October 1, 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 ALTERNATE REPAIR CRITERIA FOR STEAM GENERATOR TUBING (TAC NO. MA5395)

Dear Mr. Cowan:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 188 to Facility Operating License No. DPR-72 for Crystal River Unit 3. This amendment is in response to a Florida Power Corporation (FPC) request dated May 5, 1999, as supplemented on May 21, May 28, August 20, and September 2, 1999. FPC proposed alternate repair criteria to be applied to steam generator tubes with crack-like indications within the upper and lower tubesheet areas.

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. 188 to DPR-72
2. Safety Evaluation

cc w/enclosures: See next page

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

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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. 188
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 May 5, 1999, as supplemented on May 21, May 28, August 20, and September 2, 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. 188 , 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 within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION

Richard L. Emch, Jr.

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

Attachment: Changes to the
Technical Specifications

Date of Issuance: October 1, 1999

ATTACHMENT TO LICENSE AMENDMENT NO. 188

TO FACILITY OPERATING LICENSE NO. DPR-72

DOCKET NO. 50-302

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

Remove Page	Insert Page
5.0-14	5.0-14
5.0-14A	5.0-14A
5.0-15	5.0-15
5.0-17A	5.0-17A
5.0-18	5.0-18
5.0-29	5.0-29

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Tube Surveillance Program (continued)

in the specific area of an OTSG are inspected with the inspection result classification and the corresponding action required as specified in Table 5.6.2-3. No credit will be taken for these tubes in meeting minimum sample size requirements. Degraded or defective tubes found in these areas will not be considered in determining the inspection results category as long as the mode of degradation is unique to that area and not random in nature.

e. Inservice tubes with pit-like IGA indications in the first span of the B OTSG, identified in the OTSG Inservice Inspection Surveillance Procedure, must be inspected with bobbin and Motorized Rotating Pancake Coil (MRPC) eddy current techniques from the lower tube sheet secondary face to the bottom of the first tube support plate during each inservice inspection of the B OTSG. No credit is to be taken for this inspection in meeting minimum sample size requirements for the random inspection. Defective tubes found during this inspection are to be plugged or sleeved. Degraded or defective tubes found during this inspection are not to be considered in determining the inspection results category for the random inspection, unless the degradation mechanism identified is a mechanism other than pit-like IGA.

f. Tubes in-service with axially oriented tube end cracks (TEC) are identified in the OTSG Inservice Inspection Surveillance procedure. The portion of the tube with the axial TEC must be inspected using the motorized rotating coil eddy current technique during each subsequent inspection. No credit is to be taken for this inspection for meeting the minimum sample size requirement for random sample inspection.

Tubes identified with TEC that meet the alternate repair criteria will be added to the existing list of tubes in the OTSG Inservice Inspection Surveillance procedure. Tubes identified with TEC during the previous inspection which meet the criteria to remain in-service will not be included when calculating the inspection category of the OTSG.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Tube Surveillance Program (continued)

The inspection data for tubes with axially oriented TEC indications shall be compared to the previous inspection data to monitor the indications for growth.

Tubes with axially oriented TEC may be left in-service using the method described in Topical Report BAW-2346P, Revision 0, provided the combined projected leakage from all primary-to-secondary leakage, including axial TEC indications left in-service, does not exceed the Main Steam Line Break (MSLB) accident leakage limit of one gallon per minute, minus 150 gallons per day, per OTSG.

If the plant is required to shut down due to primary-to-secondary leakage and the cause is determined to be degradation of the TEC portion of the tubes, 100% of the tubes with TEC in that OTSG shall be examined in the location of the TEC. If more than 1% of the examined tubes are defective tubes, 100% of the tubes with TEC in the other OTSG shall be examined in the location of the TEC.

Tubes with crack-like indications within the carbon steel portion of the tubesheet shall be repaired or removed from service using the appropriate approved method. Tubes with circumferentially oriented TEC or volumetric indications within the Inconel clad region of the tubesheet shall be repaired or removed from service using the appropriate approved method.

The results of each bobbin coil sample inspection shall be classified into one of the following three categories:

---------- NOTE----------
In all inspections, previously degraded tubes whose degradation has not been spanned by a sleeve must exhibit significant (>10%) further wall penetrations to be included in the below percentage calculations.

