

**Florida  
Power**  
CORPORATION

April 6, 1990  
3F0490-01

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555

Subject: Crystal River Unit 3  
Docket No. 50-302  
Operating License No. DPR-72  
Technical Specification Change Request No. 181

Dear Sir:

Florida Power Corporation (FPC) hereby submits Technical Specification Change Request No. (TSCRN) 181 requesting amendment to Appendix A of Operating License No. DPR-72. This submittal proposes the use of mechanical sleeves as an alternative to plugging defective once-through steam generator tubes. As part of this request, the proposed replacement pages for Appendix A and associated bases are provided.

FPC requests this amendment become effective 30 days after issuance in order to allow for procedure changes and training.

Sincerely,

P. M. Beard, Jr.  
Senior Vice President  
Nuclear Operations

PMB:BPW

xc: Regional Administrator, Region II  
Senior Resident Inspector

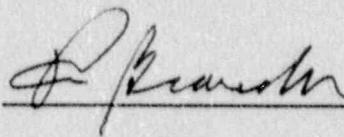
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STATE OF FLORIDA

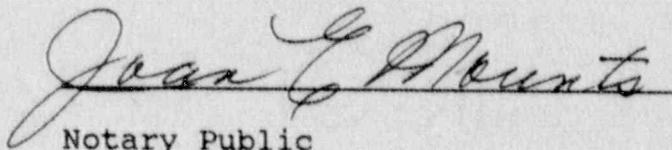
COUNTY OF PINELLAS

P. M. Beard, Jr. states that he is the Senior Vice President, Nuclear Operations for Florida Power Corporation; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission the information attached hereto; and that all such statements made and matters set forth therein are true and correct to the best of his knowledge, information, and belief.



P. M. Beard, Jr.  
Senior Vice President  
Nuclear Operations

Subscribed and sworn to before me, a Notary Public in and for the State and County above named, this 6th day of April, 1990.



Notary Public

Notary Public, State of Florida at Large,  
Notary Public, State of Florida

My Commission Expires: My Commission Expires Oct. 6, 1990

Bonded thru Troy Fair Insurance Inc.

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

IN THE MATTER

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DOCKET NO. 50-302

FLORIDA POWER CORPORATION

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CERTIFICATE OF SERVICE

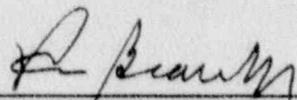
P. M. Beard, Jr. deposes and says that the following has been served on the Designated State Representative and Chief Executive of Citrus County, Florida, by deposit in the United States mail, addressed as follows:

Chairman,  
Board of County Commissioners  
of Citrus County  
Citrus County Courthouse  
Inverness, FL 32650

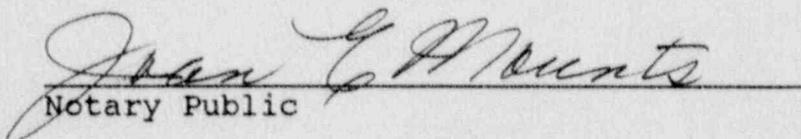
Administrator  
Radiological Health Services  
Department of Health and  
Rehabilitative Services  
1323 Winewood Blvd.  
Tallahassee, FL 32301

A copy of Technical Specification Change Request No. 181, Revision 0, requesting amendment to Appendix A of Operating License No. DPR-72.

FLORIDA POWER CORPORATION

  
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P. M. Beard, Jr.  
Senior Vice President  
Nuclear Operations

SWORN TO AND SUBSCRIBED BEFORE ME THIS 6th DAY OF April 1990.

  
\_\_\_\_\_  
Notary Public

Notary Public, State of Florida at Large

My Commission Expires:

Notary Public, State of Florida  
My Commission Expires Oct. 6, 1990  
Bonded Thru Troy Fair - Insurance Inc.

**FLORIDA POWER CORPORATION  
CRYSTAL RIVER UNIT 3  
DOCKET NO. 50-302/LICENSE NO. DPR-72  
REQUEST NO. 181, REVISION 0  
STEAM GENERATOR TUBE SLEEVING**

**LICENSE DOCUMENT INVOLVED: TECHNICAL SPECIFICATIONS**

**PORTIONS:** 4.4.5.2  
4.4.5.4  
4.4.5.5  
Bases 3/4.4.5

**DESCRIPTION OF REQUEST:**

This submittal requests permission to install mechanical tube sleeves in the Crystal River Unit 3 (CR-3) once-through steam generators (OTSG) as an alternative to plugging defective steam generator tubes. The acceptance criteria for steam generator inservice inspections has been revised to reflect sleeving as an acceptable means of returning a defective tube to operable status. The submittal also requests that degraded tubes which have been sleeved, be excluded from the results category determination for future inspection requirements. Reporting requirements have been added for those tubes spanned by a sleeve.

