in NRC report 05000324/2004008 (VIO 05000324/2004008-01).

3. June 6, 2004 - Functional failure of diesel generator number 1 due to improper maintenance practices during surveillance testing. This event was identified as a self-revealing violation of Technical Specifications (TS) 5.4.1 for failure to implement a maintenance procedure in NRC integrated inspection report 05000325/2004003 and 05000324/2004003 (NCV 05000325,324/2004003-01).

4. November 10, 2004 - Functional failure of diesel generator number 3 due to a failed relay in the engine control circuitry.

5. July 28, 2005 - Functional failure of diesel generator number 4 due to an improper differential current relay set point.

6. August 5, 2005 - Functional failure of diesel generator number 2 due to an improper generator differential overcurrent relay set point.

Throughout the report enclosure, these functional failures will be referred to by their numerical designators listed above. An NRC special inspection was conducted after functional failures 5 and 6. The special inspection team identified two non-cited violations (NCV) in NRC special inspection report number 05000325/2005010 and 05000324/2005010. The first NCV was identified for performing an inadequate extent of condition review after functional failure 5, as required by Technical Specification 3.8.1.D (NCV 05000325, 324/2005010-01). The second NCV was a Green NCV for inadequate corrective action as required by 10 CFR 50, Appendix B, Criterion XVI, Corrective Action, in that there were at least two prior opportunities, prior to functional

failure 5, to identify a problem that could cause an EDG to trip upon starting. (NCV 05000325, 324/2005010-02).

02 EVALUATION OF INSPECTION REQUIREMENTS

02.01 Problem Identification

a. Determination of who identified the issue and under what conditions.

The functional failures listed in section 01 were self-revealing. The performance deficiencies listed in section 01 for functional failures 2, 3, 5 and 6 were NRC identified.

b. Determination of how long the issue existed, and prior opportunities for identification.

Functional failure number 1 occurred during the operability run of emergency diesel number 3 on July 24, 2003. This operability run was performed to ensure operability of the diesel after maintenance was performed, including replacement of a printed circuit board in the AC voltage regulator circuitry. Later analysis determined that the replacement circuit board had degraded components which failed during the operability run. The diesel was run for a post maintenance test earlier and passed the post maintenance test. Therefore, the issue only existed for a short time.

Functional failure number 2 was caused by leakage in the jacket water system of number 3 emergency diesel generator. A leak was identified on December 7, 2003 during surveillance testing and work was performed on a leaking fitting on December 8, 2003. Additional repairs were attempted between December 8, 2003 and January 4, 2004. The failure to repair the leak was identified as a violation of 10CFR50, Appendix B, Criterion XVI as noted in section 01 above.

Functional failure number 3 was caused by licensee personnel while preparing emergency diesel generator number 1 for testing. Maintenance personnel improperly left cylinder indicator valves open, rendering the diesel generator inoperable until the valves were shut during testing later that day. As outlined in section 01 of this report, this deficiency was identified as a violation of Technical Specifications (TS) 5.4.1.

Functional failure number 4 was caused by a relay failure in the control circuit for emergency diesel number 3. The failure was attributed to normal equipment aging and the licensee identified that inadequate preventative maintenance practices led to the failure.

Functional failures 5 and 6 were caused by the same problem: generator differential overcurrent lockout relay setpoints. The relay setpoints were established by a plant modification in 1982. Two other trips prior to these functional failures were attributed to the same cause. As outlined in section 01 of this report, this deficiency was previously identified as a violation of 10 CFR 50, Appendix B, Criterion XVI, Corrective Action.

c. Determination of the plant-specific risk consequences (as applicable) and compliance concerns associated with the issues.

