June 28, 1999

Mr. John Paul Cowan
Vice President, Nuclear Operations
Florida Power Corporation
ATTN: Manager, Nuclear Licensing (NA1B)
Crystal River Energy Complex
15760 W. Power Line Street
Crystal River, Florida 34428-6708

SUBJECT: CRYSTAL RIVER UNIT 3 - ISSUANCE OF AMENDMENT REGARDING REPAIR CRITERIA FOR STEAM GENERATOR TUBING (TAC NO. MA3592)

Dear Mr. Cowan:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 179 to Facility Operating License No. DPR-72 for Crystal River Unit 3. This amendment is in response to a Florida Power Company (FPC) request dated August 31, 1998, and revised on March 18, 1999, in which FPC proposed a repair roll process which would be used to repair steam generator tubes with defects within the upper tubesheet. Changes to inservice inspection and reporting requirements and several format and editorial changes were also included in the FPC submittal.

A copy of the related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly Federal Register notice.

Sincerely,

Original signed by:

L. Wiens, Senior Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-302

Enclosures: 1. Amendment No. 179 to DPR-72
2. Safety Evaluation

cc w/enclosures: See next page

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

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Mr. John Paul Cowan
Florida Power Corporation

CRYSTAL RIVER UNIT NO. 3

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

FLORIDA POWER CORPORATION
CITY OF ALACHUA
CITY OF BUSHNELL
CITY OF GAINESVILLE
CITY OF KISSIMMEE
CITY OF LEESBURG
CITY OF NEW SMYRNA BEACH AND UTILITIES COMMISSION,
CITY OF NEW SMYRNA BEACH
CITY OF OCALA
ORLANDO UTILITIES COMMISSION AND CITY OF ORLANDO
SEMINOLE ELECTRIC COOPERATIVE, INC.
CITY OF TALLAHASSEE

DOCKET NO. 50-302

CRYSTAL RIVER UNIT 3 NUCLEAR GENERATING PLANT

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 179
License No. DPR-72

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Florida Power Corporation, et al. (the licensees), dated August 31, 1998, as revised on March 18, 1999, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. 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;

   D. 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

E. 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 changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C(2) of Facility Operating License No. DPR-72 is hereby amended to read as follows:

Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 179, are hereby incorporated in the license. Florida Power Corporation shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented prior to commencing cycle 12 operation.

FOR THE NUCLEAR REGULATORY COMMISSION

Sheri R. Peterson

Sheri R. Peterson, Chief, Section 2
Project Directorate II
Division of Project Licensing Management
Office of Nuclear Reactor Regulation

Date of Issuance: June 28, 1999

ATTACHMENT TO LICENSE AMENDMENT NO. 179

TO FACILITY OPERATING LICENSE NO. DPR-72

DOCKET NO. 50-302

Replace the following pages of the Appendix "A" Technical Specifications with the enclosed pages. The revised pages are identified by amendment number and contains vertical lines indicating the area of change.

Remove Page	Insert Page
5.0-16	5.0-16
5.0-17	5.0-17
-----	50.17A
5.0-25	5.0-25
5.0-26	5.0-26
5.0-29	5.0-29

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Tube Surveillance Program (continued)

4. Acceptance criteria:

   a. Vocabulary as used in this Specification:

      1. Tubing or Tube means that portion of the tube or sleeve which forms the primary system to secondary system pressure boundary.

      2. Imperfection means an exception to the dimensions, finish or contour of a tube from that required by fabrication drawings or specifications. Eddy-current testing indications below 20% of the nominal tube wall thickness, if detectable, may be considered as imperfections.

      3. Degradation means a service-induced cracking, wastage, wear, or general corrosion occurring on either inside or outside of a tube.

      4. Degraded Tube means a tube containing degradation $\geq$ 20% through-wall but < 40% through-wall in the pressure boundary.

      5. % Degradation/% Through-wall means the percentage of the tube (pressure boundary) wall thickness affected or removed by degradation.

      6. Defective Tube means a tube containing degradation $\geq$ 40% through-wall in the pressure boundary. Any tube which does not permit the passage of the eddy-current inspection probe shall be deemed a defective tube.