**REASON FOR REQUEST:**

Crystal River Unit 3 (CR-3) Technical Specification 4.4.5.2 requires a periodic inservice inspection of representative tube sampling from the CR-3 OTSGs. The tube inspection program is intended to detect degradations in the primary system to secondary system pressure boundary via the steam generator tube walls. At present, a tube that exhibits a through-wall reduction of 40% is isolated from service by means of a tube plug. The tube plug isolates flow through the tube, thereby removing the tube from service. Extensive plugging operations have shown a cause and effect relationship to elevated corrosion rates. This is due to the creation of localized "cold spots" in widely-plugged areas. As more and more tubes are plugged, the effective heat transfer area of the steam generators is also reduced and the power output of the plant limited.

Steam generator tube problems have historically been very minimal at CR-3, as supported by the small number of tubes (approximately 30) which have been plugged since CR-3 became commercially operational in March 1977. Based on this operating history and the continuing emphasis placed on maintaining primary and secondary system chemistry within limits, Florida Power Corporation (FPC) does not anticipate the need to undertake a large-scale sleeving program for CR-3. However, in order to allow for flexibility in future steam generator repairs, FPC is requesting this change to Technical Specifications to allow tube sleeving.

A definition for "tube and tubing" has been added to the acceptance criteria. This was intended to clarify that the critical monitored parameter for inservice inspection is degradation in the primary system to secondary system pressure boundary (regardless whether it is in the sleeve or parent tube). The degraded tube criteria was also revised since the testing capability to detect 20% through-wall penetrations has not been demonstrated for all areas of the tube/sleeve interface. A limit on the maximum number of sleeved tubes has been added to ensure the number installed in CR-3 is bounded by the analysis in BAW-1823P "OTSG Mechanical Sleeve Qualification".

The inspection results classification and category determination were revised to eliminate growth of those defects which have been spanned by a sleeve from consideration for determination of subsequent actions. The addition of reporting requirements for sleeved tubes assures changes to the OTSGs (modifications to original OTSG design and indications of degraded pressure boundary) are reported.

#### **EVALUATION OF REQUEST:**

The use of a mechanical tube sleeve to span OTSG tube degradation will provide CR-3 with the capability to plug defective tubes while still allowing the tube to remain in service. The mechanical tube sleeves intended for use at CR-3 are type 600 Inconel, per ASME Specification SB-163, and were developed and qualified by Babcock and Wilcox (B&W). B&W Topical Report BAW-1823P "Once-Through Steam Generator Mechanical Sleeve Qualification", dated June 1984, contains the general design criteria for the sleeves and has been previously submitted to the NRC on other utility docket. The qualification report addresses the following areas:

- o Leakage Tests
- o Joint Strength Tests
- o Light Expansion Tests
- o Corrosion Tests
- o Flow-Induced Vibration Analysis
- o Strain Tests
- o Adjacent Tube Tests
- o Thermal/ Hydraulic effects of sleeving
- o Structural and Functional integrity of the sleeves

The qualification report recommends "that up to 10,000 mechanical sleeves be installed in the OTSGs of any plant as needed to correct or prevent tube degradation." While the imposed limit of 10,000 sleeves is arbitrary, the number has been evaluated against ASME Code specifications and the above tests and analyses. The limiting design concern is the amount of leakage through the tube sleeves during normal and faulted conditions. If there were 10,000 sleeves installed in the plant (and all the tubes leaked), the predicted leakage during normal operation would be less than 0.04 gpm. This is significantly less than the 1.0 gpm Technical Specification limit on primary-to-secondary leakage through the steam generators. For accident conditions, the

leakage through the steam generators is approximately twice the normal operational level.

FPC has considered the impact on the CR-3 safety analysis due to sleeving 5000 tubes in each OTSG. Sleeving a tube results in a small reduction in primary-to-secondary heat transfer through the OTSG due to the air gap between the parent tube and the sleeve. There is also a slight decrease in primary system flow rate due to the sleeved tubes. As part of BAW-1823P, B&W performed a generic evaluation of the effects of tube sleeving on RCS flow and OTSG heat transfer. Assuming worst-case conditions, the 1823P evaluation predicted a decrease of less than 1% full RCS flow with 5000 sleeves installed in each OTSG.

The minimum acceptable sleeve wall thickness was determined in accordance with the allowable stress and pressure limits of ASME Section III and NRC draft Regulatory Guide 1.121. The minimum thickness required to resist collapse under the external pressures resulting from a LOCA was determined for the type of defects expected. Allowing additional margins for continued degradation and uncertainties in eddy current testing, a sleeving limit of 40% has been established.

Despite recent improvements in eddy current testing (ECT) techniques, the ability to detect 20% through-wall penetrations has not been demonstrated for all regions of the tube/sleeve combination. This is the case for the tube at the sleeve end and is due to the change in tube/sleeve diameters in this location. The reduced detection capability at the sleeve end is considered acceptable primarily because: 1) this region is inspected prior to sleeve installation when the 20% through-wall sensitivity is available, 2) a baseline eddy current test (ECT) signal is determined immediately after sleeve installation such that any subsequent change in the signal can be evaluated should it occur, and 3) the 40% through-wall degradation is detectable, and since this is the plugging criterion, no action (other than reporting the "degraded" tube) is required in the affected range of the 20-40% through-wall.

