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Docket No. 50-251

Florida Power and Light Company
 ATTN: Dr. Robert E. Uhrig
 Vice President
 P. O. Box 013100
 Miami, Florida 33101

Gentlemen:

The Commission has issued the enclosed Amendment No. 20 for the Turkey Point Unit No. 4. The amendment consists of an added condition to the Facility Operation License No. DPR-41 which limits operation of Unit No. 4 to 60 equivalent days of operation. During the allowed operating period we will continue to examine information supplied by Florida Power and Light and other facility licensees regarding the integrity of steam generator tubes to determine the justification for continued operation.

Copies of the Federal Register Notice are also enclosed.

Sincerely,

Original signed by

Karl R. Goller, Assistant Director
 for Operating Reactors
 Division of Operating Reactors

Enclosures:

1. Amendment No. 20
2. Safety Evaluation
3. Federal Register Notice

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 See next page

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Docket No. 50-251

Florida Power and Light Company
 ATTN: Dr. Robert E. Uhrig
 Vice President
 P. O. Box 013100
 Miami, Florida 33101

Gentlemen:

The Commission has issued the enclosed Amendment No. 20 for the Turkey Point Unit No. 4. The amendment consists of an added condition to the Facility Operation License No. DPR-41 which requires the plant be brought to a cold shutdown condition to perform inspection of steam generators within 140 equivalent days of operation.

Based on the conclusions of our enclosed Safety Evaluation, we concur that the repair program for the steam generators of Turkey Point Unit No. 4 is adequate. Therefore, we are approving the resumption of power operation at Turkey Point Unit No. 4 subject to the conditions of the amendment to the facility operating license.

You are requested to submit the details of the steam generator inspection program which you plan for Turkey Point Unit No. 4 after 140 days of operation. These details should be submitted no later than 30 days prior to the date you expect the inspection to commence.

Copies of the Federal Register Notice are also enclosed.

Sincerely,

Karl R. Goller, Assistant Director
 for Operating Reactors
 Division of Operating Reactors

Enclosures:

1. Amendment No. 20
2. Safety Evaluation
3. Federal Register Notice

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cc:

Mr. Jack R. Newman, Esquire
Lowenstein, Newman, Reis & Axelrad
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Honorable Ray Goode
County Manager of Metropolitan
Dade County
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Florida Power & Light Company
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Plant Manager
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P. O. Box 013100
Miami, Florida 33101

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Miami, Florida 33199



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

FLORIDA POWER AND LIGHT COMPANY

DOCKET NO. 50-251

TURKEY POINT NUCLEAR GENERATING UNIT NO. 4

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 20
License No. DPR-41


1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - B. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - C. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - D. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, the license is amended by adding a new Paragraph 3.D as follows:

"D. Steam Generator Operation

Turkey Point Unit No. 4 shall be brought to a cold shutdown condition within 60 equivalent days of operation from December 3, 1976, unless the Nuclear Regulatory Commission grants prior approval for continued operation. For the purpose of this requirement, equivalent operation is defined as operation with a primary coolant temperature greater than 350°F."

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in cursive script, appearing to read "George Lear".

George Lear, Chief
Operating Reactors Branch #3
Division of Operating Reactors

Date of Issuance: December 3, 1976



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 20 TO LICENSE NO. DPR-41

FLORIDA POWER AND LIGHT COMPANY

TURKEY POINT NUCLEAR GENERATING UNIT NO. 4

DOCKET NO. 50-251

Introduction

Following an 80 gpm leak in a steam generator tube at the Virginia Electric and Power Company's (VEPCO) Surry Power Station Unit No. 2 on September 15, 1976, Florida Power and Light Company (FPL) participated in a joint inspection program designed to investigate the cracking of small bend radius steam generator tubes. By letter dated October 26, 1976, FPL provided the NRC with their steam generator tube investigation program for Turkey Point Units Nos. 3 and 4. FPL removed Turkey Point Unit No. 4 from service on Thursday, October 28, 1976, for inspection of the steam generators and committed not to resume operation until the NRC concurred in the corrective action to be taken. By letters dated November 24, 1976 and November 30, 1976, FPL informed the NRC of: (1) the results of their inspection and (2) their proposed corrective action, and requested NRC concurrence to return Unit No. 4 to power operation.

