



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

December 12, 2008

Mr. Benjamin C. Waldrep
Vice President
Carolina Power and Light Company
Brunswick Steam Electric Plant
P.O. Box 10429
Southport, NC 28461

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT - NRC SPECIAL INSPECTION
REPORT NO. 05000325/2008010 AND 05000324/2008010

Dear Mr. Waldrep:

On September 11, 2008, the U.S. Nuclear Regulatory Commission (NRC) completed the onsite portion of a special inspection at your Brunswick Steam Electric Plant. The inspection reviewed the circumstances surrounding a failed surveillance which demonstrates the ability to locally control the Emergency Diesel Generators. A Special Inspection was warranted based on the risk and deterministic criteria specified in Management Directive 8.3, "NRC Incident Investigation Program." The determination that the inspection would be conducted was made by the NRC on August 22, 2008, and the inspection started on September 8, 2008. The preliminary inspection results were discussed with you and members of your staff on September 11, 2008. Subsequently, additional in-office reviews were conducted and the enclosed inspection report documents the inspection results, which were discussed by telephone with Mike Annacone and other members of your staff on November 13, 2008.

This inspection was performed in accordance with Inspection Procedure 93812, "Special Inspection," and focused on the areas discussed in the inspection charter described in the report. The inspection examined activities conducted under your licenses as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your licenses. The team reviewed selected procedures and records, conducted field walk downs, observed activities, and interviewed personnel.

Based on the results of this inspection, no findings of significance were identified.

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 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-71, DPR-62

Enclosure: Inspection Report 05000325/2008010 and 05000324/2008010
w/Attachment: Supplemental information

cc w/encl: (See page 3)

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cc w/encl: (See page 3)

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Letter to B. Waldrep from Randall A. Musser dated December 12, 2008

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U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.: 50-325, 50-324

License Nos.: DPR-71, DPR-62

Report Nos.: 05000325/2008010 and 05000324/2008010

Licensee: Carolina Power & Light (CP&L)

Facility: Brunswick Steam Electric Plant, Units 1 & 2

Location: 8470 River Road SE
Southport NC 28461

Dates: September 08 – November 13, 2008

Inspectors: J. Hickey, Hatch Senior Resident Inspector, Team Leader
R. Rodriguez, Senior Reactor Inspector, Division of Reactor
Safety
C. Jones, Senior Construction Inspector, Center for Construction
Inspection

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

Enclosure

SUMMARY OF FINDINGS

IR 05000325/2008-010, 05000324/2008-010; 09/08/2008 – 11/13/2008; Brunswick Steam Electric Plant, Units 1 and 2; Special Inspection.

This report documents special inspection activities performed onsite and in the Region II office by a senior resident inspector, a senior reactor inspector, and a senior construction inspector to review the circumstances surrounding a failed surveillance which demonstrates the ability to locally control the Emergency Diesel Generators. 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.

A. NRC – Identified and Self – Revealing Findings

None.

B. Licensee – Identified Violations

None.

Enclosure

REPORT DETAILS

Summary of Plant Events

On August 18, 2008, the licensee was performing the Emergency Diesel Generator (EDG) DG4 Local Control Operability Test. EDGs are normally controlled from the control room. This test demonstrates the ability to locally control the EDG in the event the normal control location is not available. When the portion of the surveillance which locally resets the DG4 lockout was performed, the Lockout Control Relay (LOCR) would not reset. Without the LOCR reset, DG4 cannot be operated to supply electrical power to required equipment.

On August 19, 2008, the licensee determined there was no electrical power available at the LOCR with the Alternate Safe Shutdown (ASSD) key switch in the local position. Further investigation by the licensee determined that a wiring error occurred during the installation of a circuit modification to DG4 in June 2007. A prompt extent of condition review determined the remaining EDGs were also affected. The licensee established compensatory measures to detect any potential fire in the areas which could cause a control room evacuation and in the EDG building. The licensee proceeded to re-wire and test each affected EDG. The local control function was restored to all EDGs on August 21, 2008.

