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

Report Nos.: 50-250/91-27 and 50-251/91-27

Licensee: Florida Power and Light Company
9250 West Flagler Street
Miami, FL 33102

Docket Nos.: 50-250 and 50-251 License Nos.: DPR-31 and DPR-41

Facility Name: Turkey Point 3 and 4

Inspection Conducted: July 29-August 2 and August 12-16, 1991

Inspector: Paul J. Fillion — Paul J. Fillion — 8/28/91 Date Signed

Approved by: Caudle Julian for — M. Shymlock, Chief — 8/29/91 Date Signed
Plant Systems Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This special announced inspection was a system functional inspection of the d-c Distribution System.

Results:

In the areas inspected, violations or deviations were not identified. The d-c Distribution System had the capacity and capability to perform its intended function. Engineering studies reviewed were excellent. Current generic issues and NRC initiatives were addressed.

REPORT DETAILS

1. Persons Contacted

   Licensee Employees

   C. Bible, Electrical Engineer, Nuclear Engineering
   *W. Bladow, Quality Manager
   *S. Hale, Site Engineering Manager
   *V. Kaminskas, Operations Superintendent
   *M. Migliaro, Sr. Technical Specialist, Nuclear Engineering
   *L. Pearce, Plant Manager
   *T. Plunkett, Site Vice President
   D. Smith, Manager, Electrical and I&C, Nuclear Engineering
   *M. Wayland, Maintenance Superintendent

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

   NRC Personnel

   *R. Butcher, Senior Resident Inspector
   *F. Jape, Section Chief, Test Programs

   *Attended exit interview

2. Inspection Details

   During the week of July 29-August 2, 1991, the inspection was conducted at the Florida Power and Light Company engineering office in Juno Beach, Florida. On August 7 and 8, documents were reviewed at the NRC Region II office in Atlanta, Georgia. During the week of August 12-16, 1991, the inspection was conducted at the site.

   The objective was to confirm that the d-c Distribution System had the capacity and capability to meet its intended function and/or to identify any problem areas in regard to this system. During inspection preparation, it was decided that the objective could best be accomplished by focusing on twelve specific attributes of the system, and the inspection was carried out according to this plan. The twelve attributes were:

   - Application of the circuit breakers and fuses from a short-circuit interrupting viewpoint

   - Battery sizing and loading

   - Voltage regulation throughout the system

- Sizing of valve actuators and motors

- Selection of thermal overload relays for motor operated valve circuits

- Equipment condition and system configuration control as could be seen through walkdowns of equipment areas

- Equipment condition as could be inferred from a review of records of corrective maintenance work over a one-year period

- Design and operation of the ground detection equipment

- Proper coordination of overcurrent protective devices

- Battery charger sizing

- Control circuits for the Auxiliary Feedwater System steam inlet valves and trip and throttle valves

- Inverter sizing

At the conclusion of the inspection, the inspector had specific comments with regard to three of the attributes. The specific comments were:

- Battery sizing and loading. The inspector pointed out an inconsistency in the FSAR. On page 8.2-21, the last paragraph began: "Each battery is capable of carrying its expected shutdown loads (reference Table 8.2-4 for the loads and approximate duration) following a unit trip and loss of all AC power for a period of approximately two hours without battery terminal voltage falling below 105 volts. This may be demonstrated by calculation." However, Table 8.2-4, Emergency Battery Loads--Battery 3A, included the emergency lights, which was a 150A load, for only the first minute of the load profile. The table for battery 4B showed 136A in the first minute and 13A thereafter for emergency lights. The FSAR did not have tables for the 3B, 4A and spare batteries. The actual calculations treated the emergency lights similar to the FSAR. Therefore, FSAR Table 8.2-4 and the battery loading calculations actually represented a loss of offsite power with loss of charger scenario rather than a loss of all AC power scenario.

  Since the loading for a loss of all AC power with a LOCA scenario was not much more severe than for a loss of all AC power without an accident scenario, the inspector calculated the battery size required for the LOCA case with the emergency lights on for two hours. The calculations indicated that all five batteries (3A, 3B, 4A, 4B and spare) could deliver the current profile for two hours. The only caveat on this statement was a lack of aging margin on the 3A battery and spare battery.

