UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report Nos.: 50-325/94-25 and 50-324/94-25

Licensee: Carolina Power and Light Company
P. O. Box 1551
Raleigh, NC 27602

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

Facility Name: Brunswick Steam Electric Generating Plant Units 1 and 2

Inspection Conducted: August 8-12, 1994

Inspectors: for H. Whitener — 9/1/94 Date Signed

Accompanying Inspector: G. Wiseman

Approved by: C. Casto, Chief — 9/6/94 Date Signed
Test Programs Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This routine, announced inspection was conducted in the areas of design changes and plant modifications, and engineering and technical support activities (IP 37550).

Results:

In the areas inspected, violations or deviations were not identified.

- The licensee had implemented a process for reviewing, prioritizing and scheduling needed design changes which considered plant safety, reliability and cost benefits. Documented technical justifications for cancellation of proposed design changes by the Project Review Group (PRG) were adequate.

- Plant Modification (PM) and Temporary Plant Modification (TPM) packages were technically adequate with sufficiently detailed 10 CFR 50.59 safety evaluations. Adequate post modification test requirements were specified.

- The completed modifications reviewed were considered adequately implemented. However, Phase 2 testing of the hydrogen water chemistry system $H_2$ injection upgrade for PM 93-044/45 indicated that the design modification may not have been fully effective to achieve the desired result of full 100 scfm flow injection rate without inducing system trips. Since completion of the installation of the modification in February 1994, three system trips have been experienced. Adverse Condition Report 94-01323 was initiated to address this condition. This item will be reviewed further by the NRC Resident Inspectors.

- The control of TPMs had improved. Engineering has significantly reduced the TPM backlog and was maintaining the TPMs at a manageable level.

- Management initiatives were addressing the area of PM closure backlog reduction. Previous efforts to reduce the backlog of open PMs had not been fully effective. The licensee has recently initiated a program to address the PM backlog and has planned a significant reduction of open PM packages by the end of 1994.

- The various engineering groups provided adequate and timely support to maintenance and operations for day-to-day activities and emergent issues. Engineering communications with interfacing organizations was good. The availability of a 24-hour, on-site single point contact for site engineering support was a positive initiative.

- Organization and staffing levels for Engineering appeared to be adequate to perform the assigned duties and responsibilities.

- Engineering Support Personnel (ESP) training was adequate. Training was established consistent with INPO guidelines.

- CP&L had initiated a three phase Action Plan associated with the resolution of the Thermo-Lag issue for Brunswick. The Thermo-Lag Action Plan for Brunswick inoperable fire barrier installations was logical and responsive.

## REPORT DETAILS

1. Persons Contacted

Licensee Employees

*R. Anderson, Vice President, Brunswick Plant
*P. Beane, Quality Control Manager
*R. Deacy, Manager, Craft Resources
*D. Eng, Manager, Projects
*R. Grazio, Manager, Nuclear Engineering Department (NED)
S. Hardy, Fire Protection Engineer, NED
*G. Honma, Manager, Licensing
*W. Levis, Unit 1 Plant Manager
*C. Pardee, Manager, Technical Support
*G. Thearling, Specialist, Regulatory Affairs
*J. Titrington, Unit 2 Plant Operations Manager
*W. Triplett, Senior Specialist, NED
*M. Turkal, Manager, Regulatory Programs

Other licensee employees contacted during this inspection included engineers, technicians, and administrative personnel.

NRC Resident Inspectors

P. Byron, Resident Inspector
*M. Janus, Resident Inspector
*C. Patterson, Senior Resident Inspector

*Attended exit interview

2. Design Changes and Plant Modifications (PM) (37550)

a. Planning and Development of Plant Modifications

The inspectors reviewed the design change development process used for identifying, screening, evaluating, and approving plant modifications to improve reactor safety and plant operation. The inspectors also held discussions with licensee personnel regarding the PM prioritization process. Modification and design control documentation reviewed during this inspection included:

- Administrative Instruction AI-109, Performance of Nuclear Safety Reviews, Revision 2, May 1992.

- Engineering Procedure ENP-03, Plant Modification Procedure, Revision 46, July 31, 1992, (Valid For Modifications Approved Prior To September 1, 1989).