Inspection Scope

Based on the deterministic and conditional risk criteria specified in Management Directive 8.3, "NRC Incident Investigation Program," a Special Inspection was initiated in accordance with NRC Inspection Procedure 93812, "Special Inspection Team." An initial charter was developed on August 22, 2008. The inspection focus areas included the following special inspection charter items:

1. Develop a sequence of events, including applicable management decision points, from implementation of the relay modification (mid-2007) through restoration of the alternate safe shutdown function.
2. Review and assess the licensee's corrective actions after the identification that the EDGs were not able to perform their alternate safe shutdown function, including compensatory measures the licensee put in place prior to completing corrective actions. This should also include a review of the probable causes and contributing factors to the event, as well as any common cause analysis performed by the licensee.
3. Review and assess the design change that was completed in mid-2007 that adversely impacted the lockout relay and the design change used to correct the initial discrepant condition.
4. Review and assess the post modification testing completed after the implementation of the design change to determine why the testing did not identify the inability of the EDGs to perform their alternate safe shutdown function.

Enclosure

5. Collect data necessary to support completion of the significance determination process, as applicable.
6. Verify that applicable documents have been updated to reflect actual plant conditions.
7. Interview engineering and maintenance personnel involved in the modification which resulted in the EDGs being unable to perform their alternative safe shutdown function to gain additional information and insights regarding the deficiency.
8. Determine the extent of condition regarding the design change that incorrectly wired the lockout relays.

4. OTHER ACTIVITIES

4OA5 Other Activities - Special Inspection (93812)

.01 Develop a sequence of events, including applicable management decision points, from implementation of the relay modification (mid-2007) through restoration of the alternate safe shutdown function (Charter Item 1).

a. Inspection Scope

The inspectors reviewed operating logs, corrective action documents, maintenance documents, engineering documents and interviewed licensee personnel to develop a sequence of events for this issue. Documents reviewed are listed in the Attachment.

b. Findings and Observations

On 2/19/2007, the Low Pressure Shutdown Control Relay on DG2 failed.

Management Decision: Preventive maintenance activities were developed to schedule replacement of all relays associated with the EDGs.

On 2/28/2007, Engineering Change Request (ECR) 7373 identifies obsolete LOCR relays in the EDG control circuit.

On 5/15/2007, Engineering Change (EC) 66274 issued to replace the obsolete EDG LOCR.

On 6/7/2007, DG1 LOCR was replaced.

On 6/15/2007, DG2 LOCR was replaced.

On 6/20/2007, DG3 LOCR was replaced.

On 6/27/2007, DG4 LOCR was replaced.

On 8/18/2008 at 9:52 pm, DG4 failed the Local Control Operability Test.

On 8/19/2008 at 11:10 am, Troubleshooting identifies the LOCR wiring error and the extent of condition determines all EDGs are affected.

Management Decision: Proceed with repairs for all EDGs by working all shifts.

On 8/19/2008 at 6:30 pm, compensatory measures are put in place in the areas which would cause a control room evacuation if a fire occurred.

On 8/19/2008 at 11:30 pm, EC 66274 is revised to correct the wiring error.

On 8/20/2008 at 5:02 am, DG4 is rewired and tested to demonstrate local control capability. The safe shutdown function was restored for DG4.

On 8/20/2008 at 2:15 pm, DG2 is rewired and tested to demonstrate local control capability. The safe shutdown function was restored for DG2.

On 8/21/2008 at 3:40 am, DG1 is rewired and tested to demonstrate local control capability. The safe shutdown function was restored for DG1.

On 8/21/2008 at 11:15pm, DG3 is rewired and tested to demonstrate local control capability. The safe shutdown function was restored for DG3. ASSD function is restored for all EDGs.

The timeline demonstrates that upon discovery the licensee proceeded in a deliberate manner to resolve the wiring error.

