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

MAY 0 1 1987

Report Nos.: 50-250/87-17 and 50-251/87-17

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: April 6-10, 1987

Inspector: Susan S. Adamovits for W. J. Ross Apr 22 1987 Date Signed

Approved by: Susan S. Adamovits for J. B. Kahle, Section Chief Apr 22, 1987
Division of Radiation Safety and Safeguards Date Signed

SUMMARY

Scope: This was an unannounced inspection in the areas of plant chemistry control and corrosion prevention.

Results: No violations or deviations were identified.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*C. M. Wethy, Site Vice President
C. J. Baker, Plant Manager - Nuclear
*D. Grundage, Acting Plant Manager
*D. E. Meils, Chemistry Department Supervisor
E. F. Baker, Site Superintendent - Land Management
F. Carr, Corporate Performance Engineer
K. H. Clotfelter, Lead Engineer, Technical Support
M. Cooper, Training Supervisor - Health Physics - Chemistry
*A. Gould, Corporate Chemist
*E. LaPierre, Staff Chemist
J. Meaha, Corporate Performance Engineer
A. Rice, Radiochemist, Chemistry Department
P. Vollmar, Laboratory Supervisor, Chemistry Department

Other Organizations

B. Howard, Westinghouse

NRC Resident Inspectors

D. R. Brewer
*J. B. McDonald
*K. W. Van Dyne

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on April 10, 1987, with those persons indicated in Paragraph 1 above, The inspector described the areas inspected and discussed the inspection findings. No dissenting comments were received from the licensee.

The licensee did not identify as proprietary any of the material provided to or reviewed by the inspector during this inspection.

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

4. Unresolved Items

Unresolved items were not identified during the inspection.

5. Plant Chemistry

During this inspection, the inspector re-evaluated the licensee's capability to ensure the integrity of the primary coolant pressure boundary of the two Turkey Point units. This evaluation was based on the effectiveness of the design and operation of the main components of the plant as well as on the effectiveness of primary and, especially, secondary chemistry control.

At the time of the inspection both units were shutdown. Unit 3 was in a refueling outage after its ninth fuel cycle, and Unit 4 was undergoing repairs of corrosion damage caused by leakage of reactor coolant (boric acid solution) through an instrument port on the reactor head. Through an audit of operational data it was determined that Unit 3 had operated throughout 1986 in a relatively stable condition; i.e., at 100% power most of the time, except for a three week outage in July-August 1986 related to an analysis of the use of the emergency diesel generators. During the current outage, several major maintenance programs were underway that related to the scope of this inspection, e.g., replacement of moisture separator reheater (MSR) tube bundles and replacement of low pressure turbine rotors. Unit 4 had been shutdown for refueling (after it tenth fuel cycle) during the inspector's site visit in February 1986 and did not return to power until September 1, 1986. Subsequently, this unit had operated at full power most of the time until the reactor coolant leak forced the licensee to shutdown the unit on March 13, 1987.

A. Review of Plant Design

The inspector evaluated the effectiveness of each of the major components or systems of the secondary water cycle for minimizing exposure of the primary coolant pressure boundary (e.g., the steam generator tubes) to corrosive environments.

(1) Circulating Cooling Water System

During 1986, the licensee had expended considerable resources to maximize the effectiveness of the cooling water canals to provide cooling water for the main condenser and for the heat exchangers in the Intake Cooling Water System (e.g., component cooling water (CCW) and turbine building cooling water (TBCW)). These efforts had resulted in slightly cooler condenser cooling water (and increased efficiency of the main condenser) but had not decreased the burden of calcium carbonate in the water or the salinity of this water (approximately 25% more saline than average sea water).

Deposition of solid material in the tubes of the CCW and TBCW heat exchanges had caused the thermal efficiency of the heat exchangers to decrease to such an extent that the heat exchangers had to be taken out of service frequently (approximately 2 weeks) so that the tubes could be cleaned by

hydrolasing or rodding. In a effort to reduce outage time, the licensee was installing Amertap tube cleaning systems on all CCW and TBCW heat exchangers during the current outage. (Similar systems will be installed in Unit 4 during its next refueling outage). The inspector was informed that the Amertap systems would be operated on a schedule that would depend on the temperature and salinity of the circulating water.

