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

JAN 5 1993

Report Nos.: 50-325/92-46 and 50-324/92-46

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 1 and 2

Inspection Conducted: December 7-11, 1992

Inspector: Paul J. Fillion 12/29/92
Paul J. Fillion Date Signed

Approved by: Candle A. Julian 12/31/92
M. Shymlock, Chief Date Signed
Plant Systems Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This routine, announced inspection was conducted in the areas of technical support and maintenance with regard to electrical equipment.

Results:

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

Overall, the procedures and controls for maintenance work were adequate. One example of apparently not being aware of a generic industry problem was identified. The System Engineering certification process was moving quite slowly with regard to some systems. An Inspector Followup Item was established because the NRC intends to followup on a problem with wiring at the large power transformers.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*K. Ahern, Manager, Unit 2 Operations
*D. Beets, Manager, Electrical Systems
*M. Bradley, Manager, Nuclear Assessment Department
L. Chambers, Supervisor, Relay Maintenance, Transmission Maintenance
J. Combs, Manager, Wilmington Area Transmission Naubtebabce
*R. Helme, Manager, Technical Support
*T. Jones, Senior Specialist, Regulatory Compliance
*M. Kirkland, System Engineer
*W. Leininger, Manager, On-Site Nuclear Engineering Department
*J. Titrington, Manager, Unit 1 Operations
L. Troutman, System Engineer
H. Wall, Principal Specialist, Unit 1 Operations

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

NRC Resident Inspectors

*D. Nelson
R. Prevatte, Senior Resident

*Attended exit interview

2. Inspection Details

This inspection focused on maintenance activities performed by Transmission Maintenance at the Brunswick Steam Electric Plant (BSEP) switchyard, transformer yard and within the power plant. The inspection also evaluated the adequacy of the coordination between Transmission Maintenance and BSEP personnel.

The inspection included the following specific activities:

- Held discussions with the Manager of Transmission Maintenance (Wilmington, N.C., area office) and the Supervisor of the Relay Maintenance Crew concerning their organization, scope of work and procedures.

- Reviewed the "Customer/Supplier Agreement," dated September, 1991, which outlines the process and responsibilities for coordinating work between Transmission Maintenance and BSEP.

- Conducted a walkdown inspection of the unit auxiliary transformer (UAT) and the startup auxiliary transformer (SAT) for Units 1 and 2 (a total of four transformers).

- Reviewed corrective maintenance work request summaries, Adverse Condition Report summary and Licensee Event Reports (the latter for 1990, 1991 and 1992).

- Reviewed BSEP's response to two generic industry problems - static electrification of transformers and vulnerability of breaker failure relays to voltage spikes (the latter problem is discussed in NRC Information Notice 91-81).

Since original plant startup there has been some type of customer/supplier agreement between Transmission Maintenance and BSEP. One purpose of this agreement was to help ensure that the plant was not placed in an undesirable configuration with regard to the offsite power source as a result of maintenance activities. Procedures implemented under these earlier agreements were not completely effective in that regard. In July, 1983, the Transmission Relay Maintenance Crew caused a loss of power on a safety-related bus while calibrating a watthourmeter. After this event, they instituted procedures whereby detailed work procedures would have to be followed by Transmission Maintenance and that these procedures would be reviewed by BSEP operations personnel before work could begin. Even these tighter controls were not completely effective in averting problems. On March 5, 1991, an event occurred where the Transmission Relay Maintenance Crew did not return a voltage controlled overcurrent relay (51V) setting to proper configuration following calibration which resulted in a generator trip/reactor scram. About September, 1991, Transmission Maintenance began a program of upgrading all work procedures. And henceforth, the supervisor of the relay crew would inspect relays after calibration to confirm that the relay had been properly restored. New procedures would call for the supervisor to sign the data sheet to document that the restoration check had been made.

A detailed and comprehensive "Customer/Supplier Agreement" went into effect during September, 1991. A key feature of this agreement was that it called for one BSEP person to be Plant-Transmission Activities Coordinator. In other words, having a single point of contact among BSEP personnel should help avoid coordination type problems. The Manager of Electrical Systems was assigned this coordinator function. On a day-to-day basis, the responsibility was delegated to a System Engineer. Although not specifically stated in the 1991 agreement document, Transmission Maintenance has agreed to not make any changes to approved work procedures, either substantive, administrative or other, without obtaining approval of BSEP operations personnel.

The inspector concluded that the work procedures governing Transmission Maintenance activities at BSEP were adequate for ensuring the integrity of the non-safety-related systems and equipment which comprise the offsite power source. He also noted that there was only one Licensee

Event Report submitted in the last three years which has a bearing on the quality of work performed by Transmission Maintenance. That was the March, 1991, trip, which was discussed above. However, the inspector did identify a minor problem in failure to document how a deficient condition was resolved.