      7. Pit-like Intergranular Attack (IGA) indication means a bobbin coil indication confirmed by Motorized Rotating Pancake Coil (MRPC) or other qualified inspection techniques to have a volumetric, pit-like morphology characteristic of IGA.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Tube Surveillance Program (continued)

8. Plugging/Repair Limit means the extent of pressure boundary degradation beyond which the tube shall either be removed from service by installation of plugs or the area of degradation shall be removed from service (a new pressure boundary established) using an Approved Repair Technique. The plugging/repair limit is 40% through-wall for all pressure boundary degradation.

9. Unserviceable describes the condition of a tube if it leaks or contains a defect large enough to affect its structural integrity in the event of an Operating Basis Earthquake, a loss-of-coolant accident, or a main steam line or feedwater line break, as specified in 5.6.2.10.3.c, above.

10. Tube Inspection means an inspection of the OTSG tube pressure boundary.

11. Approved Repair Technique means a technique, other than plugging, that has been accepted by the NRC as a methodology to remove or repair degraded or defective portions of the pressure boundary and to establish a new pressure boundary. Following are Approved Repair Techniques:

    a) Sleeve installation in accordance with the B&W process (or method) described in report BAW-2120P. No more than five thousand sleeves may be installed in each OTSG.

    b) Installation of repair rolls in the upper tubesheet in accordance with the Framatome Technologies Incorporated processes (or methods) described in reports BAW-2303P and BAW-2342P. The repair process (either single roll or double roll) may be performed once per tube. The repair roll area will be examined using eddy-current methods following installation. The repair roll must be free of imperfections and degradation for the repair to be considered acceptable.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Tube Surveillance Program (continued)

The repair roll in each tube will be inspected during each subsequent inservice inspection while the tube with a repair roll is in service. The repair roll will be considered a specific limited area and will be excluded from the random sampling. No credit will be taken for meeting the minimum sample size.

If primary-to-secondary leakage results in a shutdown of the plant and the cause is determined to be degradation in a repair roll, 100% of the repair rolls in that OTSG shall be examined. If that inspection results in entering Category C-2 or C-3 for specific limited area inspection, as detailed in Table 5.6.2-3, 100% of the repair rolls shall be examined in the other OTSG.

b. The OTSG shall be determined OPERABLE after completing the corresponding actions (plug or repair all tubes exceeding the plugging/repair limit) required by Table 5.6.2-2 (and Table 5.6.2-3 if the provisions of Specification 5.6.2.10.2.d are utilized).

   There are a number of OTSG tubes that have the potential to exceed the tube plugging/repair limit as a result of tube end anomalies. Defective tubes will be repaired or plugged during the next outage of sufficient duration. An evaluation has been performed which confirms that operability of the CR-3 OTSGs will not be impacted with those tubes in service.

c. Inservice tubes with pit-like IGA indications in the “B” OTSG first span shall be monitored for growth of these indications by using a test probe equivalent to the high frequency bobbin probe used in the 1997 inspection. The indicated percentage throughwall value from the current inspection shall be compared to the indicated percentage throughwall value from the 1997 inspection.

5.6.2.11 Secondary Water Chemistry Program

This program provides controls for monitoring secondary water chemistry to inhibit steam generator tube degradation and low pressure turbine disc stress corrosion cracking. The program shall include:

a. Identification of a sampling schedule for the critical variables and control points for these variables;

b. Identification of the procedures used to measure the values of the critical variables;

(continued)