.02 Review and assess the licensee's corrective actions after the identification that the EDGs were not able to perform their alternate safe shutdown function, including compensatory measures the licensee put in place prior to completing corrective actions. This should also include a review of the probable causes and contributing factors to the event, as well as any common cause analysis performed by the licensee (Charter Item 2).

a. Inspection Scope

The inspectors reviewed maintenance documents, engineering documents, corrective action documents, and interviewed licensee personnel to determine what actions the licensee took following the failure of the DG4 Local Control Operability Test. The inspectors performed a field walk down of the cabinet where the DG4 LOCR relays are located. The inspectors reviewed what compensatory measures the licensee put in place while the rewiring activities were ongoing. The inspectors also reviewed the licensee's cause determination. Documents reviewed are listed in the Attachment.

b. Findings and Observations

The licensee's response was deliberate and methodical. This is supported by the sequence of events (4OA5.01). From the time of discovery that all four EDGs were affected by this wiring error, approximately 60 hours was required to restore the ASSD capability for all four EDGs.

Upon discovery that the EDGs were not able to perform their ASSD capability the licensee established compensatory measures to prevent and identify fires in the EDG building and locations which could cause a control room evacuation. The inspectors identified a weakness in the compensatory measures. Areas which would not result in a control room evacuation but could require operators to take local control of the EDG(s) were not considered by the licensee for compensation. Licensee's procedure OPLP-01.5 "Alternative Shutdown Capability Controls" step 6.1.3.3.c states that if both trains of ASSD equipment on a unit are inoperable, then implement appropriate compensatory measures within 72 hours. However, the licensee implemented repairs to the circuitry such that the ASSD function was restored within the 72 hour procedure limit. The licensee accepted the inspectors' comments and initiated corrective actions to re-evaluate affected areas in the plant. The licensee initiated NCR 294505.

The licensee's investigation into the cause of the wiring error has determined two primary causes. The first cause relates to the wire number convention for the ASSD local-normal key switches. The wire segment number on either side of the ASSD local-normal key switch was the same. Therefore, the individual selecting the point for the wiring change chose the correct wire number but the wrong locations on the ASSD local-normal key switches. For the second cause, the licensee determined a lack of rigor was evident in the design change process. This relates to the human performance of the Engineer and Design Verifier in the control circuit design change process.

An extent of cause review is being performed by the licensee. The licensee will review all safety related circuit modifications for the previous two years. Two years was chosen by the licensee because the periodicity of most technical specification surveillances falls within this interval. The corrective action to address this issue is tracked by NCR 292232 CORR#5.

An extent of condition review is being performed by the licensee. The focus of this action is to identify and correct the licensee's stated primary cause. A review of all ASSD switch modifications will be performed to verify the wire numbering convention across the switch is different. Additionally, a sample of other safety related switches will be performed to verify the wire numbering convention. The corrective action to address this issue is tracked by NCR 292232 CORR #6b.

- .03 Review and assess the design change that was completed in mid-2007 that adversely impacted the lockout relay and the design change used to correct the initial discrepant condition. (Charter Item 3)

a. Inspection Scope

The inspectors conducted direct observations of the as-built configuration at DG4, interviewed responsible engineers, and examined documentation created for the initial (mid-2007) design change and the subsequent change issued to correct the discrepant condition.

b. Findings and Observations

The initial design change was documented in EC 66274, revision 0, "Evaluate Replacement Relays for the Diesel Generator LOCR, LTACR, and N2CR Relays," dated May 15, 2007. The change was issued to replace obsolete logic control relays in all four emergency diesel control systems. To accomplish this, the logic and wiring configuration for one group of relays, the LOCRs, had to be modified to accommodate differences in the operating characteristics of the replacement relays. The design solution featured the addition of an auxiliary lockout reset (LR) relay in the logic circuitry. The change also corrected a legacy design problem that created a relay race between the LOCR relays and the emergency control relays (ECRs).

The inspectors reviewed the initial engineering change package and confirmed the critical design features of the replacement relays had been evaluated and measures were specified to establish system functionality equivalent to the original design. Designers identified and dispositioned a number of design input requirements, including a general requirement for the replacement relays "to operate under normal and accident conditions" (Design Input "15"). However, the design package did not identify an applicable requirement from Design Basis Document DBD-39, "Emergency Diesel Generator System," which states "... the EDGs shall be considered a safe shutdown system and shall be capable of being controlled from both the Control Room and a remote location." Consequently, design specifications for acceptance testing did not require the functionality of the modified logic to be demonstrated while control was established at the "remote location" (i.e. the local control panel). Details from the inspection of design acceptance testing are provided under Section 4OA5.04 of this report.