- Engineering Procedure ENP-12, Engineering Work Requests, Evaluations, And Action Items, Revision 34, November 15, 1993.

- Engineering Procedure ENP-25, Plant Drawing Correction Procedure, Revision 11, May 19, 1993.

- Engineering Procedure ENP-33.6, Equipment Data Base System (EDBS) Control and Revision, Revision 7, March 31, 1994.

- Nuclear Engineering Department (NED) Procedure 301, Design Control Procedure, Revision 0, August 26, 1993.

- Carolina Power and Light (CP&L) Nuclear Plant Modification Program (NPMP), Revision 4, November 21, 1991.

- Plant Modifications List With Release or Turnover to Operations After November 7, 1993, August 5, 1994.

- Projects Review Effort Results and Scrub List, March 22, 1994.

- Projects Identification Document (PID) Phase Approval Report, August 1994.

The inspectors determined that PMs were prepared by the Nuclear Engineering Department (NED) located primarily on-site. Proposed design projects that led to plant modifications were primarily requested through the on-site Technical Support Unit. Responsibility had been assigned to the Engineering Projects Manager for maintaining logs of the status of project PIDs and PMs. The process used to develop, prioritize, and authorize plant modifications was described in the CP&L NPMP. This process consisted of three phases (Proposal, Plan, and Plant Modification Package) of PM review and approval. A Brunswick Project Review Group (PRG) reviewed and approved proposed plant modifications for inclusion in the Master Project Plan and the Brunswick Three-Year Plan.

The PRG was a project management group comprised of primary senior Site Managers established to evaluate plant projects and make recommendations for development, deferral or cancellation. Prioritization under the PRG review and approval process involved cost benefit analysis, assignment of schedule index for implementation activities based on six areas which included nuclear safety, industrial safety, unit availability and reliability, unit capacity, radiation exposure (ALARA), and plant enhancement to improve operation or maintenance.

The inspectors reviewed selected PM project proposals identified in the PRG meeting minutes of December 17, 1993, January 17, February 16, and May 4, 1994, to verify that the PRG performed the technical reviews in accordance with the NPMP. The inspectors noted that the projects were prioritized and categorized by the PRG according to the safety significance of the plant change.

In addition, the inspectors reviewed the results of a March 1994, project management review effort (307 total outstanding projects in the review). From this review 116 projects were approved, 38 required further study, 44 underwent scope reductions, and 109 were cancelled.

The inspectors reviewed the following projects (PIDs/PMs) cancelled by the PRG to determine if the basis for cancellation was acceptable.

| PID No. | Project Description |
|---|---|
| P977 | Replace High Pressure Core Injection (HPCI) Room Carbon Dioxide System Alarms |
| 08592A | Emergency Diesel Generator Field Flash Circuit Modification |
| G0207A | Install Turbine Building Smoke Removal |
| G0225A | Provide Cooled Air For Vital UPS Units |

The descriptions of the basis and technical justifications for cancellation of the PMs were adequate to determine that the issues did not adversely affect overall plant reliability or safety. The inspectors noted that a number of the PMs were cancelled because they were either re-channeled by the PRG to other plant work programs or determined to be unnecessary with the concurrence of the responsible system engineer.

Based on discussions with licensee engineering personnel, and review of the above documentation, the inspectors concluded that the licensee had an adequate prioritization and review process for identifying and implementing plant design changes.

b. Plant Modifications to Improve Reactor Safety

Five PM packages which had been installed with release or turnover to operations after November 7, 1993, were selected for review. The inspectors noted the PM packages reviewed were not fully closed-out; but, were undergoing document close-out reviews. The inspectors reviewed the PMs listed below to: (1) determine the adequacy of the safety evaluation screening and the 10 CFR 50.59 safety evaluations, (2) verify that the modifications were reviewed and approved in accordance with Technical Specifications and applicable administrative controls, (3) verify the modifications were installed and had proper sign-offs, (4) verify that applicable design bases were included and design documents (drawings, vendor manuals, plant procedures, FSAR, etc.) were revised, (5) verify that the modifications were properly turned

over to operations, and (6) verify that both installation testing and post modification test requirements were specified and that adequate testing was performed.