When the two-hour design profiles were compared to the battery capacities, one could see that the 3A battery and spare battery did not have margins for aging. The 3A battery was about eight years old at the time of the inspection, and there was good assurance it still was above rated capacity on the aging curve. However, the capacity of the 3A battery would certainly fall below rated capacity well before its normal 20-year life. When this occurred, it would no longer be a two-hour battery. A similar situation existed for the new spare battery. The licensee, being aware of the lack of aging margin, was planning timely action, such as replacement, load shedding procedure, etc., to maintain the two-hour capacity over the life of the plant.

The inspector reviewed the procedure and results for the service test (or load profile test). The service test was a 30-minute test. This was adequate because it enveloped the requirement for the battery to supply the load on the d-c system during the time period from loss-of-offsite power to reenergization of the battery chargers by the emergency diesel generators.

At the time of the inspection, the 3A, 3B, 4A and 4B batteries were all about eight years old. Capacity tests performed on them in 1988 and 1989 showed capacities of 110-122 percent of rated.

- <u>Selection of thermal overload relays for motor operated valve circuits</u> was done under a calculation dated September 1989 according to a corporate standard having the same date. In 1990, the IEEE published new criteria for the protection of valve actuator motors to provide for safe operation and to minimize their spurious trips. This guidance was contained in IEEE Std 941-1990, IEEE Standard Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power Generating Stations.

  The inspector reviewed the licensee's selection calculation for the auxiliary feedwater turbine A trip and throttle valve. This circuit utilized an Allen Bradley Bulletin 815 relay. The licensee's calculation concluded that a size N18 (3.23 full load amperes) should be used in this circuit. Using the IEEE criteria, the inspector concluded that a size N15 (2.41 full load amperes) would meet the design criteria. The difference in results may be explained by the fact that the selection procedures differ in two ways: First, different multiplying factors are applied to the motor full load current in making the initial trial selection; second, the licensee's corporate standard called for increasing the heater size by one size after all the other design considerations had been addressed. There were other differences between the corporate standard and the IEEE standard, although these differences were not significant in the particular example chosen.

A separate matter was that the licensee's corporate standard was confusing when applied to the Allen Bradley Bulletin 815 relays, because the manufacturer provided an average heater trip curve rather than minimum and maximum heater trip curves. The inspector demonstrated how the average curve was misapplied by the person doing the selection calculation in the context of the corporate standard. Furthermore, the corporate standard allowed the use of an estimating factor in determining the current at twice normal load (and this was used in the calculation reviewed). The practice of using an estimating factor for critical valves should be reevaluated by the licensee.

In conclusion, the licensee's selection of thermal overload relays for motor operated valves did not provide as much protection as was possible. The licensee agreed to review their corporate standard in light of the inspector's comments and the latest revision of IEEE Std 741.

- Inverter sizing. The licensee was in the process of developing an inverter sizing calculation. At the time of the inspection, the adequacy of the inverter rating was established by measurements made during appropriate plant conditions. Measurements of inverter output current and voltage were made while the plant was running at full load and for a period of time immediately following an emergency plant trip. Both these sets of measurements indicated that the inverter was conservatively sized. The battery loading calculation carried the full inverter rating at minimum allowable voltage, so that calculation was conservative.

As a general comment, the calculations and studies reviewed were excellent, except for the selection of thermal overload relays in MOV circuits which had room for improvement as discussed. In general, the calculations were thorough and accurate. Recent generic issues were addressed in the calculations. For example, the breaker time current curves were adjusted for dc system application. Responsiveness to NRC initiatives was noted in the modification to install discharge resistors across the shunt fields of dc motors to prevent damage due to switching surges. The basic conclusion was that the dc Distribution System could perform as intended.

3. Exit Interview

The inspection scope and results were summarized on August 16, 1991, 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. Dissenting comments were not received from the licensee.