The inspectors verified an error was committed by designers in translating design requirements into the sketches used to guide physical installations in the field. Although requirements depicted in higher-level schematic logic drawings were consistent with DBD-39, sketches provided for field installation of the changes specified incorrect termination points for linking control power to the lockout relay reset circuitry. The drawing errors were overlooked by the design engineer, a supervising engineer, and a design verifier. This had the unintended effect of removing control power from the circuitry whenever control of the associated emergency diesel was transferred from the control room to the local panel. As documented in corrective action report NCR 292232, the design output error was discovered in August 2008 when operators were unable to reset the emergency diesel generators while attempting to operate the systems from the local control panels. This issue is unresolved pending NRC review of the EDG control wire routing to verify what areas are affected and is designated as URI

05000325,324/2008010-001, Verify cable routing locations affected by a design change error which resulted in a loss of Emergency Diesel Generator local control function described in Section 4OA5.02 of this report.

Revision 5 to engineering change EC 66274 was issued to correct the wiring error. The inspectors' review of the revision found the design input requirements were not updated. The omission indicated a continuing lack of rigor in implementing the design control process; however, in this case the necessary information was separately captured in corrective action report NCR 292232. Inspectors found the installation sketches were revised with clear instructions for restoring full functionality of the lockout reset relays. The changes to the design output products were processed, reviewed, and approved under controls commensurate with the original design. Inspector review of documentation contained in maintenance work order 01401989-03, dated 8/18/2008, determined the work records provided evidence that corrective installations were properly completed, peer verifications were conducted, and acceptance testing was completed for the required wiring changes.

.04 Review and assess the post modification testing completed after the implementation of the design change to determine why the testing did not identify the inability of the EDGS to perform their alternate safe shutdown function. (Charter Item 4).

a. Inspection Scope

The inspectors reviewed post modification testing, control wiring diagrams, and the root cause evaluation for the EDGs relay replacement design change implemented in June 2007 to determine why the post modification test did not identify the inability of the EDGs to perform their alternate safe shutdown function. The review contrasted the test completed after the implementation of the design change in June 2007, and the subsequent performance of surveillance test OPT-12.14.L, DG4 Local Control Operability Test, in August 2008.

b. Findings and Observations

The inspectors independently verified the licensee's conclusion that the post modification testing was designed to validate the effectiveness of the design and circuit changes, but that it did not sufficiently test the LOCR to ensure that the new component was capable of performing all of its design functions. Specifically, the new relays were tested with the ASSD key-switch in the "NORMAL" position only, and were not tested with the ASSD key-switch in the "LOCAL" position. The licensee determined that while this was in compliance with their testing guidance procedure, EGR-NGGC-0155, it did not meet the intent of this procedure or Generic Letter 96-01. Corrective action was initiated to revise EGR-NGGC-0155 to 1) more fully discuss the concept of unintended consequences as it relates to control logic circuits, 2) discuss the need for additional care when dealing with daisy-chained circuits, and 3) more fully describe how to comprehensively determine the sphere of influence of a control circuit modification such that potential consequences can be adequately addressed. The inspectors concluded that the inadequate post modification testing was not a cause of the event, but a barrier

that failed to detect the inadequate design change. A conceptual design error was transferred from the design modification package into the post modification testing process which resulted in the post modification test not identifying the wiring error. The inspectors concluded that the post modification testing issue did not constitute a separate performance deficiency and as previously stated, the inadequate design change will be assessed by URI 05000325,324/2008010-001. The licensee has entered the post modification testing aspects of this matter into the corrective action program as part of NCR 292232 CORR #4.

.05 Collect data necessary to support completion of the significance determination process, as applicable (Charter Item 5)

a. Inspection Scope

The team reviewed plant procedures, corrective action documents, plant general arrangements drawings, plant fire area delineation drawings, and cable routing information to gather data necessary to develop and assess the safety significance of any identified findings. The team also walked down the affected fire areas to evaluate ignition sources and their potential impact to safe shutdown equipment.

b. Findings and Observations

No findings or observations of significance were identified.