The nature of and circumstances surrounding this problem were as follows. On January 31, 1991, work request No. 91-ACCY1 was written to troubleshoot ground faults on the 1A battery portion of the DC Distribution System. In doing this troubleshooting work, BSEP personnel determined that a ground fault existed in the control or indication circuits at the Unit 1 UAT. According to the "Customer/Supplier Agreement," correcting the ground fault at the transformer was turned over to Transmission Maintenance. They determined that the ground fault existed on the wires running between the transformer control cabinet and the oil level switch on the conservator tank. The reason for this ground fault was that the wire insulation had become brittle and cracked. The cracking was observed in a location where multiconductor jacketed cable was run exposed on the transformer tank. The jacket did not appear degraded but the individual conductor insulation was. The affected wiring to the oil level switch was replaced with suitable cable, which had been purchased safety-related, in order to remove the ground fault.

At that time BSEP personnel and Transmission Maintenance inspected much of the wiring on the Unit 1 UAT. Based on what was seen in this inspection, the decision was made to inspect wiring on all power transformers and replace wiring as necessary at the next outage.

When the next outage arrived, some inspections of wiring were performed on all transformers, and some wiring was replaced by Transmission Maintenance. The supervisor's notes indicated that all resistance temperature detector (RTD) wiring mounted outside the UAT tank was replaced. His notes indicate that Unit 2 work was performed in the period from September 18, to 20, 1991; and Unit 1 work was performed in the period from August 11-13, 1992. His notes also indicated that the rewiring of the RTD's was independently verified.

The inspector made several observations with regard to the inspections and rewiring. First, the RTD wiring in question appeared to be new wiring. Second, work request No. 92-AUPU1 was initiated on August 13, 1992, to inspect the hot spot current transformer wiring at the Unit 2 UAT. The work request states that a problem was found with the corresponding wiring at Unit 1 UAT. This work request is consistent with the supervisor's notes because the notes stated that Unit 1 UAT wiring was being inspected on August 11-13, 1992, the date the work request was initiated. Even though the Unit 2 UAT had been inspected in September, 1991, the work request called for reinspecting the hot spot current transformer circuit in light of the problem seen on Unit 1. Third, the licensee saved a length of the defective RTD wiring, and they showed it to the inspector. It was seven conductor cable with a neoprene jacket. The purchase specification for the UAT's called for

ethylene propylene rubber insulation with a neoprene jacket for external wiring. Therefore the original wiring appeared to be as specified. Fourth, Transmission Maintenance rewired the RTD's with their standard substation wiring which is polyethylene insulation with individual conductor polyvinyl chloride (PVC) jacket and overall cable jacket of PVC. Polyethylene/PVC cable is good to excellent for this application.

The supervisor's notes did not provide adequate documentation commensurate with the importance and complexity of the problem at hand. As a result, the status of wiring on the transformers other than the RTD and hot spot current transformers at the UAT's was somewhat in question. Examples of wiring which should have been inspected [at least on a sample basis] but for which inspections were not documented were:

- Oil level switches
- Oil temperature indicators
- Pressure/vacuum gauges
- Pump and fan motor leads
- Oil flow indicators

During the inspection the System Engineers stated that the transformer defective wiring problem and its resolution should have been documented in a careful auditable manner. To rectify the situation they proposed to perform additional documented inspections before plant startup. In addition, Adverse Condition Report (No. B92-971) was written to address the larger potential problem of the lack of documentation described above.

The inspector's conclusions with regard to the transformer wiring problem were as follows. In or about February, 1991, the licensee knew that certain circuits on the transformer had defective wiring, but the offsite power supply was considered OPERABLE. The inspector reviewed this decision and agreed that the transformers were operable despite the wiring problem. The transformers could still perform their design basis function. The control wiring which was exhibiting the deterioration was for indication only and its failure would not defeat the function of the transformers. The hot spot current transformers and fan and pump motor leads were important to transformer cooling. However, problems with the hot spot current transformers would be discovered through the daily rounds checking of the hot spot temperature indicators. Cooling motor leads were a lesser concern due to their relatively cooler location and the failure of these cables would not affect the ability of the transformer to carry the required load during and immediately following an accident. Short-circuits on the sudden pressure relay circuit could cause a transformer lockout, but they would manifest themselves during normal operation. Since the licensee will perform additional inspections of wiring, the NRC desires to followup on this matter.

Therefore, Inspector Followup Item 92-46-01, Transformer Wiring Problems, is established.