The corrective action proposed by FPL for Unit No. 4 will result in the number of plugged steam generator tubes increasing from 4% to 7%. The increased number of steam generator tubes increases calculated predicted peak clad temperature in the event of a loss-of-coolant accident. Prior to the shutdown for steam generator tube inspection, Unit No. 4 was operating under the conditions of an NRC Order for Modification of License dated August 27, 1976. This Order restricted the total nuclear peaking factor (Fq) to 2.11 and required a submittal of an ECCS cooling performance reevaluation, as soon as possible. The effect of increasing the number of plugged steam generator tubes from 4% to 7% invalidates one of the assumptions upon which our Order of August 27, 1976 is based. Therefore, we are issuing, as a separate action, an Order for Modification of License for Unit No. 4 which further restricts Fq. The further restriction is necessary to assure that the peak clad temperature following a LOCA does not exceed 2200°F.

Discussion

The steam generator tube inspection program at the Turkey Point facility was initiated because the Turkey Point Unit No. 4 steam generator had experienced a significant level of steam generator tube "denting". Tube denting has been identified as the initial condition that leads to a large leak at the U-bend apex in the small radius row 1 tubes of the steam generator. The denting phenomenon causes inward closure (hourglassing) of the tube support plate flow slots which in turn forces an inward displacement of the steam generator tube U-bend legs. The inward movement and increased dynamic strain in the U-bend apex of the small radius row 1 tubes (those tubes adjacent to the flow slots) is sufficient to initiate stress corrosion cracking on the primary coolant side of the Inconel 600 steam generator tubes.

FPL has performed eddy current examinations of rows 1 through 5 around U-bends in all three steam generators of Turkey Point Units No. 4, and measured the flow slot openings in the bottom and top tube support plates of steam generator 4B. Hourglassing of the support plate flow slots in steam generator 4B is more advanced than steam generators 4A and 4C. The eddy current examinations found no defects at the U-bends in rows 1 through 5 in each steam generator.

Thirty one tubes located at the first top support plate flow slot (15 from row 1, 15 from row 2, and 1 from row 3) were removed for examination. Tubes in rows 1 and 2, located near the center of the flow slot had a greater degree of ovality than those tubes located at the corners of the flow slot. Evidence of intergranular cracking at the U-bend apex could not be detected by radiographic or metallographic examinations. However, short (1/16 inch and approximately 10% to 50% through wall) longitudinal intergranular cracks were found in three tubes from row 1 located near the center of the first flow slot. All the cracks initiated on the ID surface of the extrados at the U-bend apex. They were detected by placing the ID surface of the U-bend apex in tension during a 90° bend test. The bend tests did not reveal any cracking at the U-bend apex in the tubes removed from rows 2 and 3.

Flow slot measurements taken at the bottom tube support plate in steam generator 4B revealed evidence of hourglassing in all six flow slots. Significant hourglassing was evident only in the first three flow slots at the top support plate. The licensee has estimated the rate of flow slot closure to be 0.239 inch per calendar month at the bottom tube support plate, where the maximum slot displacement was 1-7/8 inches. The flow slot closure rate varies from 0.016 to 0.239 and the slot displacement varies from 1/2 to 1-7/8 inches. The expected minimum opening dimensions for the bottom support plate flow slot after 60 days operation is expected to vary from 0.4 to 1.8 inches. These rates were determined from measurements taken in

April and November 1976. The maximum flow slot displacement is 7/8 inch in the top support plate. Therefore a more realistic flow slot closure rate in the top support plate would be 0.11 inch per calendar month. This closure rate is based on the ratio of the top and bottom support plate flow slot displacement times the bottom support plate closure rate.

