Progress Energy

Crystal River Nuclear Plant
Docket No. 50-302
Operating License No. DPR-72

Ref: 10 CFR 50.55a

December 10, 2008
3F1208-04

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Subject: Crystal River Unit 3 – Relief Request (RR) #08-001-MX, Revision 0

Dear Sir:

Pursuant to 10 CFR 50.55a(a)(3)(i), Florida Power Corporation (FPC), doing business as Progress Energy Florida, Inc., is hereby submitting Relief Request #08-001-MX, Revision 0, to use an alternate tendon examination schedule for tendons affected by repair/replacement activity at Crystal River Unit 3 (CR-3) during the Fourth Ten-Year Inservice Inspection (ISI) Interval which began on August 14^{th}, 2008.

No new regulatory commitments are established in this correspondence.

If you have any questions regarding this submittal, please contact Mr. Dan Westcott, Supervisor, Licensing and Regulatory Programs at (352) 563-4796.

Sincerely,

Stephen J. Cahill
Engineering Manager
Crystal River Nuclear Plant

SJC/scp/pdk

Attachment: Proposed Alternative in Accordance with 10 CFR 50.55a(a)(3)(i)

xc: NRR Project Manager
Regional Administrator, Region II
Senior Resident Inspector

A047
NRR

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Crystal River Nuclear Plant
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PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

ATTACHMENT

PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

ALTERNATIVE EXAMINATION SCHEDULE FOR REPAIR/REPLACEMENT TENDONS

--Alternative Provides Acceptable Level of Quality and Safety--

CRYSTAL RIVER UNIT 3 INSERVICE INSPECTION
RELIEF REQUEST #08-001-MX
FOURTH TEN-YEAR INTERVAL

1.0 ASME Code Components Affected

The American Society of Mechanical Engineers (ASME) Code components associated with this request are the unbonded post-tensioning system tendons that are part of the reactor containment building. This includes existing tendons and tendons that will be replaced as part of the repair of a containment construction opening created for replacement of the Crystal River Unit 3 (CR-3) steam generators. This repair/replacement activity is scheduled to occur during the upcoming CR-3 16th Refueling Outage (R16) scheduled to start in September 2009.

1.1 Category and System Details:

Code Class: CC
Subsection: Table IWL-2521-2
Description: Augmented Examination Requirements Following Post-Tensioning System Repair/Replacement Activities

1.2 Component Identification:

This alternative applies to a limited number of the total tendons that will be affected by the CR-3 R16 repair/replacement activity. This request applies to the following specific components:

Components: 30 Vertical Tendons

23V1	34V3	34V8	34V13	34V18	34V23
23V2	34V4	34V9	34V14	34V19	34V24
23V3	34V5	34V10	34V15	34V20	45V22
34V1	34V6	34V11	34V16	34V21	45V23
34V2	34V7	34V12	34V17	34V22	45V24

2.0 Applicable Code Edition and Addenda

CR-3 is currently in the Fourth Ten-Year Inservice Inspection (ISI) Interval. The ASME Boiler and Pressure Vessel Code (Code) of record for the Fourth Ten-Year ISI Interval is Section XI, 2001 Edition, including Addenda through 2003, (Reference 1).

3.0 Applicable Code Requirement

Subsection IWL-2521.2 of the ASME Section XI Code states that tendons affected by repair/replacement activities shall require augmented examination in accordance with Table IWL-2521-2.

Table IWL-2521-2 requires an initial inspection one year (+/- three months) following completion of an IWL repair/replacement activity that affects the containment prestressing system. Subsequent Inservice Inspections will coincide with IWL-2420, Unbonded Post-tensioning Systems, following completion of the repair/replacement activity.

4.0 Background

CR-3 is planning to replace steam generators during R16 currently scheduled for late 2009. To facilitate the removal of the existing steam generators from the containment building and transport of the replacement steam generators into the containment building, a temporary construction opening will be created in the containment wall and steel liner plate directly above the equipment hatch, located at the 150° azimuth. Creation of the opening and restoration of the wall will require the removal and reinstallation of the concrete, rebar, post-tensioning tendons, and liner plate within the boundaries of the opening and detensioning and retensioning of selected vertical and horizontal tendons adjacent to the opening. The activity affecting the tendons is classified as a repair/replacement activity per ASME Section XI, Article IWL.