| PM No. | Title/Description of Work |
|---|---|
| PM 92-013 | Install Reactor Level Indication on the Remote Shutdown Panels. |
| PM 92-090 | Replace the Emergency Diesel Generator (EDG) Pedestal Seals and Oil Drain System to Contain and Collect Oil Leaks from the EDGs. |
| PM 92-107 | EDG Nos 3 and 4 Starting and Control Air Dryer Installation. |
| PM 93-044/45 | Hydrogen Water Chemistry Upgrade to Increase Injection Flow Rates For Mitigation of Intergranular Stress Corrosion Cracking (IGSCC). |

For the above PMs, the inspectors verified that: the modification field work was complete; applicable design input information such as seismic requirements, environmental qualification, industry codes, etc., were addressed; the modifications contained a work instruction package; the packages contained additional information such as the design basis; and affected plant documentation such as operator/control room drawings were revised before turnover to operations. This review also verified whether selected affected instrument set point index drawings, vendor manuals, computer equipment data base (EDBS), fire brigade pre-fire plans and procedures, fire protection Safe Shutdown Analysis (SSA), Alternate Safe Shutdown (ASSD) procedures and FSAR tables and figures had been updated to accurately reflect the modifications. The inspectors performed field inspections for some of the modifications and verified that the modifications were installed in accordance with the requirements specified in the applicable modification package. The inspectors identified no significant findings for the PMs reviewed and concluded the documentation of the modification packages was satisfactory; however, they were not fully closed out. The close-out reviews and updates of the EDBS, Environmental Qualification (EQ) List, Nuclear Plant Reliability Data System (NPRDS), and FSAR for the PMs were not yet complete. The licensee had included these PMs in their remaining Unit 2 refuel 11 modification close-out backlog list for tracking. This backlog is discussed further in Section 2.c. of this report.

The inspectors also noted that Phase 2 tests of the hydrogen water chemistry system $H_2$ injection upgrade for PM 93-044/45 indicated that the design modification had not been fully effective to achieve the desired result of full 100 scfm flow injection rate without inducing system trips. Since completion of the

installation of the modification in February 1994, three system trips had been experienced. Adverse Condition Report 94-01323 was initiated on August 8, 1994, to address this condition. This item will be reviewed further by the NRC Resident Inspectors.

c. Plant Modification Backlog

The inspectors reviewed the backlog of open PM packages which had not completed the close-out review process and lacked approved close-out sheets. The NRC had previously reviewed the backlog of engineering open items during inspections documented in NRC Inspection Reports 50-325,324/93-55 and 50-325,324/94-17. The backlog of remaining modifications requiring Document Control, EDBS, EQ, NPRDS and Regulatory Affairs reviews for close-out numbered approximately 164 during July 1994. The remaining Unit 2 Refuel 11 modification close-out backlog list included 25 PMs that were in the close-out review process. The PM close-out backlog had remained unchanged since April 1994; however, recent progress had been made in the reviews of EQ items, changes to NPRDS documents and EDBS updates. The licensee had recently initiated a program to address the PM backlog and has planned a significant reduction of open PM packages by the end of 1994.

d. Temporary Modifications (TPM)

The inspectors reviewed the licensee's TPM process to determine its adequacy for controlling and tracking temporary changes to the plant's configuration. TPMs were prepared by the system engineers within the Technical Support Unit. Plant Procedure PLP-22, Revision 2, "Temporary Modifications," provided requirements and controls for the installation and removal of TPMs. The procedure provided the detailed steps for the initiation, approval, evaluation, installation, removal, and tracking of temporary plant changes. TPMs were initiated by Engineering Work Requests (EWRs) which were reviewed by plant management for necessity. Engineering Evaluations Reports (EERs) were completed for the situation and safety reviews were performed as required. TPM travelers were generated and accompanied the EERs to track installation and removal of temporary changes.

Based on review of PLP-22, the inspectors concluded that the licensee has provided adequate directions for administrative control of the temporary modification process.

From a list of installed TPMs the inspectors selected five installation packages for review. The TPMs were examined to verify that: (1) adequate safety evaluations and technical reviews were performed; (2) testing was specified and performed where applicable; and (3) TPMs were periodically reviewed in accordance with PLP-22. The following TPMs were reviewed:

- 1-92-0065 Suppression Pool oxygen increase during RCIC runs.