Westinghouse has examined tubes removed from rows 1, 2, and 3 from the Surry Unit No. 1 but only row 1 of Surry Unit No. 2 steam generators which have also experienced denting, flow slot hourglassing, and excess tube ovality and cracking at the U-bend apex. Cracking at the U-bend was found only in the row 1 tubes of these steam generators. The hourglassing at the top tube support plates in Surry Units Nos. 1 and 2 is analogous to the U-bend leg displacement in row 1 and adjacent rows. The design flow slot opening is 2.75 inches. In five months operation the flow slot openings in Surry Unit No. 2 had decreased to an average of 1.46 inches for all six flow slots, with the largest slot displacement has only been 1.37 inches. In Surry Unit No. 1, the flow slot opening had decreased to 0.50 inch, the narrowest measured dimension where 4 tubes were examined in row 1, 6 tubes in row 2 and 1 tube in row 3. No U-bend cracks were found in rows 2 and 3. The total slot displacement in Surry Unit No. 1 was 2.25 inches. Therefore, an additional 1-3/8 inch inward displacement of the flow slot would have to occur at Turkey Point Unit No. 4 to cause sufficient rise in the strain at the U-bend apex of the row 2 tubes of Unit 4 to be equivalent to the strain in the row 2 tubes of Surry Unit No. 1 in which no cracking has been observed.

Although there is the possibility that hourglassing may continue during the operation of Turkey Point Unit No. 4 steam generators, the Westinghouse analysis for Surry Units Nos. 1 and 2 indicated that only the tubes located adjacent to the flow slot openings in row 1 are susceptible to intergranular defects at the U-bend apex. The row 1 tubes have the highest level of plastic deformation and residual stresses due to the small U-bend radius, and are subject to sufficient additional strain as a result of any continued closure of the flow slots. Even though hourglassing may continue, it was demonstrated that equivalent strain to that which caused cracking in the row 1 tubes is not projected to occur in rows 2, 3, 4 and etc., and the cumulative damage anticipated for tubes beyond row 1 would be substantially less because of the larger U-bend radius, less plastic deformation, and smaller residual stresses.

FPL has initiated selective plugging as the corrective action to prevent the reoccurrence of "intergranular cracking" at the U-bend apex of the small radius steam generator tubes. Consequently, all the tubes in row 1 of all three Turkey Point Unit No. 4 steam generators have been plugged. FPL has proposed to return Turkey Point Unit No. 4 to power for 60 effective days at primary system temperatures greater than 350°F. FPL has proposed to perform a reinspection of Unit No. 4 during its next refueling in April 1977.

Evaluation

FPL has submitted both analytical and experimental data in support of the corrective action for Turkey Point Unit No. 4 and the proposed 60 days operation. We have reviewed these data and have performed independent evaluations to determine the adequacy of the corrective action and the conditions for the 60 days operation.

Regarding the tube plugging criteria applied to Turkey Point Unit No. 4 steam generators, the tube denting phenomenon, the 60 days operating period, and the potential for "intergranular cracking" at the U-bend apex of the tubes in rows 2, 3, 4 and etc., we have considered the following issues in our safety evaluation of Turkey Point Unit No. 4: (1) the strain in the steam generator tubes at the U-bend apex is displacement controlled by the tube support plate flow slot closure, (2) the total inward movement of the flow slots will not cause significant additional strain at the U-bend apex of the tubes in rows 2, 3, 4 and etc., during the proposed 60 days operating period, (3) the closure of the flow slots in the top support plate will not progress to the distance observed in Surry Units Nos. 1 and 2, and the flow slots in the bottom support plate are not expected to completely close during the proposed 60 days operation, (4) all of row 1 is plugged and the likelihood for the initiation of intergranular cracking of the unplugged tubes in rows 2 and beyond is minimal, (5) although tube denting is associated with tube support plate corrosion, support plate cracking, and the hourglassing of the support plate flow slots, it does not reflect an immediate concern regarding tube integrity of the Turkey Point Unit No. 4 steam generators, because there have been relatively few leaks at the dent locations and no rapid failures have occurred, (6) no cracking has been observed in any tubes from rows 2 and outward, (7) the cumulative damage anticipated for the unplugged tubes in rows 2, 3, 4 and etc., as a result of continued hourglassing of the top support plate flow slots, will be substantially less than that incurred in the row 1 tubes, and row 1 has been plugged.