---------- NOTE----------
For the inspection conducted in accordance with 5.6.2.10.2.f, only tubes with TEC indications identified after the 1997 inspection will be included in the below percentage calculations.

Category	Inspection Results
C-1	Less than 5% of the total tubes inspected are degraded tubes and none of the inspected tubes are defective.
C-2	One or more tubes, but not more than 1% of the total tubes inspected are defective, or between 5% and 10% of the total tubes inspected are degraded tubes.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Tube Surveillance Program (continued)

C-3 More than 10% of the total tubes inspected are degraded tubes or more than 1% of the inspected tubes are defective.

3. The above-required inservice inspections of OTSG tubes shall be performed at the following frequencies except, a one-time change for Cycle 11 is granted to modify the scheduled inspection frequency from a calendar-based interval to an interval of 21.6 months of operating time at a temperature of 500°F or above (measured at the hot leg side). This will allow the OTSG tube inspection to coincide with Refuel Outage 11R:

   a. Inservice inspections shall be performed at intervals of not less than 12 nor more than 24 calendar months after the previous inspection. If two consecutive inspections following service under all volatile treatment (AVT) conditions, not including the preservice inspection, result in all inspection results falling into the C-1 category, or if two consecutive inspections demonstrate that previously observed degradation has not continued and no additional degradation has occurred, the inspection interval may be extended to a maximum of once per 40 months.

   b. If the inservice inspection of an OTSG, conducted in accordance with Table 5.6.2-2 or Table 5.6.2-3 requires a third sample inspection whose results fall in Category C-3, the inspection frequency shall be reduced to at least once per 20 months. The reduction in inspection frequency shall apply until a subsequent inspection demonstrates that a third sample inspection is not required. If the C-3 inspection results classification is due to including new tubes with TEC indications that meet the criteria to remain in-service, no reduction in inspection frequency is required.

   c. Additional unscheduled inservice inspections shall be performed on each OTSG in accordance with the first sample inspection specified in Table 5.6.2-2 or Table 5.6.2-3 during the shutdown subsequent to any of the following conditions:

      1. Primary-to-secondary tube leaks (not including leaks originating from tube-to-tube sheet welds) in excess of the limits of Specification 3.4.12,

      2. A seismic occurrence greater than the Operating Basis Earthquake,

      3. A loss-of-coolant accident requiring actuation of the engineered safeguards, or

      4. A main steam line or feedwater line break.

(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.

12. Tube End Cracks (TEC) are those crack-like eddy current indications, circumferentially and/or axially oriented, that are within the Inconel clad region of the primary face of the upper and lower tubesheets, but do not extend into the carbon steel-to Inconel clad interface.

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.

(continued)

5.6 Procedures, Programs and Manuals

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;

c. Identification of process sampling points, which shall include monitoring the discharge of the condensate pumps for evidence of condenser in leakage;

d. Procedures for the recording and management of data;

e. Procedures defining corrective actions for all off control point chemistry conditions; and

f. A procedure identifying the authority responsible for the interpretation of the data and the sequence and timing of administrative events, which is required to initiate corrective action.

5.6.2.12 Ventilation Filter Testing Program (VFTP)

A program shall be established to implement the following required testing of the Control Room Emergency Ventilation System (CREVS) and the Auxiliary Building Ventilation Exhaust System (ABVES) per the requirements specified in Regulatory Guide 1.52, Revision 2, 1978, and/or as specified herein, and in accordance with ANSI N510-1975 and ASTM D 3809-89 (Re-approved 1995).

a. Demonstrate for each train of the CREVS that an inplace test of the high efficiency particulate air (HEPA) filters shows a penetration < 0.05% when tested in accordance with Regulatory Guide 1.52, Revision 2, 1978, and in accordance with ANSI N510-1975 at the system flowrate of between 37,800 and 47,850 cfm.

b. Demonstrate for each train of the CREVS that an inplace test of the carbon adsorber shows a system bypass < 0.05% when tested in accordance with Regulatory Guide 1.52, Revision 2, and ANSI N510-1975 at the system flowrate of between 37,800 and 47,850 cfm.

c. Demonstrate for each train of the CREVS that a laboratory test of a sample of the carbon adsorber, when obtained as described in Regulatory Guide 1.52, Revision 2, 1978, meets the laboratory testing criteria of ASTM D 3803-89 (Re-approved 1995) at a temperature of 30°C and relative humidity of 95% with methyl iodide penetration of less than 2.5%.