The inspector performed a walkdown inspection of the UAT and SAT for both Units. In general, the inspector found the transformers were in good condition. Specifically, the wiring in the control cabinets was not deteriorated, and the workmanship of the wiring was good. The inspector noted two deficiencies for which the licensee would initiate work request. Those were:

- At Unit 1 SAT, rust on the top inside of the fan controller compartment which could flake off metal fragments and cause a short-circuit (WR/JO 92-BHJT1)

- At Unit 1 SAT, retaining pin loose on fan manual-thermal-off selector switch which was labeled "EN" (WR/JO was not written during the inspection)

As far as the inspector could determine there had not been any recent inspections of the control cabinets, and therefore the deficiencies noted did not indicate a problem with the quality of the licensee's inspections.

With regard to the licensee's response to generic industry problems, the inspector had the following findings and comments. The licensee had sufficiently investigated and had formulated an adequate response to NRC Information Notice 91-81: Switchyard Problems that Contribute to Loss of Offsite Power. The inspector also inquired as to whether or not the licensee had addressed the phenomenon of static electrification in power transformers. Static electrification is the buildup of static charge within a transformer as a result of ionization of the circulating oil as it passes through the heat exchangers, pumps, and over the insulating material of the windings. Negative ions collect on the insulation and positive ions in the top oil. The buildup of charge can lead to a discharge which can lead directly to transformer failure. EPRI Report EL6081 concludes, based on experimentation, that the problem is aggravated for some conditions where more cooling capacity is provided than is needed. This can result in high oil flow rates of relatively cold oil. The licensee presented a copy of an internal Transmission Dept. memorandum on the subject of static electrification of transformers, dated December 9, 1992. The memorandum made the recommendation, which applied to BSEP, that: "the cooling on our large base load generator stepup transformers not be left running when the units are off line". The licensee's Startup Procedure, OP-50, called for manually starting the initial stage of cooling. However, as far as the inspector could determine, the shutdown procedures did not address transformer cooling. Therefore, after an emergency trip the cooling could be left running for an indefinite period of time, which would be contrary to the recommendations of the memorandum.

Also, it appeared from reading the memorandum that engineering had not specifically addressed the backfeeding mode. During the extended outage

which was ongoing at the time of the inspection, the plant shutdown loads were receiving power from the grid through the generator stepup transformer. The transformer was carrying very light loads while all pumps and fans were running. This appeared to be excessive cooling and would be contrary to the intent of the recommendation in the memorandum. The licensee agreed that the situation should be reviewed. In conclusion, this evolution with regard to response to industry operating experience, namely the phenomenon of static electrification of transformers, could indicate a minor weakness in this area. The transformer problem has been known for some time, but apparently has not been addressed at BSEP.

During the course of the inspection, the inspector interfaced with engineers from the System Engineering group. The inspector was led to the opinion that System Engineering was not as knowledgeable about the power transformers as one would expect of a system engineer at a nuclear power plant. They were basically competent engineers but apparently had not attended specialized training on transformers nor carefully reviewed the operation manual. The inspector learned that one engineer was assigned the following systems in April, 1992:

- 24 KV isolated phase bus
- Caswell Beach pumping station distribution
- 230 KV equipment
- power transformers, ie. GSU, CAT, UAT
- equipment grounding
- surge protection
- house power distribution

The schedule established by management was that this engineer would become "certified" on the 230 KV equipment by the end of March, 1993. A schedule had not been established for the other systems. It appears that the certification process was moving quite slowly with regard to some systems.

3. Exit Interview

The inspection scope and results were summarized on December 11, 1992 with those persons indicated in paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results including the Inspector Followup Item listed below. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

IFI 92-46-01, Transformer Wiring Problems.

NRC FORM 591 PART 2
(7-91)
10 CFR 2.201

U.S. NUCLEAR REGULATORY COMMISSION

SAFETY INSPECTION

1. LICENSEE	2. REGIONAL OFFICE
Monmouth Radiologists, P.A. 279 Third Avenue Long Branch, New Jersey 07740	REGION I U S NUCLEAR REGULATORY COMMISSION 475 ALLENDALE ROAD KING OF PRUSSIA PA 19406-1415

3. DOCKET NUMBER(S)	4. LICENSE NUMBER(S)	5. DATE OF INSPECTION
030-27828	29-27832-01	August 4, 1992

2 (Continued)

2a. The Radiation Safety Officer did not review at least quarterly, the external radiation doses of authorized users and visitors to determine that their doses were ALARA as required by the licenses established ALARA program.

identified, and corrective action was or is being taken, and the

source leak tests
approved by