A definition for "tube and tubing" is added which includes the use of a sleeve to form the pressure boundary in the area of the tube spanned by the sleeve. This is intended to clarify that steam generator tubing surveillance applies to that portion of the tube or sleeve which forms the pressure boundary. The intent of this change is to clarify that a tube must contain a defect in its pressure boundary to be defective. A defect in the region of the tube which is spanned by a sleeve is not a defect in the tube's pressure boundary, and should not be defined as such.

Defects which have been spanned by a sleeve need not be considered for determination of inspection result category. For the case in which the degraded tube has been spanned by a sleeve, further tube wall penetrations in the parent tube are considered inconsequential since that portion of the tube no longer constitutes the primary-to-secondary system pressure boundary. This exception applies to tubes in which

sleeves have been installed to span detectable degradations. The portion of the parent tube spanned by the sleeve (from the bottom of the uppermost rolled joint to the top of the lower-most rolled joint) is no longer considered part of the primary-to-secondary system pressure boundary. Any degradation in the parent tube in the area spanned by the sleeve poses no threat to the integrity of the pressure boundary and, therefore does not require the same degree of scrutiny as a wall penetration >20% in a portion of the tube that does constitute the pressure boundary. The mandatory inspection requirement still applies to a sleeved tube which has been subjected to a random full length examination and has been found to have a wall penetration >20% in either the portion of the tube which is not spanned by the sleeve or in the sleeve itself.

The addition of reporting requirements for sleeved tubes ensures tubes which have exceeded the plugging/sleeving limit are promptly reported to the Commission. Changes to the OTSGs (modification to the original OTSG design and indications of degraded pressure boundary) should be reported. This philosophy is consistent with current reporting requirements for plugged tubes.

## SHOLLY EVALUATION:

The proposed amendment which adds provisions to Technical Specifications to allow the installation of mechanical sleeves in the Crystal River 3 (CR-3) once-through steam generators (OTSG) does not involve a significant hazards consideration. The proposed amendment provides an alternative to plugging defective OTSG tubes which will allow the tubes to remain in service. The Technical Specifications continue to require isolation of a tube containing a detected 40% reduction in the primary-to-secondary system pressure boundary. The Technical Specifications also continue to require Nuclear Regulatory Commission (NRC) notification whenever significant degradation is detected or modifications are performed to the original OTSG design.

Based on the above, it is concluded that this change will not:

1. Involve a significant increase in the probability or consequence of an accident previously evaluated. The CR-3 Final Safety Analysis Report (FSAR) contains a conservative analysis of several accidents which could affect OTSG tube integrity, and the sleeves proposed for installation in CR-3 were designed with consideration for these accidents. The sleeves are considered structural members, designed in accordance with ASME Section III and draft NRC Regulatory Guide 1.121, and have been demonstrated to meet normal, upset, emergency, and faulted conditions resulting from normal operations and accident transients. Furthermore, the sleeves have been demonstrated to be mechanically stronger than the tubes themselves, making a sleeved tube no more likely to rupture, collapse or be pulled apart than an unsleeved tube. Therefore, the probability of a previously evaluated accident is not significantly increased due to installation of sleeves in the OTSG.

The consequences of a previously evaluated accident are also not significantly increased as a result of the installation of OTSG tube sleeves. The Reactor Coolant System (RCS) flow rate through a sleeve is reduced, such that in the unlikely event a sleeved tube does rupture, primary-to-secondary system leakage would be less than that assumed in the safety analysis for the rupture of an unsleeved tube.

2. Create the possibility of a new or different kind of accident from any accident previously evaluated. A sleeved tube performs the same function, in the same passive manner, as an unsleeved tube. Tube sleeves are designed, qualified, and maintained under the stress and pressure limits of ASME Section III and draft NRC Regulatory Guide 1.121. Eddy current testing (ECT) is performed following installation of each sleeve. This is done to verify proper installation of the sleeve and to obtain a baseline ECT reading for each sleeve in order to monitor for subsequent degradation of the pressure boundary.

3. Involve a significant reduction in the margin of safety provided by current Technical Specifications. OTSG tube integrity is maintained under the same limits for sleeved tubes as for unsleeved tubes; ie. ASME Section III and NRC draft Regulatory Guide 1.121. The value of OTSG pressure boundary degradation at which a tube becomes inoperable remains unchanged and is detectable for sleeves as well as plugs. The Technical Specifications continue to require monitoring and restriction of primary (RCS) to secondary system leakage through the steam generators, such that there is reasonable assurance that a significant increase in leakage, due to failure of a sleeved (or unsleeved) tube, will be detected. The slight reduction in RCS flow and full-power steam superheat due to sleeving the maximum number of OTSG tubes allowed is considered to have an insignificant impact on OTSG operation during accident conditions. The Technical Specifications will continue to contain reporting requirements for tubes which have had their degradation spanned (regardless whether the tube is plugged or sleeved).