(continued)

5.7 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.

c. 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; and

4. Number of tubes and axially oriented TEC indications left in-service, the projected accident leakage, and an assessment of growth for TEC indications.

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. 188 TO FACILITY OPERATING LICENSE NO. DPR-72

ALTERNATE REPAIR CRITERIA FOR STEAM GENERATOR TUBING

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

1.0 INTRODUCTION

By letter dated May 5, 1999, as supplemented on May 21, May 28, August 20, and September 2, 1999, Florida Power Corporation (FPC or licensee) submitted for staff review a request for an amendment to the Crystal River Unit 3 Improved Technical Specifications (ITS). The licensee proposed to implement alternate repair criteria that would allow tubes having axial tube end crack (TEC) indications in the upper and lower tubesheet of the once-through steam generators (OTSG) to remain in service. The May 21, May 28, August 20, and September 2, 1999, supplements did not affect the original proposed no significant hazards consideration determination, or expand the scope of the request as noticed in the Federal Register. (64 FR 29710 (June 2, 1999)).

The technical basis for the alternate repair criteria is contained in the Babcock & Wilcox Owners Group topical report, "Alternate Repair Criteria for Tube End Cracking in the Tube-to-Tubesheet Roll Joint of Once Through Steam Generators," BAW-2346P, Revision 0 (proprietary). Framatome performed analysis and testing for the alternate repair criteria and prepared the topical report for the Owners Group.

2.0 DISCUSSION

In recent years, licensees have detected eddy current indications in the steam generator tubes near the upper tube end in the OTSGs in Babcock and Wilcox nuclear plants. The indications were characterized as tube end anomalies instead of cracking at the time of discovery because they were located on the tube above the primary face of the upper tubesheet and were considered outside of the primary pressure boundary. In 1998 licensees found that some tube end anomalies had grown into the cladding region of the tubesheet. Therefore, the tube end anomalies are now considered to be inside the primary pressure boundary and they have been reclassified as TEC indications.

In the summer of 1997, the licensee detected tube end anomalies in the Crystal River OTSG. By letters dated June 18 and 30, 1998, the licensee requested a technical specification amendment to leave the tubes affected by tube end anomalies (now considered TECs) in service until either Refueling Outage 11 or during an outage of sufficient duration if such an

outage occurs before Refueling Outage 11. On July 30, 1998, the U.S. Nuclear Regulatory Commission (NRC) issued License Amendment Number 169 approving the FPC request. Crystal River is scheduled to enter Refueling Outage 11 in October 1999. The current amendment is to implement an alternate repair criteria for tubes having TEC indications.

The steam generator tube inspection data from various Babcock & Wilcox nuclear units have shown that TEC indications are initiated on the inside surface of the tubes and are typically short and axial oriented. They are usually located in the rolled portion of the tube near the heat-affected zone created by the tube-to-tubesheet seal weld. The degradation mechanism is identified as primary water stress corrosion cracking which is caused by residual stresses from the rolling of the joints in the tubesheet and from the seal weld.

Topical report BAW-2346P, Revision 0, delineates the following requirements and limitations for application of the proposed alternate repair criteria:

- Under the alternate repair criteria, axially-oriented indications located adjacent to the cladding region of the tube-to-tubesheet rolled joint, or in the portion of the tube protruding from the cladding, will be allowed to remain in service without repair. "Adjacent to the cladding" refers to the portion of the tube that was rolled into the tubesheet cladding, as opposed to the portion of the tube that was rolled into the carbon steel portion of the tubesheet.

- The alternate repair criteria do not apply to tubes with circumferential, mixed mode, or volumetric indications.

- The alternate repair criteria do not apply to tubes with any portion of an axial indication that extends into the carbon steel region of the tubesheet.

- The alternate repair criteria will only apply to those tubesheets whose cladding thickness is less than 0.625 inch.

- The combined total leakage from all primary-to-secondary sources, including TEC indications left in service, shall not exceed the main steam line break accident leakage limit (one gallon per minute for Crystal River) minus operational leakage (150 gallons per day per SG for Crystal River). For tubes with multiple indications, a separate leak rate for each indication must be used.

- A plant-specific analysis for detected tube end cracks will be performed to establish a plant-specific growth rate or to verify the applicability of the generic growth rate in BAW-2346P, Revision 0.

