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

Report No.: 50-302/89-25

Licensee: Florida Power Corporation
3201 34th Street, South
St. Petersburg, FL 33733

Docket No.: 50-302 License No.: DPR-72

Facility Name: Crystal River 3

Inspection Conducted: October 16-20, 1989

Inspector: T E Conlon for 12/7/89
Paul F. Fillion Date Signed

Approved by: T E Conlon 12/7/89
Thomas E. Conlon, Chief Date Signed
Plant Systems Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This special announced inspection was conducted in the areas of electrical design problems and plant modifications. The inspector reviewed related calculations, test procedures, test results, event reports, correspondence, deficiency reports, drawings and other documentation.

Results:

Since January 1989, Crystal River has reported several design deficiencies in the electrical area. Also, Crystal River is proceeding with a major retrofit to the electrical systems to provide a new independent source of offsite power. In addition a project to replace the safety-related batteries is scheduled to be completed during the spring of 1990 refueling outage. In response to these reports and in light of the planned modification, the NRC conducted an inspection to determine if requirements have been met, to monitor the retrofit work, and other corrective actions.

The licensee's on-site and corporate headquarters engineers were effective in defining and implementing corrective actions for the design problems identified. Installation of a new independent source of offsite power (2nd startup transformer) is a positive licensee initiative.

There were no violations, deviations or unresolved items identified during this inspection.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*G. L. Boldt; Vice President of Nuclear Production
*A. H. Gelston, Supervisor, Site Nuclear Engineering Services
D. A. Shook, Manager Nuclear Electrical/I&C Engineering
P. R. Tanguay; Manager Nuclear Operations Engineering
*M. S. Williams, Nuclear Regulatory Specialist
*K. R. Wilson, Manager, Nuclear Licensing

Other licensee employees contacted during this inspection included craftsmen, engineers, operators, mechanics, security force members, technicians, and administrative personnel.

Impell Corporation

R. Atkinson, Principal Engineer

NRC Resident Inspectors

*P. Holmes - Ray
*W. H. Bradford

*Attended exit interview

2. Inspection Details

a. Batteries

The DC System is rated 250/125 volt nominal. The Train A and Train B batteries consist of two 126 volt banks interconnected to feed a combination of 250 volt and 125 volt loads. Original battery sizing calculations, carried out by the engineer/architect in 1972, incorporated the assumption that the total 125 volt load on each train was equally divided between the two battery banks of that train. The calculations defined seven discrete time segments within the two-hour capacity. Logically, the service test used the same load profile as developed in the calculation.

LER 89-32, issued September 29, 1989, stated that the load profile was not valid because:

(1) The generator hydrogen seal oil back-up pump, TBP-10 (250 volt) could start in one minute (second time segment) rather than sixty minutes (sixth time segment) assumed in the calculations; and

(2) The calculational assumptions that the 125 volt loads were equally divided had not been translated into the actual installation. The reality was that the two 125 volt banks of the train B battery were not equally loaded. Bank 3B2 had more load than originally thought. Train A battery had balanced loads.

The Unit was in MODE 5 (cold shutdown) at the time this loading problem was identified. Before start-up from that outage, the licensee field verified a large percentage of the load values. These verified values typically were lower than had been used in the calculations. After the load data was obtained, individual loads were moved from 3B2 bank to 3B1 bank to balance the load on each bank. The seal oil pump was removed and connected to a temporary non 1E battery. The net result of the field verifications, load balancing and removal of non safety related loads produced a calculated load profile that is less than the test profile.

Technical Specification 3.8.2.3 requires that both batteries be operable in modes 1, 2, 3 and 4. The corresponding surveillance test, 4.8.2.3.2.d calls for a two-hour battery service test at 18-month intervals. TS 3.8.2.3 was violated over the years of plant operation because the service test was not valid. The test was not valid because in four of the time segments the test current was less than the calculated load. For example in the second time segment (1-2 min) the load was 621 amperes while the test current was 468 amperes. In the fifth time segment (20-60 min) the load was 470 amperes while the test current was 403 amperes. This violation of Technical Specifications was cited in NRC report 50-302/89-24, but a Notice of Violation was not issued, because the matter was under consideration for escalated enforcement action. The licensee will be informed about the characterization of this violation in correspondence separate from this report.

During this inspection, the NRC inspector requested the licensee to calculate the size battery required for the two-hour load profile on bank 3B2 that represents the original system configuration using the refined load values. The computational results were that 10.3 positive plates would be needed to supply that load. After reviewing the methodology and battery discharge characteristics, the inspector agreed these results were valid. Since the battery actually has 11 positive plates, one may conclude that the batteries would have met their design criteria even with the original configuration.

Results of the last load profile test, conducted about October 1988, together with the latest loading calculations give positive evidence that the batteries have sufficient capacity to perform their design basis function. However, realizing that the batteries are approaching the end of their useful life, the licensee is vigorously proceeding to replace the batteries

during the spring 1990 refueling outage. The NRC inspector reviewed the status of that plant modification with the cognizant plant engineers and purchasing personnel, and concluded that the project in on schedule. LER 89-32 is closed.

b. DC Distribution System

On September 8, 1989, the licensee reported that the actual system voltages, at times, have exceeded the voltage range rating of numerous components energized by the DC distribution system. The overvoltage problem was discovered through efforts in implementing the B&WOG Safety and Performance Improvement Program. LER 89-35 will cover the reportable conditions, but it had not been submitted at the time of the inspection.