- 1-93-0606 Disable automatic level control for Off-Gas Loop Seal Reservoir.

- 1-94-0042 Leakage repair clamp installation on flow orifice in condensate drain line.

- 1-94-0240 Lift leads to Suppression Pool Temperature Monitoring system.

- 1-94-0252 Refuel Bridge Grapple Limit Switch cable repair.

From review of the above installation packages the inspectors determined that the licensee had adequately analyzed the problems; developed acceptable temporary solutions; evaluated the impact of proposed changes on other systems and plant operability; performed adequate 50.59 safety reviews; provided step by step installation instructions; and, specified acceptance testing where applicable. Additionally, the inspectors verified that for the TPMs reviewed, the affected control room drawings had been properly annotated.

PLP-22 requires that the System Engineer perform a walk-down of the TPMs installed in his/her system (if accessible) each calendar month to verify that the installation remains proper, the need is still valid, each TPM tag is in place and in good condition, and the material condition of the TPM is acceptable. The walk-down is to be documented by sign-off on the TPM Traveler in the control room log. During the review of the TPM packages the inspectors noted that the monthly walk-downs for TPM 1-92-0065 had not been routinely performed. For Unit 1 no walk-down was documented on the Traveler for May, July or September 1993. For Unit 2 no walk-down was documented for August or October 1993. These problems were discussed with licensee personnel who indicated that about four months after the new TPM process (PLP-22) was initiated an audit was performed to verify the process. A number of performance and documentation deficiencies were identified. Adverse Condition Report (ACR) 93-204 was issued to document and correct the problems. The requirements of the new procedure were re-emphasized to each individual involved and the Manager of Technical Support discussed his expectations with the Technical Support personnel. The inspectors observed that the monthly walk-downs were routinely performed and documented for the ten months previous to this inspection for the TPM packages reviewed.

Based on this review the inspectors concluded that the licensee has implemented the installation of temporary modifications in accordance with the plant procedure (PLP-22).

e. TPM Backlog

The licensee had developed a significant backlog of installed temporary modifications in early 1993. In April 1993, 29 TPMs were installed in Unit 1 and 32 TPMs were installed in Unit 2 (Unit 2 numbers include the TPMs common to both units). Management considered this an unacceptable condition and established a work-off plan to reduce the installed TPMs to zero which extended into mid-1997. Also, a goal was established to reduce the TPMs to 20 or less in each unit. This goal was achieved for Unit 1 in September 1993. However, from April 1993, to April 1994, the TPMs in Unit 2 trended up and reached 44 in April 1994. From May through August 1994, Engineering achieved a significant reduction in Unit 2 TPMs. At the time of this inspection there were 12 TPMs installed in Unit 1 and eight in Unit 2. The trending charts and data for TPMs showed the work-off curve to reduce TPMs to zero ends in June 1995 for Unit 1 and July 1996 for Unit 2.

The inspectors concluded that engineering has significantly reduced the TPM backlog and was maintaining the installed TPMs at a manageable level.

3. Engineering And Technical Support

a. Organization, Staffing And Training

CP&L had reorganized the engineering functions from a Central Design Centered organization located at the corporate offices to an on-site centered organization located at each of the nuclear plants. On-site engineering and technical support services at Brunswick were provided principally by the Brunswick Engineering Support Services Unit (BESS). Under this organization structure, BESS included the Design Engineering, Technical Support (System and Test Engineers), and Projects and Engineering Services groups. This effectively combined the design, implementation, engineering test, and systems management functions under one engineering manager. One other on-site engineering group was assigned to the Maintenance Department. This group included the Component Engineers who are the experts on components and have historically been associated with maintenance support. The inspectors held discussions with licensee personnel and reviewed documentation of plant activities to evaluate engineering involvement in support of plant operation and maintenance. This support included items such as preparing and implementing plant modifications and temporary modifications; monitoring component and system performance; and, performing safety evaluations, engineering evaluations, root cause analysis, etc.