- The total number of detected TEC indications (as an input to the leak rate analysis) must be increased to account for the probability of detection. This increase is specified to assess the population of undetected flaws.

- Site-specific inspections of tube rolled joints are required to identify locations and orientation of TEC. Location shall include tube location within the bundle and crack location with respect to the clad-to-carbon steel interface.

3.0 EVALUATION

The staff evaluated the structural and leakage integrity of the tubes with TEC indications, inspection methods, operational assessments specified in the alternate repair criteria, and technical specification wording to determine the acceptability of the proposed alternate repair criteria.

Structural Integrity

The ends of each straight tube in the OTSGs are hard rolled into the upper and lower tubesheets. The roll joint is about 1-inch long inside the tubesheet and the tube end protrudes about 0.2 inch beyond the primary face of the tubesheet. Of the 1-inch length of the roll joint, the cladding region of the tubesheet spans about 5/16-inch of that length and the rest of that roll length is spanned by the carbon steel region of the tubesheet. The upper and lower tubesheets provide a radial restraint to the hard roll portion of tubing which precludes the possibility of tube burst at TEC locations. The tubesheet also limits the affected tubes from bending in the vicinity of the TEC indications. The potential failure mode, therefore, would only be associated with the tensile axial loads that may cause the tube to fail within the rolled joint. The structural integrity is, therefore, dependent on the axial load carrying capability of the rolled joint and/or seal welds.

The structural strength of the tube affected by TECs is maintained if the seal weld can be demonstrated to resist the axial tube loads without assistance from any frictional forces that may be available from the hard roll joint. Framatome has used a finite element analysis to qualify the structural integrity of the original fabrication seal (fillet) weld and the flush weld used to repair tube end damage at Crystal River 3 and Oconee Unit 1. The analysis assumes that the hard roll joint does not carry any portion of the tube load. The analysis evaluated the welds using loads from normal operating transient conditions and accident conditions. The analysis considered all loading mechanisms including primary and secondary pressures, tube axial loads and weld dilations. The analysis showed that the original seal weld and the flush repair weld satisfy American Society of Mechanical Engineers Code Section III for Class I components. Based on the analysis performed by Framatome, the staff finds the structural integrity of the tubes with TEC indications to be acceptable.

Leakage Integrity

The leakage integrity of the tubes was demonstrated by leak testing. Framatome performed leak testing to determine leak rates for rolled joints with through-wall axial cracks of various lengths for both steady-state power and bounding accident transient conditions. Leak rates at steady-state power conditions were determined to be comparable with the allowable primary-to-secondary leakage limit. The leakage at accident conditions was determined to be less than the allowable leakage limit under accident conditions.

Before leak testing, Framatome used a finite element model to analyze the structural behavior of the tubes to determine test parameters that would give the least tight test roll joints, which in turn would give maximum possible leak rates in the leakage test. The analyzed conditions included heatup, normal operating conditions, main steam line break, and a small-break loss-of-coolant accident. Framatome found that maximizing tube thickness, yield strength of the test tube, and tubesheet bore diameter and minimizing the yield strength of the tested tubesheet, cladding thickness, and roll joint torque would give the worst-case leak rates in the leakage test.

Framatome fabricated 15 mockups to perform leakage tests. Each mockup included the simulated tubesheet with actual tubes rolled into the mockup block to form roll joints. The ends of the test tubes were sealed with fillet welds. Each test tube had a through-wall notch to represent a TEC indication. The mockups were subjected to dilation to simulate tubesheet bowing under OTSG operating conditions followed by axial load cycling to simulate the 40 years of plant operation.

Leakage for normal power operation and accident conditions was evaluated to determine the leakage integrity of tubes with TEC indications. Framatome established the leak rates based on radial position of the tube in the tubesheet, axial tube loading, and tubesheet hole dilation in order to compensate for the tubesheet bowing. The leak rates that are to be applied to TEC indications to calculate the total leakage were established based on the statistical analysis of leak rates obtained in the leak tests. In the statistical analysis, Framatome applied a 95/50 bound (95 percent confidence that 50 percent of the leak rates were greater than the limit) to the leak rates obtained in the leak tests. The leak rates in the tests were very small compared to the leakage limits of 150 gallons per day for normal operation and the limit under accident conditions of one gallon per minute. Since the leak rates obtained from the testing are well within technical specification and accident analysis limits, they are acceptable.