(2) Main Condenser

The inspector established that there had been no inleakage of the highly saline circulating cooling water as the result of chemical corrosion during 1986. However, three leaks had been caused in Unit 3, within a period of one week in August 1986, by a loose object (a metal bolt) on the steam side of the tube bundle. Another incident of inleakage occurred in Unit 4 in October 1986 as the result of an unexplained misalignment of the steam generator waste blowdown system. The licensee had been able to isolate these leaks and restore the desired level of chemistry control in the condensate/feedwater without significant ingress of chloride or other corrosive species.

The titanium tubes in the condensers of both units had been eddy current tested during the most recent refueling outages (100% of the tubes in Unit 3 and 10% in Unit 4) and no evidence of significant (30-40% through-wall) degradation had been found. The licensee expressed concern that this barrier may be in jeopardy because some of the titanium tubes have been hydrided in regions adjacent to the inlet tube sheet of the condenser. Extensive hydriding had also occurred at the licensee's St. Lucie Plant where 1300 condenser tubes had been plugged to reduce the potential for catastrophic tube failure. As the result of preliminary investigations of this phenomenon, the licensee believed that hydriding may be related to the use of cathodic protection systems that have been used to minimize salt water corrosion of the inlet water boxes of condensers.

Through an audit of chemistry control data the inspector established that inleakage of air into the secondary water systems of both units had been maintained at 5 to 10 standard cubic feet per minute (SCFM). This level of inleakage is considered acceptable.

(3) Water Treatment Plant

The inspector verified that the two 200 gpm water treatment trains had provided good quality water (conductivity of approximately 0.07 umho/cm) for condensate makeup and for other plant systems. The inspector was informed that the plant had been operating in such a stable condition that the set point of

the isolation valve of the effluent line was going to be reduced to 0.1 umho/cm from the current level of 0.3 umho/cm.

This action reflects the increased confidence in the quality of the product. Also, in an effort to provide increased control of water purity throughout the water treatment plant the licensee was installing state-of-the-art inline monitors for silica, sodium, and total organic carbon (TOC). (Previously TOC analyses had to be performed by a contractor because the licensee's chemistry laboratory was not equipped with a TOC analyzer).

(4) Integrity of Condensate/Feedwater Lines

As a followup of previous reviews of the licensee's policy and procedures related to prevention of transport of iron oxide sludge to the steam generators, the inspector reviewed actions that had been taken by the licensee to control general oxidation of the carbon steel pipe in the low-and-high-pressure lines that provide feedwater to the steam generators. Specifically, the inspector discussed with cognizant licensee personnel actions that had been taken in response to IE Notice 86-106, Feedwater Line Break.

The licensee stated that immediately after the accident described in this Notice reviews were made to determine if similar conditions could exist at Turkey Point. Subsequently 73 fittings on the condensate/feedwater lines in Unit 4 were ultrasonicly tested for thinning. Similar tests were being performed on Unit 3 during the current refueling outage. No indications of thinning had been identified except on small diameter recirculation lines. Some indications of wear were also identified in the MSR crossover lines in Unit 3. The licensee's program for monitoring degradations of dual phase systems (i.e., unit steam) was being reviewed and revised.

(5) Steam Generators

The condition of the steam generators is one of the best indications of the degree to which corrosive contaminants have been excluded from the secondary coolant. The inspector established that 10% of the steam generator tubes in Unit 4 had been eddy current tested, during the refueling outage in 1986, without any indications greater than 40% throughwall being observed. Likewise "relatively small" amounts of sludge were removed by lancing. (The exact amounts were not established.) The results of the eddy current testing of Unit 3 during the current outage were also negative and a total of 154 pounds (74 pounds, 49 pounds, and 31 pounds respectively in steam generators A, B, and C) of iron oxide sludge was removed by lancing techniques.

(6) Moisture Separator Reheaters-(MSR)

The inspector observed that the tube bundles in all Unit 3 MSR's were being replaced during the current refueling outage. The licensee stated that these actions were being taken to improve heat transfer characteristics of the MSR and no chemical or corrosive degradation was involved.