TABLE 5.6.2-2 (page 1 of 1)
OTSG TUBE INSPECTION

1st Sample Inspection			2nd Sample Inspection		3rd Sample Inspection	
Sample Size	Result	Action Required	Result	Action Required	Result	Action Required
A minimum of S tubes per OTSG	C-1	None	N/A	N/A	N/A	N/A
	C-2	Plug or repair defective tubes and inspect an additional 2S tubes in this OTSG.	C-1	None	N/A	N/A
			C-2	Plug or repair defective tubes and inspect additional 4S tubes in this OTSG.	C-1	None
					C-2	Plug or repair defective tubes.
					C-3	Perform action for C-3 result of first sample.
			C-3	Perform action for C-3 result of first sample.	N/A	N/A
	C-3	Inspect all tubes in this OTSG, plug or repair defective tubes, inspect 2S tubes in each other OTSG, and notify NRC per 10CFR50.72	All other OTSGs are C-1	None	N/A	N/A
			Some OTSGs C-2 but no additional OTSGs are C-3	Perform action for C-2 result of second sample.	N/A	N/A
			Additional OTSG is C-3	Inspect all tubes in each OTSG, plug or repair defective tubes, and notify NRC per 10CFR50.72.	N/A	N/A

S = 3 N/n % Where N is the number of OTSGs in the unit and n is the number of OTSGs inspected during inspection period.

TABLE 5.6.2-3 (page 1 of 1)
SPECIFIC LIMITED AREA INSPECTION

1st Sample Inspection of a "Specific Limited Area"			2nd Sample Inspection of a "Specific Limited Area"	
Sample Size	Result	Action Required	Result	Action Required
100% of area in both OTSGs	C-1	None	N/A	N/A
	C-2	Plug or repair defective tubes.	N/A	N/A
	C-3	Plug or repair defective tubes.	N/A	N/A
100% of area in one OTSG	C-1	None	N/A	N/A
	C-2	Plug or repair defective tubes and inspect 100% of corresponding area in other OTSG	C-1	None
			C-2	Plug or repair defective tubes.
			C-3	Plug or repair defective tubes.
	C-3	Plug or repair defective tubes and inspect 100% of corresponding area in other OTSG.	C-1	None
			C-2	Plug or repair defective tubes.
			C-3	Plug or repair defective tubes.

5.8 Reporting Requirements

5.7.2 Special Reports (continued)

The following Special Reports shall be submitted:

a. When a Special Report is required by Condition B or F of LCO 3.3.17, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.

b. Any abnormal degradation of the containment structure detected during the tests required by the Containment Tendon Surveillance Program shall be reported to the NRC within 30 days. The report shall include a description of the tendon condition, the condition of the concrete (especially at tendon anchorages), the inspection procedures, the tolerances on cracking, and the corrective action taken.

c. Following each inservice inspection of steam generator (OTSG) tubes, the NRC shall be notified of the following prior to ascension into MODE 4:

   1. Number of tubes plugged and repaired,

   2. Crack-like indications and assessment of growth for indications in the first span,

   3. Results of in-situ pressure testing, if performed.

d. Results of OTSG tube inspections that fall into Category C-3 shall be reported to the NRC in accordance with 10CFR50.72.

e. The complete results of the OTSG tube inservice inspection shall be submitted to the NRC within 90 days after breaker closure following restart. The report shall include:

   1. Number and extent of tubes inspected,

   2. Location and percent of wall-thickness penetration for each indication of an imperfection,

   3. Location, bobbin coil amplitude, and axial and circumferential extent (if determined) for each first span IGA indication, and

   4. Identification of tubes plugged or repaired and specification of the repair methodology implemented for each tube.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 179TO FACILITY OPERATING LICENSE NO. DPR-72

REPAIR ROLL CRITERIA FOR STEAM GENERATOR TUBING

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

1.0 INTRODUCTION

By letter dated August 31, 1998, as revised on March 18, 1999, Florida Power Corporation (the licensee), submitted a request to amend the technical specifications (TSs) for Crystal River Unit 3 (CR-3). The purpose of the amendment is to implement alternate repair criteria for steam generator (SG) tubes that have degraded roll joints inside the upper tubesheet. The alternate repair criteria would allow new roll joints to be installed below the degraded roll joints in the upper tubesheet. The alternate repair criteria were developed based on the results of a qualification program, documented in Framatome topical report, BAW-2303P, Revision 3, "OTSG Repair Roll Qualification Report," which was included in the submittal dated August 31, 1998. Subsequent to the initial application for this amendment, the licensee and its vendor revised the limiting accident for the CR-3 once-through steam generators (OTSGs) that was considered in BAW-2303P. On March 18, 1999, the licensee submitted an additional topical report, BAW-2342P, Revision 1, "OTSG Repair Roll Qualification Report - Addendum A," to appropriately modify the previous analyses and proposed changes to the TSs to support the amendment. The information contained within this submittal superseded that provided by the August 31, 1998, submittal. The March 18, 1999, submittal also included a double repair roll methodology which was not included in the original submittal. As a result, a revised proposed no significant hazards consideration determination was noticed in the Federal Register.