.06 Verify that applicable documents have been updated to reflect actual plant configuration (Charter Item 6)

a. Inspection Scope

The inspectors reviewed Engineering Change (EC) 66274 as well as the Control Wire Drawings (CWD) and Control Panel Connection Diagrams (CPCD) associated with the EDGs to verify that applicable portions of the documents had been updated to reflect actual plant configuration.

b. Findings and Observations

No findings or observations of significance were identified.

.07 Interview engineering and maintenance personnel involved in the modification which resulted in the EDGs being unable to perform their alternative safe shutdown function to gain additional information and insights regarding the deficiency (Charter Item 7).

a. Inspection Scope

The inspectors interviewed several engineering, maintenance planning, and maintenance personnel to determine how these individual approach the design, planning and implementation of design changes.

b. Findings and Observations

The inspectors determined, based on the sample interviews, the individuals understood their responsibilities in the design change process.

.08 Determine the extent of condition regarding the design change that incorrectly wired the lockout relays (Charter Item 8).

a. Inspection Scope

The inspectors reviewed 31 corrective action system reports related to quality of engineering change packages. The reports were selected from system history between 2006 and mid-2008. In addition, inspectors reviewed the licensee's statement of extent of condition as described in Section 4OA5.02 of this report.

b. Findings and Observations

The inspectors verified the incorrect logic wiring extended to all four emergency diesel generators, affecting both generating units. No other instances were found in corrective action history where designers failed to properly connect logic circuitry involving mode selection switches. Also, none of the corrective action reports selected for review described a failure of a design change package to implement a requirement from a design basis document.

Six instances were identified where avoidable deficiencies were discovered after distribution of approved design packages. The following Action Requests (ARs) were identified to the licensee to include in their evaluation of AR 294505, "Common Cause Implementation of ECs."

- AR 203701, dated 8/18/2006, reported that a design package assigned identification numbers to new terminal boards that were already assigned to pre-existing terminal boards in the same panel.
- AR 216386, dated 12/13/2006, identified that specifications for a design acceptance test provided inadequate set up of a turbine building ventilation flow instrument.
- AR 227854, dated 4/1/2007, identified a failure of designers to identify and control electromagnetic interference (EMI) from new model relays.
- AR 252046, dated 10/24/2007, reported that a new model relay would not physically fit into the location specified by design.
- AR 264459, dated 1/31/2008, reported design installation sketches specified an orientation for new RHR system valves that was opposite to the flow direction.
- AR 272275, dated 3/27/2008, reported a design package issued to accommodate a problem with field alignment of piping to a valve specified the wrong dimension for the alignment spacer.

4OA6 Meetings, Including Exit

On September 11, 2008, the special inspection team leader presented the preliminary inspection results to Mr. B. Waldrep, Brunswick Site Vice President, and members of his staff. Subsequently, additional in-office reviews were conducted and the final inspection results were discussed by telephone with Mr. Mike Annacone and members of his staff on November 13, 2008. The licensee acknowledged the inspection observations. No proprietary information is included in this inspection report.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

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B. Davis, Manager - Engineering
S. Hardy, Fire Protection
S. Howard, Manager - Operations
R. Ivey, Recovery Manager
A. Pope, Manager - Maintenance
T. Sherrill, Engineer - Technical Support
B. Waldrep, Site Vice President

NRC Personnel

G. Kolcum, Resident Inspector, Brunswick, Region II
J. Munday, Deputy Director (acting) Division of Reactor Projects, Region II
R. Musser, Chief, Reactor Projects Branch 4, Division of Reactor Projects Region II
P. O'Bryan, Senior Resident Inspector, Brunswick, Region II

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened

05000325,324/2008010-001	URI	Verify cable routing locations affected by a design change error which resulted in a loss of Emergency Diesel Generator local control function
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Closed