(7) Low Pressure Turbines

During the current refueling outage for Unit 3 all of the low-pressure turbine rotors were being replaced to improve the integrity of the turbine blades and reduce the probability of cracks forming in the disks. The new rotors were machined with the bore and disks as integral units. These are the first rotors of this type to be installed in a Region II plant.

(8) Summary

The potential for severe corrosion throughout the secondary coolant cycle of the Turkey Point units as the result of ingress of the highly saline water from the cooling canals makes it mandatory that all heat exchanger interfaces retain a high level of integrity. The effectiveness of the design and maintenance of these components was reflected in the licensee's capability to meet the control limits for chemical variables that have been recommended by the Steam Generator Owners Group (SGOG). During the past year there had not been any significant degradation of any of the following components; main condenser, ICW heat exchangers, feedwater heaters, steam generator tubes, or MSR tubes. Because of the potential for loss of integrity of the titanium condenser tubes as the result of hydriding, the NRC will continue to receive the licensee's efforts to monitor this situation.

No violation or deviation were identified.

b. Review of the Licensee's Chemistry Program

Through reviwe of pertinent procedures and records and by discussion with members of the plant and corporate chemistry staffs the inspector re-evaluated the effectiveness of various elements of the licensee's water chemistry program. Within the scope of this review the following items were noted.

(1) Staffing

The licensee had continued to make major changes in supervisory positions; e.g.; the Chemistry Department Supervisor and the Laboratory Supervisor had been in their present positions for only brief periods of time. In addition to the Laboratory Supervisor, who oversees the activities of ten technicians on

three shifts, three Coordinators were also reporting to the Department Supervisor. These Coordinators were supporting activities in three areas: counting room responsibilities, primary water chemistry, and secondary water chemistry/water treatment plant. Three additional technicians assisted in the counting room on day shift, and one additional technician was working in the water treatment plant on day shift. The ten technicians under the Laboratory Supervisor provided the resources for staffing back shifts (two per shift) and for replacing personnel who were absent or in training.

(2) Training

The inspector was informed that more than 100 modules had been developed to provide guidance in the performance of activities that fall under the responsibility of the Chemistry Department. These modules are to be used to qualify personnel through both on-the-job (OJT) and classroom training. Although a new Plant Training Department had been developed, the turnover of chemistry instructors had been so frequent that a chemistry training program had not been started. The inspector concluded that several other elements for such a program were also lacking, such as:

- An instruction manual had not been prepared; however, a contract for such a manual had been given to an outside vendor.

- The licensee did not have a training laboratory or analytical chemistry instrumentation for such a laboratory.

- A training schedule had not been developed. Because of the limited number of people in the Chemistry Department, the preliminary planning was to provide training to three people during half days, three days per week.

The OJT program had been revised to use the new training modules. All technicians had to be qualified in the use of all instruments, including those in the counting room, before they were allowed to work on the back shifts.

(3) Staff Support

Through discussions with the present and former Chemistry Department Supervisors and with two members of the corporate chemistry staff, the inspector evaluated the degree to which the licensee was abreast of the SGOG guidelines and current technology of corrosion as it is being encountered in the nuclear industry. Chemistry Department personnel (especially the lead corporate chemist) had become involved in industry conferences and in the activities of the SGOG and INPO. Also,

as the result of frequent changes in the supervisory staff of the Chemistry Department, there was an ongoing need to expose supervisory personnel to both theoretical and operational information that is being collected through EPRI and through the nuclear plant chemistry community.

(4) Procedures

The inspector reviewed Revision 3 of the Nuclear Energy Department Nuclear Plant Parameters Manual (dated July 3, 1986) and concluded that this directive and guidance document was consistent with the recommendations of the SGOG/EPRI guidelines. The inspector was informed that the revised chemistry procedures were consistent with this document and with the corporate policy for a chemistry program that meets the intent of the SGOG/EPRI guidelines.

The inspector verified, through review of Appendix C of the Plant Chemistry Parameters Manual and through discussion with Chemistry Department personnel, that the chemistry quality control progam remained unchanged from the last inspection and was acceptable.