The CR-3 vertical tendons span the height of the containment building from the top of the cylinder to a tendon gallery located below grade. The horizontal tendons span 120° (degrees) of arc and are tensioned between two of six buttresses spaced around the structure at 0° (north), 60°, 120°, 180°, 240°, and 300°. The horizontal tendons affected by the containment opening span between buttresses number two (60°) and number four (180°) and between buttresses number three (120°) and number five (240°).

The arc between the center of buttresses number one (0°) and number three (120°) is referred to as the Steam Exclusion Zone. This zone is not accessible during power operation due to the proximity to the Main Steam Relief and Atmospheric Dump Valve discharge stacks. Working in this zone presents a danger to personnel working in that area to an unanticipated pressure excursion releasing 1000 pounds per square inch (psi) superheated steam to the atmosphere. All of the horizontal tendons have one of the two ends located in the Steam Exclusion Zone. Since access to both ends of each horizontal tendon is required to complete the tendon examination, none of the affected horizontal tendon examinations can be completed during power operation. Three of the total thirty vertical tendons affected are located within the Steam Exclusion Zone preventing access to the top end of those tendons. It is possible that one or both of the two future randomly selected vertical tendons could be within the Steam Exclusion Zone.

5.0 Reason for Request

CR-3 recently updated its ISI Program commitment to the ASME Section XI, 2001 Edition through the 2003 Addenda, effective August 14, 2008. The 2002 Addenda added Section IWL-

2521.2 and Table IWL-2521-2 and thereby established the specific requirement for the initial inspection at one year (+/- three months) following the completion of the repair/replacement activity, followed by subsequent inspections scheduled to coincide with the ongoing five year ISI examinations performed in accordance with IWL-2420. CR-3's current five year ISI schedule is performed in accordance with IWL-2420 (c).

At least one of the buttresses that anchor the affected horizontal tendons is located in the Steam Exclusion Zone making personnel access during plant operation a safety hazard. As allowed by the provisions of Note 4 of Table IWL-2521-2, initial inspection for the impacted horizontal tendons will be deferred until the next scheduled Refueling Outage (R17) in 2011, approximately two years after completion of the repair/replacement activity. Note 4 states, "If plant operating conditions are such that examination of portions of the post-tensioning system cannot be completed within this stated time interval, examination of those portions may be deferred until the next regularly scheduled plant outage."

This relief request is being submitted to obtain relief from the examination frequency requirement in Table IWL-2521-2 which requires an initial inspection of the repair/replacement population vertical tendons at one year (+/- three months) following completion of the repair/replacement activity.

A total of thirty vertical tendons and thirty five horizontal tendons will be affected by the containment access opening repair/replacement activity. Ten vertical tendons and seventeen horizontal tendons fall within the construction opening and will be completely removed and replaced with tendons of the same design and construction. In addition, twenty vertical tendons and eighteen horizontal tendons immediately adjacent to the access opening will be temporarily detensioned and subsequently retensioned.

The total numbers of vertical and horizontal tendons in the containment building are one hundred forty four and two hundred eighty two, respectively. Since the percentage of tendons affected by the repair/replacement activity are greater than 5% of the total, the required sample size, per Table IWL-2521-2, is two vertical tendons and two horizontal tendons (i.e., the lesser of 4% of the affected tendons or ten tendons).

The prescribed schedule for ISI of the impacted tendons is:

- 2009 – Pre-service examination
- 2010 – Initial (one year) inspection of accessible [vertical] tendons
- 2011 – Initial inspection of inaccessible [horizontal] tendons and subsequent inspection of vertical tendons to coincide with the 9th Surveillance (35th year) examination schedule of the original tendon scope.

Note: The 9th Surveillance (35th Year) Tendon Inspection will be performed during R17 (2011). From 2011 forward, both tendon populations (remaining original population and R16 repair/replacement affected population) will coincide on a five year frequency as currently established by IWL-2420 (c). The provisions of IWL-2420 (a) and (b) do not apply to CR-3 because CR-3 is in its 31st year of operation beyond the original Structural Integrity Test (SIT).

As described in Section 6, an alternative is proposed to the one year initial inspection schedule given in Table IWL-2521-2 for the vertical tendons affected by the repair/replacement activities. It is proposed that the initial inspection of the two vertical tendons be performed at the same time as the two horizontal tendons in 2011 during R17. This would coincide with the 35th year examination schedule of the original tendon scope.