In addition, on the basis of the analytical and experimental data and the observations of 11 tubes removed from Surry Unit No. 1, 9 tubes from Surry Unit No. 2, and 31 tubes from Turkey Point Unit No. 4, the Staff estimates that it would take approximately 12.5 months operating time before Turkey Point Unit No. 4 steam generators would attain the same degree of top support plate flow slot closure as observed in Surry Unit No. 1. This can be verified by an reinspection during the next refueling operation. Furthermore, the proposed operating conditions for 60 days is acceptable. The top and bottom support plate hourglassing in the Turkey Point Unit No. 4 steam generators is less than Surry Units Nos. 1 and 2. Since Surry Units Nos. 1 and 2 experienced a greater degree of hourglassing during an equivalent

operating period and no intergranular cracking was evident at the U-bend apex of tubes in rows 2 and 3, we also believe that the tubes in rows 2 and beyond in the Turkey Point Unit No. 4 steam generators are free of intergranular cracks at the U-bend apex as the result of flow slot hourglassing. We agree that the maximum rate of flow slot hourglassing of 0.11 inch/month predicted for Turkey Point Unit No. 4 steam generators is a reasonable estimate.

However, the consideration of reactor operation beyond the proposed 60 days are dependent upon: (1) our assessment of additional information on the Turkey Point Unit No. 3 and Surry Units Nos. 1 and 2 inspection and, (2) an evaluation of Westinghouse's analysis on other facilities with denting and intergranular cracking of steam generator tubes with small U-bend radius.

1. Tubes in rows 2 through 5 and outward in all the steam generators of Turkey Point Unit No. 4 will retain sufficient integrity to withstand normal operating and postulated accident conditions.
2. There is reasonable assurance of tube integrity to provide adequate protection to the public health and safety.
3. Turkey Point Unit No. 4 operation will be dependent upon an evaluation of Westinghouse's analysis on other facilities with denting and "intergranular cracking" of steam generator tubes with small U-bend radius.
4. Turkey Point Unit No. 4 should not operate for more than 60 effective days and all three steam generators should be reinspected during the next refueling in April 1977 to assess the magnitude and rate of hourglassing of the upper tube support plate flow slots.
5. The rapid closure rate of the flow slots in the bottom support plate requires further consideration of the potential for tube damage and support plate movement prior to operation for more than 60 effective days.

Environmental Consideration

We have determined that the amendment does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendment involves an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR §1.5(d)(4) an environmental impact statement or negative declaration, and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

Conclusion

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: December 3, 1976

UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-251

FLORIDA POWER AND LIGHT COMPANY

NOTICE OF ISSUANCE OF AMENDMENTS TO FACILITY
OPERATING LICENSE

The U. S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 20 to Facility Operating License No. DPR-41, issued to Florida Power and Light Company, which revised Technical Specifications for Operation of the Turkey Point Nuclear Generating Unit No. 4, located in Dade County, Florida. The amendment is effective as of the date of issuance.

The amendment requires that the plant be brought to a cold shutdown condition within 60 equivalent days of operation unless the Nuclear Regulatory Commission grants prior approval for continued operation.

The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendment. Prior public notice of this amendment was not required since the amendment does not involve a significant hazards consideration.

The Commission has determined that the issuance of this amendment will not result in any significant environmental impact and that pursuant to 10 CFR §51.5(d)(4) an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with issuance of this amendment.

For further details with respect to this action, see (1) the licensee's submittal dated November 24, 1976, as supplemented by letter dated November 30, 1976, (2) Amendment No. 20 to License No. DPR-41, and (3) the Commission's related Safety Evaluation. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, N. W., Washington, D. C. and at the Environmental & Urban Affairs Library, Florida International University, Miami, Florida 33199.

A copy of items (2) and (3) may be obtained upon request addressed to the U. S. Nuclear Regulatory Commission, Washington, D. C. 20555, Attention: Director, Division of Operating Reactors.

Dated at Bethesda, Maryland, this 3 day of December 1976.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in cursive script that reads "George Lear".

George Lear, Chief
Operating Reactors Branch #3
Division of Operating Reactors