(5) Physical Facilities

The inspector noted a significant improvement in the appearance and usefulness of the licensee's "hot" laboratory since the last inspection. The licensee attributed this change to the termination of the construction work in and around the laboratory that had been in progress during the last three years. Decisions had been made to convert a former "hot-machine shop" into an expansion of the chemistry laboratory. This space would be in a convenient location near the present laboratory. The inspector was informed that the expansion work will not be completed before 1989.

The inspector followup item (84-06-01) relating to the adequacy of the secondary chemistry sample station remains open. During this inspection the licensee stated that the perceived inadequacy of this station could not be rectified before 1989 because of budgetary restraints. Plans were under development to convert the present "grab" sampling system to an inline monitoring system that would continue to make use of the sampling taps on the open, mezzanine deck. However, the samples would be piped to the new laboratory where the inline chemistry instruments would be located.

(6) Chemical Control

Through a review of Performance Management Information Reports the inspector assessed the licensee's control of chemistry in

the primary and secondary water systems during the past year. As the result of this audit the followng conclusions were reached.

(a) The concentrations of chloride, fluoride, and dissolved oxygen were kept below the limits set in the Technical Specifications.

(b) The licensee had difficulty maintaining the concentrations of lithium and dissolved hydrogen within Action Level I limits specified in chemistry procedures.

(c) During two periods of 12 days and 8 days the atomic absorption spectrophotometer was inoperable. Consequently, the concentration of lithium in the primary coolant could not be monitored during those periods. The inspector discussed with the licensee the need to develop a backup method for lithium.

(d) Action Level 2 limits were never exceeded for the primary or secondary coolants. The principal reasons that Action Level 1 limits were exceeded in the secondary coolant were the following:

- condenser leaks (Unit 3)
- faulty ammonia injection pumps
- fluoride in the resins (Unit 4)
- securing steam generator blowdown

(e) The licensee had continued its policy of bypassing the condensate polishers when the conductivity of the condensate was less than 0.3 umho/cm. Normally the conductivity was 0.1 to 0.2 umho/cm in the hotwell and 0.3 to 0.5 umho/cm in the steam generators; i.e., considerably better that the limit recommended by the SGOG guidelines (0.8 umho/cm). By bypassing the polishers, the licensee not only eliminated the possibility of resin fines leaking into the feedwater, but also was able to elevate the pH of the feedwater as high as 9.6 without concern for loading the cation exchange resins with ammonia ions. The probability of general (acid) corrosion of carbon pipes was decreased at this higher pH.

A negative feature of operating without a condensate cleanup system has been the licensee's inabilty to cleanup steam generator blowdown. During startup of a unit the water treatment plant output had not been able to provide sufficient condensate makeup for the other operating unit. Consequently, blowdown had to be recovered and reused as feedwater without removal of soluble impurities; e.g., sodium, choloride, sulfate. In October, while blowdown was

being recovered, fluoride was being leached from new welds in Unit 4, an unidentified leak of saline water occurred, the cation condition of the steam generator water approached the Action Level 2 limit (2.0 umho/cm).

(7) Summary

The inspector identified several elements of the licensee's water chemistry program that appeared to be below the standards needed to fully implement a program based on the SGOG guidelines; i.e., frequency of turnover of chemistry supervisors and instructors; absence of a training program; absence of sampling facilities consistent with the stringent criteria implicit in the concept of Action Levels (i.e., maintaining and monitoring secondary coolant that is essentially pure water); and absence of means to determine organic contaminants other than in the Water Treatment Plant.

The licensee had initiated an improvement program that included upgrading chemistry laboratories and installing an inline sampling system for secondary chemistry. These actions should result in improved capabilities to meet the SGOG goals; however, the conversion from grab sampling to the use of inline and automated analytical instrumentation will also require upgrading the qualifications of chemistry technicians. The NRC will continue to review the licensee's efforts to increase the expertise of all of the members of the chemistry staff regarding the bases for the SGOG guidelines and the use of state-of-the-art analytical systems for monitoring trace levels of organic and inorganic ions.

No violations or deviations were identified.