CR-3 has two model 177FA OTSGs that were manufactured by Babcock and Wilcox. The OTSG tubes were fabricated from Alloy 600 material and are secured by roll expansion joints in the upper and lower tubesheets. The tubesheet is approximately 24-inches thick, and a seal weld at the primary face of each tubesheet prevents primary-to-secondary leakage around the hardroll expansions.

2.0 BACKGROUND

General Design Criterion (GDC) 14 of Appendix A to 10 CFR Part 50 requires that the reactor coolant pressure boundary (RCPB) be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture. A significant portion of the RCPB is maintained by SG tubes which have experienced various levels of degradation. U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide (RG) 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," provides guidance on an acceptable method for establishing the limiting safe conditions of tube degradation. In addition, the plant TSs require periodic inspections of SG tubes and require that those tubes with defects in excess of the repair limits (e.g., 40 percent through-wall) be repaired or removed from service.

The joint between the tube and tubesheet is an interference fit constructed by roll expanding the tube into the bore of the tubesheet, followed by a seal weld at the primary face of the tubesheet. The original tube-to-tubesheet roll joint provides sufficient strength to maintain adequate structural and pressure boundary integrity.

Industry experience has shown that defects have developed in the tube-to-tubesheet roll joints as a result of various degradation processes. In general, tubes with degraded roll joints are either removed from service or repaired. The NRC has accepted alternate repair criteria allowing repaired tubes with degraded roll joints to remain in service provided that the repaired tubes can maintain adequate structural and leakage integrity under loadings from normal operation, anticipated operational occurrences, and postulated accident conditions.

RG 1.121 recommends that the margin of safety against tube rupture under normal operating conditions should be equal to or greater than three at any tube location where defects have been detected. For postulated accidents, RG 1.121 recommends that the margin of safety against tube rupture be consistent with the margin of safety determined by the stress limits specified in NB-3225 of Section III of the Boiler and Pressure Vessel Code of the American Society of Mechanical Engineers. Structural loads imposed on the tube-to-tubesheet roll under normal operating conditions result primarily from the differential pressure between the primary and secondary sides of the tubes. Loadings from a postulated small break loss of coolant accident are significant and are limiting for OTSG tubing. Cyclic loading from transients (e.g., startup/shutdown) were also considered in the qualification of the roll joints.

3.0 EVALUATION

3.1 Qualification Program

On the basis of the qualification program, the licensee established that either a single or double roll repair will carry all structural loads and minimize potential leakage. The need to use a double roll depends on the location of the tube within the tube bundle. The qualification program consisted of (1) preparing a mockup to simulate tubesheet conditions, (2) establishing tube loads for the qualification tests, and (3) performing verification tests and analyses.

The mockup consisted of a perforated metal block inserted with SG tubes that simulates the tube-to-tubesheet configuration in the field. The tubes were expanded into the mockup tubesheet using an expanding tool that had the same critical dimensions as the tool used in the field.

To determine the strength of the roll joints, the licensee applied loads to the sample tubes to simulate or exceed normal, thermal and pressure cycling transients, and postulated accident conditions. In accordance with RG 1.121, the test pressure applied to the sample tubes exceeded three times normal operating pressure and 1.43 times peak accident pressures. To obtain conservative leakage results, the sample tubes were severed 360 degrees through the tube wall in the roll joints.