6.0 Proposed Alternative and Basis for Use

It is proposed that the vertical tendons requiring augmented examination, in accordance with Sub-article IWL-2521.2, utilize the same inspection interval as the horizontal tendons.

6.1 Discussion / Analysis:

The thirty vertical tendons that are impacted by the repair/replacement activity will utilize the same prestressing system, will be identical in design, and will be exposed to, or protected from, the same outside environment as the existing tendons, which have been in service for the last thirty two years. Fifteen ISI examinations have been completed to date. The existing vertical tendons have met all the post-tensioning test and examination acceptance criteria. The planned repair/replacement activities impacting the vertical tendons will not result in any unique condition that may subject the vertical tendons to a different potential for structural or tendon deterioration.

The purpose for conducting the inspections is to monitor the post-tensioning system for degradation and to verify that actual loss of prestress is consistent with predicted values used in design. For new containments, the main reason for performing the one year tendon inspection, as required by Paragraph IWL-2420, is to benchmark the tendon losses shortly after the Structural Integrity Test (SIT) when prestress losses (which are due to elastic shortening, creep, shrinkage and relaxation) occur at the highest rate. For the retensioned and replaced tendons in the CR-3 containment structure, prestress losses will be much smaller than those for the original tendons as shown below.

<u>Elastic shortening</u>:

The elastic shortening loss is a function of the prestress load, the elastic modulus for the steel tendon and the elastic modulus of the concrete. The prestress load and tendon material are identical to the original design, but the concrete modulus (E_c which is determined as a function of compressive strength) will differ because the concrete strength is different. The strength of the concrete shell is higher (6720 psi) due to long term strength gain and the patch concrete is specified to be a higher strength material (6000 psi). The elastic shortening loss for the new and re-tensioned tendons will therefore be lower as follows:

$$E_{c.original} = 4080ksi$$
$$E_{c.existingconc} = 57000 \times \sqrt{6720} = 4673ksi$$
$$E_{c.patch} = 57000 \times \sqrt{6000} = 4415ksi$$

$$Elastic\_loss_{original} = 2.92ksi$$
$$Elastic\_loss_{retensioned} = 2.92ksi \times \frac{E_{c.original}}{E_{c.patch}} = 2.70ksi$$

Thus, the elastic shortening loss is reduced from 2.92 ksi (thousand pounds per square inch) in the original design to 2.7 ksi for the replaced and re-tensioned tendons.

Creep:

Creep is a time dependent function of the concrete. Creep is represented by a creep coefficient which is the ratio of creep strain to elastic strain. The creep loss will be lower for the new and re-tensioned tendons because of two primary factors. First, the concrete mix for the patch targets a relatively low creep coefficient. Second, only the new concrete will experience significant creep (because of its age, the existing concrete will undergo no appreciable creep) and since the height of the opening is only a fraction of the height of the shell (and thus the length of the tendon) its influence is relatively small. The creep loss for the new tendons is computed as follows:

$$creep.coeff = 0.704$$
$$height_{opening} = 28feet$$
$$length_{vert\_tendon} = 187feet$$
$$Elastic\_loss_{retensioned} = 2.7ksi$$

$$Creep\_loss_{retensioned} = Elastic\_loss_{retensioned} \times creep.coeff \times \frac{height_{opening}}{length_{vert\_tendon}}$$
$$= 2.7ksi \times 0.704 \times \frac{28feet}{187feet} = 0.28ksi$$

Thus, the creep loss is reduced from 7.10 ksi in the original design to 0.28 ksi for the replaced and re-tensioned tendons.

Shrinkage:

Shrinkage losses will similarly be reduced because only the new concrete experiences significant shrinkage and the new concrete constitutes only a small portion of the tendon length.

$$Shrinkage\_loss_{original} = 2.9ksi$$

$$Shrinkage\_loss_{retensioned} = Shrinkage\_loss_{original} \times \frac{height_{opening}}{length_{vert\_tendon}}$$

$$= 2.9ksi \times \frac{28\,feet}{187\,feet} = 0.43ksi$$

Thus, the shrinkage loss is reduced from 2.9 ksi in the original design to 0.43 ksi for the replaced and re-tensioned tendons.

Relaxation:

Steel relaxation losses will be lower for the replaced and re-tensioned tendons because of the shorter remaining life of the plant (i.e., forty years for original design versus seven years remaining). The loss due to relaxation is based on tendon steel relaxation of 4% at 40 years. Thus, the relaxation loss is reduced from 5.64 ksi in the original design to 4.67 ksi for the replaced and re-tensioned tendons.