Realignment of the engineering organization involved moving Design Engineering to the site; moving Technical Support to BESS; combining Project Controls and Project/Programs into one Project

and Engineering Services group; and moving Craft Resources to the plant organization. These moves were intended to improve consistency of performance, eliminate redundancy, improve efficiency, and simplify work processes. There has been some staff reduction in the realignment of the engineering organization and some further organizational adjustments are to be announced in 1994. Currently, the BESS staffing level is 240. This includes approximately 51 System Engineers and 23 Testing Engineers. While the inspectors considered this staffing level to be adequate to maintain support to plant operations and maintenance, it is too early to evaluate the effectiveness of the reorganization which is still adjusting to the new processes. For instance, in a recent self assessment, the licensee attributed the majority of problems to performance errors and identified contributing factors as tight schedules, heavy workload, and burdensome processes. Additionally, engineering management is faced with large backlogs in the engineering work area. Contractor help is being used to address some of the major backlog issues (For details see NRC Report 50-325,324/94-17). The effectiveness of the engineering reorganization will be tracked during future NRC inspections.

Engineering Support Personnel (ESP) training was adequate. The licensee had set up a training course modeled after the INPO Guidelines which consists of three phases: Orientation, Position specific, and Continuing training. Trending charts showed that Technical Support had completed 98% of the Orientation training. Orientation training for design engineers who have recently transferred to the site was approximately 45% complete and scheduled to be completed by all engineers by December 1995. Position Specific training consisted of completing training courses appropriate to an individual's job and was managed by the individual's supervisor who determines when task training is successfully completed. The inspectors verified that the training coordinators had established schedules and were monitoring the training status of engineering support personnel.

b. Engineering Support

The inspectors interviewed licensee personnel and reviewed station records to evaluate engineering involvement in support of day-to-day plant operations. The type of records reviewed included but were not limited to the following (Some documents are listed by character of information rather that title):

- BNP Organizational Charts
- Progressive Organization Changes
- New Processes Within NED (CP&L Memo)
- BESS Functions

- BESS Improvement Action Plan Update
- Managers Expectations
- NED Guideline Unit Functions No. A-29
- Technical Support Organization And Conduct of Activities (TSPN 94-001)
- Technical Support Performance Report (June 1994)
- BNP Technical Support Morning Reports (Daily Activity Reports, Unit 1 and Unit 2)
- Vibration Analysis Reports (Specific cases)
- Monthly Vibration Reports (Summary of Equipment monitoring)
- Units 1 and 2 Efficiency Report (April-June, 1994)
- Miscellaneous Engineering Activity Reports

Technical Support Policy Notice, TSPN 94-001, described the mission, standards, administration, organization, responsibilities, and duties of the engineers. For System Engineers some of the principal duties involved monitoring system performance; trending performance parameters; periodic walk-downs of assigned systems; involvement in work on assigned systems such as maintenance, modifications or testing; writing test procedures; analyzing test results; identifying and resolving system deficiencies; and, recommending action to improve system reliability and availability. Also, the system engineers performed root cause analysis; recommended plant modifications to NED; reviewed proposed modifications; wrote post modification tests; and, developed and implemented TPMs. Temporary modifications was an area where the System Engineer provides real time support of plant operations since most TPMs are made to assist operations.

In the review of the above documents and discussions with licensee personnel, the inspectors concluded that engineering provided adequate and timely support to maintenance and operations for day-to-day activities and emergent issues. Examples identified included:

- Development of a preventive maintenance test to routinely discharge excess voltage on the Low Power Range Monitors. Frequent spiking on the chambers had induced half-scrams and had increased the potential of plant transients. Engineering determined that periodically applying a ramping voltage to the chambers eliminated the spiking problem and decreased the potential for a plant trip.

- The 1A and 1C Circulating Water Intake Pumps tripped. Investigations determined that the trips had resulted from problems associated with high differential pressure instrumentation. Instrument repairs were made and the pumps were returned to service with appropriate testing.

- Engineering provided an alternative plan to return a sample valve to service through an EER, which permitted repair without disabling other safety systems.

- Engineers located an alternative lubrication cooling water supply for the Service Water Pumps in order to support the performance of a periodic test within the specified time limits.