The issue was identified and resolved during a plant outage. As part of the corrective action, the rated voltage range of each device energized by the DC system was compared to the equalizing voltage. Many devices found to be outside their rating were replaced with devices having the proper rating. A few categories of components were reviewed in terms of operation of their respective systems, and the licensee concluded that exposure to overvoltages could not lead to any safety system not performing its intended safety function. Therefore these components were not replaced even though they may have seen voltages above their rating. The analysis of this problem will continue until the spring 1990 refueling outage when further actions may be taken.

Wherever analysis was carried out by the licensee to determine that a particular safety system remains operable in light of the overvoltage problem, such analysis was reviewed by the NRC inspector and found to be conservative.

It is an NRC requirement that equipment must be within its applicable rating to ensure that it will perform its intended safety function. As far as could be determined by the NRC inspector the devices that had to be replaced or analyzed as a result of misapplication was part of the original plant equipment. The problem was discovered by the licensee as a result of corrective action for a known industry problem. After discovery corrective actions were prompt and appropriate. The actual overvoltages were relatively small and may have been within design margins. Therefore, violations were not identified during inspection related to this matter.

c. Degraded Grid Voltage Protection Relays

ESF transformer, 3A, a 4160-480 volt dry type transformer had failed on August 28, 1989. The replacement transformer had a different impedance than the original and any calculations which used impedance as an input constant had to be reviewed. During this review it was determined that the voltage drop between the motor control centers

(MCC) and downstream devices had not been explicitly treated in the degraded voltage relay set point calculation. Furthermore, it was realized that the assumed drop from MCC's to several downstream devices would be less than the actual drop. Corrective action developed by the licensee was to raise the degraded voltage protection relay setpoint. At the new setpoint, the relay would operate before any device in the system saw low voltage but yet allow the system to be secure during normal transients.

The installation of degraded grid voltage protection was a plant enhancement initiated by the NRC. Licensee's were informed of the NRC position in a letter dated June 1977. As a result of the evolution described above, the licensee realized that the original setting for the degraded grid voltage protection relay was not the correct setting and had decided to make an adjustment. The evolution itself, i.e reviewing the design basis before installing a replacement transformer represents proper actions which resulted in a potential problem being identified.

d. Limitation of the Units 1 & 2 Startup/Standby (S/S) Transformer

LER's 89-13 and 89-13-1 describe an event that occurred on April 9, 1989 while in MODE 5, cold shutdown. The safety-related buses were aligned to Units 1 & 2 (fossil fuel plants) startup-standby transformers immediately prior to the event. When a boiler feed pump started at Unit 1, the degraded grid voltage protection relays for the nuclear unit operated even though the grid voltage was normal at the time. While safety systems worked properly during the event, post event analysis led to far reaching conclusions.

The FSAR states that the Unit 1 & 2 S/S transformer is capable of suppling the starting and running power for the safety related loads even if the transformer was preloaded with 10.19 mva of Unit 1 & 2 loads. However, analysis of the 89-13 event led to the conclusion that the transformer does not have sufficient capacity to allow starting of the ESF loads (as presently sequenced) if pre-load is 1.5 mva or more. Such a configuration would not have met the requirements of GDC-17 for all reasonable scenarios, although, such an alignment was allowed by the Technical Specifications.

e. New Startup Transformer

At present, the Units 1 & 2 S/S transformer serves a dual role. Besides being the only startup/standby transformer available to Units 1 & 2, (fossil plants), it fullfills the GDC-17 requirements for a second independent source of offsite power for the nuclear unit. Due to operational considerations inherent in a shared transformer, the licensee decided to install a new startup - standby transformer to serve as Unit 3's second source of offsite power. The capacity of this second source will be at least equal to the current Unit 3 S/S transformer.

Given the importance to plant safety of the new transformer and related equipment, the NRC inspector interviewed the cognizant engineers to ascertain the major design features, schedule and level of quality assurance for this project. The licensee's goal is to have the new power source operational by the end of the spring 1990 refueling outage. The 230 KV circuit breakers and transformer were already delivered at the time of the inspection. The purchase order for 5KV cable had been prepared for management approval. Nuclear Operations Engineering and Projects has overall project management responsibility, and a project manager is assigned. Substantial portions of the project will be designed, installed and tested under the direction of FPC's Substation Department. These portions will be governed by the same quality assurance as any substation in the system, except that the cable will be purchased Class 1E. Portions of the project that directly connect to safety-related equipment will be governed by Appendix B level quality assurance. The NRC inspector did not identify any concerns related to this project.

3. Exit Interview

The inspection scope and results were summarized on October 20, 1989, with those persons indicated in paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results. Proprietary information is not contained in this report.