Inspection Methods

The licensee stated that during all future inspections a motorized rotating pancake coil will be used to inspect all hard roll expansions at tube ends with previously identified TEC indications that are monitored in the OTSG inservice inspection surveillance procedure. The licensee inspected all hard roll joints at tube ends using a motorized rotating pancake coil in 1997. The objective of inspecting previously identified TEC indications is to monitor their growth from cycle to cycle. The growth is measured in terms of the distance between the tip of the TEC indication and the clad-to-carbon steel tubesheet interface. The depth of the indications will not be measured because the licensee assumes that any detected axial TEC indication is 100 percent through-wall.

In future tube inspections, using a rotating pancake coil, the licensee will inspect 20 percent of hard roll expansions that have no previously identified TEC indications. The licensee will perform additional inspection samples in accordance with existing technical specification requirements depending on the inspection results. The inspection of the hard roll expansions will be based on Electric Power Research Institute (EPRI) Steam Generator Examination Guidelines, Revision 5. The objective of this inspection is to identify additional tubes with new TEC indications. New TEC indications will be included in the surveillance list and will be

inspected in subsequent inspections, assuming the TECs satisfy the proposed alternate repair criteria.

The licensee will use existing qualified techniques for flaw detection and determining flaw orientation. An inspection technique has been developed and qualified to locate axial TEC indications relative to the cladding-to-carbon steel interface. Framatome has qualified the inspection technique consistent with the intent and protocol of EPRI Steam Generator Examination Guidelines, Revision 5. In addition, the rotating pancake coil (e.g., plus point coil) has been qualified in accordance with Appendix H of the EPRI Steam Generator Examination Guidelines, Revision 5, for detecting axial primary water stress corrosion cracking. Based on operating experience, the staff finds that the licensee's proposed inspection methods and scope are acceptable.

Operational Assessment

The alternate repair criteria specify that at the end of each inspection, the licensee will perform an operational assessment to ensure that the estimated leakage from projected TEC indications at the end of the next cycle will not exceed the leakage limit under accident conditions. To project the TEC indications at the end of the next cycle, the licensee will apply a probability of detection to the detected TEC indications. The application of the probability of detection will increase the total TEC indications to account for non-detected indications. The number of TECs is calculated by dividing the number of detected indications by the probability of detection and subtracting those tubes with TEC indications that have been plugged or repaired.

To project the total tube leakage, a 95/50 bounding leak rate is applied to each TEC indication according to its radial position within the tubesheet. The leak rates from all TEC indications are summed to obtain the total leak rate which is combined with all other known sources of primary-to-secondary leakage. The total leakage is compared to the accident leakage limit. If the projected leakage exceeds the limit, the alternate criteria require the licensee to repair tubes with TEC indications until the leakage limit is satisfied.

During its review, the staff questioned the conservatism of Framatome's use of the 95/50 bounding estimate in calculating the leak rate for each TEC indication and in calculating a probability of detection that is derived based on a 90 percent confidence level. The Framatome approach differs from the Generic Letter (GL) 95-05 methodology for a total steam generator leak rate. Framatome applies a 95/50 estimate to each TEC indication and adds leakage from all TEC indications to obtain total leakage for a steam generator, whereas GL 95-05 uses Monte Carlo simulation to estimate the leakage for all TEC indications and selects the 95/95 upper bound for the total leakage. The staff requested that the licensee address the conservatism of its total leakage calculation relative to the methodology in GL 95-05.

The licensee stated that its leakage calculation methodology is conservative relative to the methodology in GL 95-05 because leakage tests were conducted conservatively, in that: (1) the testing parameters were used in the leakage tests to give the maximum leak rate, (2) the simulated flaws in the test are all 100 percent through-wall which is conservative compared to the actual TECs in the field, and (3) in the leakage calculations, all TEC indications are assumed to be leaking which is more conservative than actual field conditions.

Based on the staff's suggestion, the licensee performed a total leakage calculation to obtain a 95/95 estimate of total SG leak rate using the methodology in GL 95-05. The results showed that the GL 95-05 methodology estimated a lower total leak rate for an OTSG than the total leak rate estimated by the methodology in the topical report. The staff position is that the methodology in GL 95-05 provides a realistic bounding approach to leakage calculation. Since the methodology in the topical report provides more conservative results than the GL 95-05 calculation, the staff finds it acceptable.