The licensee's review of failures 1 and 4 determined that plant-specific risk consequences were low. For failure number 1, emergency diesel generator number 3 was unavailable for 27 hours. For failure number 4, emergency diesel number 3 would have started and loaded properly, but at a reduced frequency. Also, operators had the ability to return frequency to the proper value. Failure number 2 was determined to be an NRC finding of low to moderate risk significance (White) in inspection report 05000324/2004008. Failure number 3 was determined to have very low risk significance (Green) in NRC inspection report number 05000325/2004003 and 05000324/2004003. Failure number 5 and 6 were determined to have very low risk significance (Green) in NRC inspection report number 05000325/2005010 and 05000324/2005010. The inspector determined that the licensee's evaluation of the risk consequences and compliance concerns associated with the six failures was adequate.

02.02 Root Cause and Extent-of-Condition Evaluation

a. Evaluation of methods used to identify root causes and contributing causes.

To evaluate this issue, the licensee used a combination of structured root cause analysis techniques including equipment performance analysis, industry bench marking analysis, causal factor analysis, human performance analysis, support/refute methodology, and fault tree analysis. The methods and combinations of methods used to identify root and contributing causes were appropriate.

b. Level of detail of the root cause evaluation.

For the six functional failures, the root cause evaluations were of sufficient detail to support the identified root and contributing causes.

For failure number 1, the licensee determined the root causes of the circuit board failure were transistor and diode defects on the circuit board. These defects were attributed to service-induced equipment aging. The licensee also determined that this circuit board was not routinely replaced at specific intervals and the history of the failed board (service life) was unknown.

For failure number 2, the licensee determined the root cause of the jacket water leak was that pipe supports were not installed to prevent a coupling from misaligning and causing the jacket water leak. The licensee also determined that previous leaks were not properly addressed. As outlined in section 01 of this report, this deficiency was identified as a violation of 10CFR50, Appendix B, Criterion XVI, Corrective Action.

For failure number 3, the licensee determined the root cause of the open indicator valves was that mechanics failed to use proper concurrent verification techniques to check the position of the indicator valves as required by plant procedure OSPP-ENG507. As outlined in section 01 of this report, this deficiency was identified as a violation of Technical Specifications (TS) 5.4.1.

For failure number 4, the licensee determined the root cause of the issue to be a failed relay coil in a relay in the control circuitry. The failed coil was attributed to equipment aging.

For failures number 5 and 6, the licensee determined the root cause of the issue to be a historical equipment deficiency related to generator differential overcurrent current relays installed in 1982. The relays were replaced with a vendor recommended equivalent model without a confirmation that the trip setting was appropriate. In addition, the licensee identified that a "group think" mentality prevented a previous opportunity to identify the issue.

c. Consideration of prior occurrences of the problem and knowledge of prior operating experience.

The root cause evaluations for the six functional failures did consider prior occurrences of similar problems where applicable.

d. Consideration of potential common causes and extent of condition of the problem.

The inspector's review of the six failures verified that the licensee's evaluation considered the potential for common cause and extent of condition. Although two of the failures were the result of improper differential overcurrent relay settings, which had a common cause, no causal linkage could be made with the four other failures.

e. Consideration of safety culture components as described in inspection manual chapter (IMC) 0305.

The licensee's evaluation consideration of safety culture components as described in IMC 0305. In addition to the cross-cutting components identified in previous NRC findings, the licensee identified safety culture components for failures 2 and 3. The safety culture components identified for failure number 2 were in the area of human performance and the cross-cutting aspects were decision making, resources, work control, and work practices. Failure number 3 had cross three cross-cutting aspects in the area of human performance (decision making, resources, and work practices).

02.03 Corrective Actions

a. Appropriateness of corrective actions.

The licensee took corrective actions to repair the equipment failures related to the emergency diesel generator failures. The licensee also specified corrective actions to address root and contributing causes for the six failures.

For failure number 1, the licensee replaced the degraded circuit board and returned the number emergency diesel generator to service. Since aging of the circuit board was identified as a cause of failure, the licensee plans to specify "newly refurbished" circuit boards as replacements.