- The use of diagnostic testing to support plant operation. The inspectors reviewed several examples where diagnostic techniques involving vibration analysis and thermography identified equipment problems which, if the equipment had failed on-line, could have resulted in plant transients or emergency plant shutdown. Depending on diagnostic results the licensee actions ranged from monitoring for further deterioration and scheduling planned maintenance to immediate repairs.

The inspectors observed that good engineering communications had been established with the operations department. An Engineering Technical Support duty representative was available on a 24-hour basis to expedite engineering assistance to operations. Also, Technical Support representatives attended the operations morning meetings to learn the latest plant needs. This information is carried to the Technical Support meetings for action. The inspectors considered the communications a positive initiative and essential to Technical Support Engineering's role in supporting plant operations.

4. (Open) NRC GENERIC LETTER (GL) 92-08, and GL 86-10, Supplement 1, THERMO-LAG 330-1 FIRE BARRIERS (64704)

NRC issued GL 92-08 on December 17, 1992, and GL 86-10, Supplement 1, on March 25, 1994. This correspondence notified licensees of failures of fire endurance tests associated with Thermo-Lag fire barrier systems and requested licensees to take appropriate corrective actions and compensatory measures. The inspectors reviewed the licensee responses to the NRC on this issue which indicated that CP&L had initiated an Action Plan which identified three phases associated with resolution of the Thermo-Lag issue. This CP&L Thermo-Lag Action Plan had been developed as part of an approved project PCN 13533A, "TSI Thermo-Lag and Related Fire Barrier Concerns." The following provides a summary of the phases identified in the CP&L Thermo-Lag Action Plan:

Phase 1
Options Development - Initiate a Project Study to re-evaluate compliance options identified from the original Safe Shutdown Analysis along with options to test and/or upgrade Thermo-Lag configurations.

Phase 2
Test Plan - If the Options Development Phase identifies recommended upgrades of raceway configurations not bounded by the Nuclear Energy Institute (NEI) (formerly NUMARC) Test Program, develop a CP&L Test Plan to address those raceway configurations.

Phase 3
Implementation - Develop and implement the selected options and test results identified from Phases 1 & 2.

The inspectors observed and photographed eleven (11) Thermo-Lag penetration, conduit, and junction box enclosure installations. The inspectors considered CP&L Thermo-Lag Action Plan for Brunswick inoperable fire barrier installations, currently under NRC review, logical and responsive; however, the Thermo-Lag generic industry issues remain open and will be reviewed during future NRC inspections.

5. Exit Interview

The inspection scope and results were summarized on August 12, 1994, with those persons indicated in paragraph 1. The inspectors described the areas inspected and discussed in detail the inspection findings. Proprietary information is not contained in this report. No dissenting comments were received from the licensee.

6. Acronyms and Initialisms

| | |
|---|---|
| ACR | Adverse Condition Report |
| AI | Administrative Instruction |
| ASSD | Alternate Safe Shutdown |
| BESS | Brunswick Engineering Services Unit |
| BNP | Brunswick Nuclear Plant |
| CFR | Code of Federal Regulations |
| CP&L | Carolina Power and Light Company |
| EDG | Emergency Diesel Generator |
| EDBS | Equipment Data Base System |
| EER | Engineering Evaluation Report |
| ENP | Engineering Procedure |
| EQ | Environmental Qualification |
| ESP | Engineering Support Personnel |
| EWR | Engineering Work Request |
| FSAR | Final Safety Analysis Report |
| GL | Generic Letter |
| HPCI | High Pressure Core Injection |

| | |
|---|---|
| IP | Inspection Procedure |
| IGSCC | Intergranular Stress Corrosion Cracking |
| NED | Nuclear Engineering Department |
| NEI | Nuclear Energy Institute |
| NPMP | Nuclear Plant Modification Program |
| NPRDS | Nuclear Plant Reliability Data System |
| NRC | Nuclear Regulatory Commission |
| NUMARC | Nuclear Management and Resources Council |
| PID | Project Identification Document |
| PLP | Plant Procedure |
| PM | Plant Modification |
| PMT | Post Modification Test |
| PRG | Project Review Group |
| RCIC | Reactor Core Injection System |
| SSA | Safe Shutdown Analysis |
| TPM | Temporary Plant Modification |
| TS | Technical Specification |
| TSI | Thermal Science Inc. |