None

Discussed

None

DOCUMENTS REVIEWED

Procedures

0AOP-36.2, Station Blackout, Rev. 37
0ASSD-00, User's Guide, Rev. 35
0ASSD-01, Alternative Safe Shutdown Procedure Index, Rev. 31
0ASSD-02, Control Building, Rev. 43
0PT-12.14.L, DG4 Local Control Operability Test, Rev. 15
1ASSD-03, Train B Shutdown, Rev. 26
1MST-DG21R, DG-1 Trip Bypass Logic Test, Rev. 19
1MST-DG22R, DG-1 Trip Bypass Logic Test, Rev. 19
1SP-07-101, Post Replacement Testing for Selected DG-1 and DG-2 Relays, Rev. 0
2ASSD-03, Train B Shutdown, Rev. 22
2MST-DG21R, DG-1 Trip Bypass Logic Test, Rev. 19
2MST-DG22R, DG-4 Trip Bypass Logic Test, Rev. 19
2SP-07-204, Post Replacement Testing for Selected DG-3 and DG-4 Relays, Rev. 2
AOP-32.0, Plant Shutdown From Outside Control Room, Rev. 45
EGR-NGGC-0155, Specifying Electrical/I&C Modification Related Tests, Rev. 3

Drawings

F-09348, Sheet 1, Diesel Gen. No. 4 Circuits Control Wiring Diagram, Rev. 30
F-09348, Sheet 2, Diesel Gen. No. 4 Circuits Control Wiring Diagram, Rev. 35
F-09348, Sheet 3, Diesel Gen. No. 4 Circuits Control Wiring Diagram, Rev. 18
0-FP-20158, Diesel Generator No. 4 Engine Control Panel Connection Diagram, Rev. Q
SK-66274-E-3023, Installation Sketch: LOCR Relay As-Built" (DG#1 LOCR), , Rev. A
SK-66274-E-3024, Installation Sketch: LOCR Relay As-Built" (DG#2 LOCR), Rev. A
SK-66274-E-3025, Installation Sketch: LOCR Relay As-Built" (DG#3 LOCR), Rev. A
SK-66274-E-3026, Installation Sketch: LOCR Relay As-Built" (DG#4 LOCR), Rev. A
SK-66274-E-3028, Installation Sketch: LOCR & LR Relay Wiring, Rev. A & B
F-09345, Sh1, Diesel Generator No. 1 Circuits Control Wiring Diagram, Rev. 30
F-09345, Sh2, Diesel Generator No. 1 Circuits Control Wiring Diagram, Rev. 31
F-09345, Sh3, Diesel Generator No. 1 Circuits Control Wiring Diagram, Rev. 19
F-09346, Sh1, Diesel Generator No. 2 Circuits Control Wiring Diagram, Rev. 29
F-09346, Sh2, Diesel Generator No. 2 Circuits Control Wiring Diagram, Rev. 29
F-09346, Sh3, Diesel Generator No. 2 Circuits Control Wiring Diagram, Rev. 18
F-09347, Sh1, Diesel Generator No. 3 Circuits Control Wiring Diagram, Rev. 31
F-09347, Sh2, Diesel Generator No. 3 Circuits Control Wiring Diagram, Rev. 29
F-09347, Sh3, Diesel Generator No. 3 Circuits Control Wiring Diagram, Rev. 21
F-09348, Sh1, Diesel Generator No. 4 Circuits Control Wiring Diagram, Rev. 30
F-09348, Sh2, Diesel Generator No. 4 Circuits Control Wiring Diagram, Rev. 34
F-09348, Sh3, Diesel Generator No. 4 Circuits Control Wiring Diagram, Rev. 19
0-FP-20152, Unit 1 & 2 Engine Control Panel Connection Diagram Diesel Generator #1, Rev. V
0-FP-20154, Unit 1 & 2 Engine Control Panel Connection Diagram Diesel Generator #2, Rev. Q
0-FP-20156, Unit 1 & 2 Engine Control Panel Connection Diagram Diesel Generator #3, Rev. T
0-FP-20158, Unit 1 & 2 Engine Control Panel Connection Diagram Diesel Generator #4, Rev. P
F-02501, Reactor Building General Arrangement Plan Below Grade El. 7'-0", Rev. 28
F-02502, Reactor Building General Arrangement Plan El. 20'-0", Rev. 27