In the qualification program, the licensee also considered the impact of tubesheet bowing on the roll joints because the tubesheet bore diameter can change during certain operating conditions. The combined effects of primary-to-secondary pressure differential and thermal loads may cause the tubesheet to bow in one direction or the other which can lead the tubesheet bore to dilate or shrink. When the tubesheet bore is dilated, the contact stress between the roll joint and the tubesheet would decrease and, thereby, reduce the pullout resistance of the roll joint. Considering the bowing effect, topical reports BAW-2303, Revision 3, and BAW-2342P, Revision 1, specified an exclusion zone in the tubesheet where the reroll joint would not be installed.

3.2 Structural and Leakage Integrity

Based on the results of the qualification testing, the licensee determined roll lengths sufficient to ensure adequate margins of structural and leakage integrity. With regard to structural integrity, the licensee demonstrated through ultimate load testing (testing to simulate accident conditions) that the tube with a new hardroll expansion would not be pulled out from the upper tubesheet under the worst possible combination of loadings. No motion of the tubes relative to the simulated tubesheet was observed during the thermal and fatigue cycling tests. With regard to leakage integrity, the qualification tests showed that if each of the tubes in a SG were rerolled in the upper tubesheet and contained a 100 percent through-wall flaw at the upper edge of the reroll, the total expected leakage from all flaws would be well below the operational leak rate limit in the CR-3 TS.

3.3 Field Installation and Inspection

The licensee proposed to repair tubes by the installation of either one or two hardroll joints (reroll) in the tubes that have degradation in or near the original roll region. The repaired roll is typically installed using a manipulator and a tool head, monitored by a control system that tracks the position and monitors the torque of the roll expander. The torque is automatically controlled during the rerolling and is recalibrated after installation of a certain number of rerolls to ensure the minimum torque is maintained to produce proper fit.

After the installation, the licensee will inspect all rerolls using eddy current techniques to ensure proper diametral expansion and positioning of the reroll repair joint. In addition, the inspections will verify that the reroll regions are free of degradation. Any reroll not satisfying the acceptance criteria will be either plugged or repaired with a method other than rerolling. For future inservice inspections, the licensee will inspect all rerolled tubes during steam generator inspection activities. If degradation is identified in the reroll region, the affected tube will be plugged or repaired by means other than rerolling. Only one reroll repair per tube is allowed by the proposed amendment.

4.0 EVALUATION OF REROLL REPAIR TECHNIQUE

The licensee proposed to implement an alternate repair method using a hardroll expansion process to repair tubes having indications of tube degradation in the original roll regions of the upper tubesheet. The technical basis for the proposed reroll method is documented in topical reports BAW-2303P, Revision 3, and BAW-2342P, Revision 1.

The staff has determined that (1) the licensee's alternate repair criteria were established on the basis of the qualification tests that used specimens simulating the actual tube-to-tubesheet joint configuration of the SGs, (2) the loads for structural and leakage tests were specified and applied in accordance with RG 1.121, and (3) the proposed changes to plant TS satisfied all regulatory requirements applicable to SG tube integrity.

On the basis of submitted information, the staff concludes that the proposed reroll repair for degraded roll joints in SGs at CR-3 is acceptable because the licensee has demonstrated through an acceptable qualification program that the reroll satisfies GDC 14 of Appendix A to 10 CFR Part 50 and RG 1.121.

5.0 STATE CONSULTATION

Based upon a letter dated March 8, 1991, from Mary E. Clark of the State of Florida, Department of Health and Rehabilitative Services, to Deborah A. Miller, Licensing Assistant, U.S. NRC, the State of Florida does not desire notification of issuance of license amendments.

6.0 ENVIRONMENTAL CONSIDERATIONS

The amendment changes requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that this amendment involves no significant hazards consideration for both the August 31, 1998, submittal (63 FR 56249) and the March 18, 1999, revised submittal (64 FR 19557), and there has been no public comment on either finding. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

Based on its review of the licensee's proposal, the staff has determined that the proposed changes to the CR-3 TSs to allow the installation of reroll repair joints in OTSG tubing in the upper tubesheet using the process described in B&W reports BAW-2303P, Revision 3, and BAW-2342P, Revision 1, will continue to provide adequate assurance of SG tube integrity. The staff concludes that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: P. Rush, DE/EMCB

Date: June 28, 1999