For failure number 2, the licensee repaired the leaking coupling and installed pipe supports in the jacket water system of emergency diesel generator number 3. In addition, the licensee reinforced with maintenance personnel the procedural requirements for maintenance to ensure that material deficiencies are dealt with properly. Procedure ADM-NGGC-0104 was also revised to require senior reactor operator permission to perform minor maintenance on safety-related equipment.

For failure number 3, the cylinder indicator valves were shut and emergency diesel generator number 1 was returned to service. In addition, the licensee clarified to maintenance personnel the expectation for the use of independent verification and concurrent verification. Maintenance procedures were also reviewed to ensure proper guidance is given for independent and concurrent verification.

For failure number 4, the failed relay was replaced and emergency diesel number 3 was returned to service. In addition, a selected population of energized control relays of this type were replaced in 2005, the other normally energized relays were scheduled to be replaced, and a new maintenance task to replace all normally energized relays every 12 years was established. A new maintenance task was also established for replacement or normally de-energized relays of this type with a 15 year periodicity.

For failures number 5 and 6, the licensee replaced the generator differential overcurrent current relays with solid state relays with increased margin to operating current. Additionally, an emergent/off-normal check list was developed to provide for a structured approach to significant equipment failure problem solving.

b. Prioritization of corrective actions.

The inspector determined that the corrective actions for the six failures were adequately prioritized with one exception. This exception is for failure number 2, and has been previously addressed as a violation (see section 01). Also, the inspector also noted that an additional emergency diesel generator functional failure occurred due to a failed control circuit relay in February, 2007. This failure was identified as an unresolved item in NRC inspection report 05000325, 324/2007007 (URI 05000325, 324/2007007-02).

c. Establishment of a schedule for implementing and completing the corrective actions

The inspector verified that the licensee's corrective action program identified assigned individuals, completion dates, and reference numbers to ensure that individual corrective actions would be completed in accordance with their priority.

d. Establishment of quantitative or qualitative measures of success for determining the effectiveness of the corrective actions to prevent recurrence.

The inspector determined that effectiveness reviews had been completed or were scheduled for the causes of the six functional failures.

04 MANAGEMENT MEETINGS

Exit Meeting Summary

The inspector presented the results of the supplemental inspection to Mr. J Scarola and other members of licensee management and staff on April 12, 2007. The inspector confirmed that any proprietary information provided or examined during the inspection would be returned.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

J. Anderson, Diesel Systems Engineer
D. Griffith, Manager - Outage and Scheduling
S. Howard, Manager - Operations
R. Ivey, Manager - Site Support Services
W. Murray, Licensing Specialist
A. Pope, Supervisor - Licensing/Regulatory Programs
W. Richardson, Diesel Systems Engineer
S. Rogers, Manager - Maintenance
J. Scarola, Site Vice President
T. Trask, Manager - Engineering
B. Waldrep, Plant General Manager
B. Wilton, Engineering Supervisor

NRC Personnel

E. DiPaolo, NRC Senior Resident Inspector
J. Austin, NRC Resident Inspector

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened and Closed

None.

Discussed

None.

LIST OF DOCUMENTS REVIEWED

Procedures

ADM-NGGC-0104, Work Management Process

Action Requests (AR)

AR 99876	Functional Failure of EDG 3 Due to Erratic Voltage Regulator
AR 114576	Functional Failure of EDG 3 Due to Jacket Water Leakage
AR 128848	Functional Failure of EDG 1 Due to Mis-positioned Pet Cock Valves
AR 143328	Functional Failure of EDG 3 Due to Failed Relay in EDG Control Circuit
AR 165042	Functional Failure of EDG 4 and EDG 2 Due to Lockout
AR 108100	#4 EDG Inoperable Due to Failed LPSCR Relay
AR 204325	Conduct of Maintenance
AR 129173	Maintenance Adverse Trend in Human Performance
AR 166409	EDG System Health

Miscellaneous

NRC Inspection Report 05000325, 324/2005010
NRC Inspection Report 05000325, 324/2004002
NRC Inspection Report 05000324/2004008
NRC Inspection Report 05000325, 324/2004003