The licensee will evaluate and monitor the growth rate of TEC indications during each inspection to confirm that growth of TEC indications is insignificant. The length of the indication in the cladding is not of concern as long as the identified TEC indication does not grow and extend into the carbon steel region of the tubesheet. Current inspection data indicate that the growth rate of TECs is insignificant.

The staff finds that leaving tubes with TEC indications in service does not significantly increase the risk associated with steam generator tube failure because the upper and lower tubesheets provide sufficient restraint to preclude tube burst under normal and postulated accident conditions and, as set forth above, tube leakage will be limited in accordance with the methodology specified in the topical report. Therefore, the staff finds the licensee's proposed operational assessment acceptable.

Proposed Changes to Improved Technical Specifications

ITS 5.6.2.10.2.f: The licensee proposed to add the following requirements to this section:

"Tubes in-service with axially oriented tube end cracks (TEC) are identified in the OTSG Inservice Inspection Surveillance Procedure. The portion of the tube with the axial TEC must be inspected using the motorized rotating coil eddy current technique during each subsequent inspection. No credit is to be taken for this inspection for meeting the minimum sample size requirement for random sample inspection.

"Tubes identified with axial TEC that meet the alternate repair criteria will be added to the existing list of tubes in the OTSG Inservice Inspection Surveillance Procedure. Tubes identified with TEC during the previous inspection which meet the criteria to remain in-service will not be included when calculating the inspection category of the OTSG.

"The inspection data for tubes with axially oriented TEC indications shall be compared to the previous inspection data to monitor the indications for growth.

"Tubes with axially oriented TEC may be left in-service using the method described in Topical Report BAW-2346P, Revision 0, provided the combined projected leakage from all primary-to-secondary leakage, including axial TEC indications left in-service, does not exceed the Main Steam Line Break (MSLB) accident leakage limit of one gallon per minute, minus 150 gallons per day, per OTSG.

"If the plant is required to shut down due to primary-to-secondary leakage and the cause is determined to be degradation of the TEC portion of the tubes, 100% of the tubes with TEC in

that OTSG shall be examined in the location of the TEC. If more than 1% of the examined tubes are defective tubes, 100% of the tubes with TEC in the other OTSG shall be examined in the location of the TEC.

"Tubes with crack-like indications within the carbon steel portion of the tubesheet shall be repaired or removed from service using the appropriate approved method. Tubes with circumferentially oriented TEC or volumetric indications within the Inconel clad region of the tubesheet shall be repaired or removed from service using the appropriate approved method.

"NOTE"

"For the inspection conducted in accordance with 5.6.2.10.2.f only tubes with new TEC indications identified after the 1997 inspection will be included in the below percentage calculations."

The "below percentage calculations" refer to calculations for inspection categories C-1, C-2, or C-3.

ITS 5.6.2.10.3.b: The licensee proposed the following requirement in this section:

"If the C-3 inspection results classification is due to including new tubes with TEC indications that meet the criteria to remain in-service no reduction in inspection frequency is required."

ITS 5.6.2.10.4.a.12: The licensee proposed the following definition in this section:

"Tube End Cracks (TEC) are those crack-like eddy current indications, circumferentially and/or axially oriented, that are within the Inconel clad region of the primary face of the upper and lower tubesheets, but do not extend into the carbon steel-to-Inconel clad interface."

ITS 5.7.2.c: This section specifies the reporting requirements for results of steam generator tube inspections. The licensee proposed the following additional item to be included in the inspection report:

"Number of tubes and axially oriented TEC indications left in-service, the projected accident leakage, and an assessment of growth for TEC indications."

The staff finds that the proposed changes incorporate requirements into the ITS to support the alternative repair criteria, which the staff found acceptable on the basis of review of information submitted by the licensee, and therefore the above changes to the ITS are acceptable.

4.0 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.

5.0 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 amendment involves 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 and there has been no public comment on such finding (64 FR 29710). 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

The licensee has demonstrated that the steam generator tubes having tube end cracking indications that are allowed to remain inservice based on the proposed alternate repair criteria will maintain adequate structural and leakage integrity. The staff concludes that the proposed changes to technical specifications to implement the alternate repair criteria for tube end cracking are acceptable and they may be incorporated into Crystal River Unit 3 Improved Technical Specifications. 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.

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