The sum of the above losses in the original design was 18.56 ksi. The sum of these losses predicted to occur in the replaced and re-tensioned vertical tendons through the end of the forty year plant life is 8.1 ksi. This is 44% of the losses that were predicted in the original design of the vertical tendons. With a ratio of 44%, based on the comparison of prestress predicted losses versus design losses, there is a high degree of confidence that the postponement of the first scheduled inspection of the vertical tendons by one year will not involve an increase in radiological risk and would not adversely affect public health and safety.

Note that new prestress losses will occur for both the replaced and the retensioned tendons. The tendons outside the opening that will be de-tensioned were selected because they have an influence on the compressive stresses in the concrete area to be removed and replaced. Thus, they will be subject to the time-dependent losses (creep & shrinkage) associated with the new concrete. When they are re-tensioned, they will be stressed back to the original tendon force (i.e., 70% of ultimate) and will be subject to the time-dependent losses (relaxation) associated with the steel.

6.2 Additional Considerations:

There is a nuclear safety risk associated with tendon inspections. Nuclear safety risks come from the need to rig and lift heavy equipment in the vicinity of operable Technical Specification structures, systems, and equipment (SSCs). CR-3 is constructed on a raised berm due to hurricane flooding considerations. As such, there is very limited open ground space and SSCs that support CR-3 operations are located in close physical proximity to the containment. To perform tendon examinations, a large mobile crane must be located on the berm, near the containment, in order to lift tendon work platforms and the hydraulic rams used to perform tendon tension tests. Technical Specification equipment, including the Borated Water Storage Tank and Emergency Feedwater Tank, are adjacent to the safe lift path for this equipment and the Nuclear Services Seawater System discharge piping (located below grade) pass under the safe lift path. Although the CR-3 heavy load program will be followed, a certain amount of risk due to human error or equipment failure will still exist. Approving this request, to defer the initial examination of the two vertical tendons to coincide with the more extensive examination in 2011, would avoid these risk sources for one examination, which should be considered on balance with the limited value derived from the examination data for two (or perhaps only one vertical tendon).

The examination at one year (+/- three months) versus the requested schedule may not actually result in a delay of the examination for one full year. The beginning of the examination interval will coincide with the completion of the Containment Integrated Leak Rate Test which is scheduled for the first week of December 2009. This would mean that examination of the two vertical tendons could be completed as late as March 2011. The examination of the repair/replacement and the 35th year ISI examination populations would commence prior to the start of the 2011 outage, scheduled to begin October 22, 2011. Completion of the 35th Year ISI examination is targeted for the end of the refueling outage or shortly thereafter. On this basis, the delay in examining the two vertical tendons would only be seven to eight months.

Considering the adequate performance of the existing tendons, which have been in service for the last thirty two years, it is believed that there is low probability of a condition existing that is adverse to quality and safety within the first two years after completion of the repair/replacement activity. Past performance of the existing tendons is an important consideration since the thirty vertical tendons that are impacted by the repair/replacement activity utilize the same prestressing system, are identical in design, and are similarly exposed to or protected from the outside environment. Considering the anticipated low probability of identifying a condition adverse to safety, it is suggested that the increased assurance of the integrity of the thirty vertical tendons that could be achieved by the performance of an inspection at a one year interval instead of a two year interval is not commensurate with the inherent risk of performing this inspection.

6.3 Conclusion:

Therefore, it is proposed that the vertical tendons requiring augmented examination in accordance with Subarticle IWL-2521.2 undergo initial inspection at two years (+/- three months) in lieu of the specified one year (+/- three months). There would be no deviation from Section XI requirements for subsequent Inservice Inspections since they would be scheduled every five years (plus one year) to coincide with future plant refueling outages as required by Table IWL-2521-2 and Paragraph IWL-2420 (c). Florida Power Corporation considers that this proposed alternative schedule will provide an acceptable level of quality and safety, consistent with the provisions of 10 CFR 50.55a(a)(3)(i).

7.0 Duration of Proposed Alternative

The alternative requirements of this request will be applied for the Fourth Ten-Year ISI Interval which began on August 14, 2008.

8.0 Precedents

None identified.

9.0 References

1. ASME Code, Section XI, 2001 Edition, including Addenda through 2003.