F-02503, Reactor Building General Arrangement Plan El. 50'-0", Rev. 22
 F-07008, Units 1 & 2 Control Building General Arrangement Plans, Rev. 50
 F-01926, Diesel Generator Building Plans, Rev. 19

Calculations

BNP-E-9.004, Attachment B, Zone Layout Drawings, Rev. 2
 BNP-0084, Cables and routing that could cause spurious Diesel Generator Lockout, 10/7/2008
 BNP-0088, Cable routing of cables that could cause a spurious EDG start and for cables that would disable that offsite power feed to 1-E2 and 2-E4, 10/2/2008
 BNP-0091, Cables that are routed in trays in cable spreading room that could cause a start of Diesel Generator 4 (2-DG4-GEN), 10/17/2008

Miscellaneous Documents

Modification EC 66274, Evaluate Replacement Relays for the Diesel Generator LOCR, LTACR, and N2CR Relays, Rev. 0 & 5
 50.59 Screen for EC 66274
 Design Basis Document DBD-39, Emergency Diesel Generator System, Rev. 7
 UFSAR 8.3.1
 Generic Letter 96-01, Testing of Safety-Related Logic Circuits
 Technical Specification and Bases

Condition Reports

AR 108100, Diesel Generator inoperable due to failed LPSCR relay
 AR 203701, New terminal boards given same ID as existing boards
 AR 206687, Performance gap identified in quality of engineering changes
 AR 210012, Deficiencies in outsourced engineering products
 AR 212093, Use of informal e-mail to communicate design requirements
 AR 212882, Deficiencies with design inputs, evaluations, and 50.59 screenings
 AR 216386, Inadequate post-modification test for turbine building flow instruments
 AR 223012, Spurious failure of logic diesel generator control relay
 AR 224366, Lack of timeliness in issuing updated engineering specification
 AR 224583, Incorrect answer to question in safety evaluation
 AR 227843, Legacy design deficiency caused relay race between diesel logic relays
 AR 227854, Diesel Generator response during performance of 2MST-DG14R
 AR 228210, Use of informal e-mail to communicate design requirements
 AR 231335, Design verifier did not follow requirements
 AR 235425, Lack of timeliness in preparing engineering changes
 AR 236223, Self-assessment task to evaluate errors in engineering changes
 AR 238501, Omissions and discrepancies found in engineering drawings
 AR 240716, Undesired scope changes to engineering change packages
 AR 247644, Acceptance test specified by engineering was not captured in work order
 AR 252046, Replacement relay would not fit in location specified by engineering change
 AR 264459, Sketches for RHR continuous flow vent valves showed incorrect flow orientation
 AR 266824, Deficiencies identified in work planning
 AR 269875, Test specified by engineering change did not address affected systems
 AR 272059, Engineering change package lacked a required evaluation
 AR 272275, Incorrect dimension specified for field fit up of piping components

AR 272615, As-built configuration was not incorporated into drawings
AR 274945, Insufficient torque value specified for two valves
AR 276213, Work package to install engineering change was incomplete
AR 281724, Documents affected by engineering change were not updated
AR 284696, Signature for Design Verifier was not correct
AR 288294, Inadequate documentation for dispositions of review comments
AR 292232, Design error in modification of emergency diesel lockout circuit

Condition Reports Generated During Inspection

AR 294505, "Common Cause Implementation of ECs." Revised to include examples indentified by the inspectors.

Work Orders

00818040 02, PMT (TR) Test 2-DG1-RC, DG1 Engine Run Control Relay, 06/11/07
01053510 05, EL; 2-DG2-ENG-CTRL-PNL; EC 66274; Perform 1SP-07-101, 06/15/07
01053523 05, EL; 2-DG3-ENG-CTRL-PNL; EC 66274; Perform 2SP-07-204, 06/29/07
01055544 18, EL: TR: 2-DG4-ACR: EC# 66594: Perform 2SP-07-204, 06/29/07
01056524 06, EL: 2-DG4-CTRL-PNL; EC 66274; Perform 2MST-DG22R, 06/29/07