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

January 5, 2012
3F0112-04

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

Subject: Crystal River Unit 3 – Response to Request for Additional Information to Support NRC Steam Generator Tube Integrity and Chemical Engineering Branch Technical Review of the CR-3 Extended Power Uprate LAR (TAC No. ME6527)

References:
1. CR-3 to NRC letter dated June 15, 2011, "Crystal River Unit 3 – License Amendment Request #309, Revision 0, Extended Power Uprate" (Accession No. ML112070659)
2. NRC to CR-3 letter dated December 7, 2011, "Crystal River Unit 3 Nuclear Generating Plant - Request for Additional Information for Extended Power Uprate License Amendment Request (TAC No. ME6527)" (Accession No. ML11326A231)

Dear Sir:

By letter dated June 15, 2011, Florida Power Corporation, doing business as Progress Energy Florida, Inc., requested a license amendment to increase the rated thermal power level of Crystal River Unit 3 (CR-3) from 2609 megawatts (MWt) to 3014 MWt. On December 7, 2011, the NRC provided a request for additional information (RAI) required to complete its evaluation of the CR-3 Extended Power Uprate (EPU) License Amendment Request (LAR).

The attachment, "Response to Request for Additional Information to Support NRC Steam Generator Tube Integrity and Chemical Engineering Branch Technical Review of the CR-3 EPU LAR," provides the CR-3 formal response to the RAI needed to support the Steam Generator Tube Integrity and Chemical Engineering Branch (ESGB) technical review of the CR-3 EPU LAR.

In support of the ESGB technical review RAI response, an enclosure, "Wear Rate Analysis: Combined Summary Report," is being provided which contains a sample list of components for which wall thinning is predicted and measured by ultrasonic testing.

This correspondence contains no new regulatory commitments.

A001
NRR

Progress Energy Florida, Inc.
Crystal River Nuclear Plant
15760 W. Powerline Street
Crystal River, FL 34428

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

Sincerely,

Jon A. Franke
Vice President
Crystal River Nuclear Plant

JAF/gwe

Attachment: Response to Request for Additional Information to Support NRC Steam Generator Tube Integrity and Chemical Engineering Branch Technical Review of the CR-3 EPU LAR

Enclosure: Wear Rate Analysis: Combined Summary Report

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

STATE OF FLORIDA

COUNTY OF CITRUS

Jon A. Franke states that he is the Vice President, Crystal River Nuclear Plant for Florida Power Corporation, doing business as Progress Energy Florida, Inc.; 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.

Jon A. Franke
Vice President
Crystal River Nuclear Plant

The foregoing document was acknowledged before me this 5th day of January, 2012, by Jon A. Franke.

Charlene Miller

Signature of Notary Public
State of Florida

CHARLENE MILLER
Notary Public - State of Florida
My Comm. Expires Nov 12, 2012
Commission # DD 837023
Bonded Through National Notary Assn.

Charlene Miller

(Print, type, or stamp Commissioned Name of Notary Public)

Personally Known ✓ -OR- Produced Identification ______

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 /LICENSE NUMBER DPR-72

ATTACHMENT

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION TO SUPPORT NRC STEAM GENERATOR TUBE INTEGRITY AND CHEMICAL ENGINEERING BRANCH TECHNICAL REVIEW OF THE CR-3 EPU LAR

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION TO SUPPORT NRC STEAM GENERATOR TUBE INTEGRITY AND CHEMICAL ENGINEERING BRANCH TECHNICAL REVIEW OF THE CR-3 EPU LAR

By letter dated June 15, 2011, Florida Power Corporation (FPC), doing business as Progress Energy Florida, Inc., requested a license amendment to increase the rated thermal power level of Crystal River Unit 3 (CR-3) from 2609 megawatts (MWt) to 3014 MWt. On December 7, 2011, the NRC provided a request for additional information (RAI) required to complete its evaluation of the CR-3 Extended Power Uprate (EPU) License Amendment Request (LAR). The following provides the CR-3 formal response to the RAI needed to support the Steam Generator Tube Integrity and Chemical Engineering Branch (ESGB) technical review of the CR-3 EPU LAR. For tracking purposes, each item related to this RAI is uniquely identified as ESGB X-Y, with X indicating the RAI set and Y indicating the sequential item number.

Steam Generator Tube Integrity and Chemical Engineering Branch (ESGB)

26. (ESGB 1-1)

On page 2.1.7-2 of attachment 5 of its letter dated June 15, 2011, the licensee stated that a new design-basis accident (DBA) test was performed to qualify the use of the Carboline Carboguard 2011SN surface topcoated with Carboline Carboguard 890N for concrete substrates. It was demonstrated that the DBA qualification test report provides the basis for qualification for these coating systems and bounds EPU conditions. Please clarify whether all Service Level 1 coatings have been qualified to meet design basis LOCA containment EPU conditions for temperature, pressure and radiation.

Response:

As noted in Section 2.1.7, "Protective Coating Systems (Paints) – Organic Materials," of the EPU Technical Report (TR) (Reference 1, Attachments 5 and 7) the 1990 DBA test was performed for previous coating products approved for application in the CR-3 Reactor Building. Afterward, following the CR-3 response to Generic Letter 98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System After a Loss-Of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment," FPC qualified an additional coating system; Carboguard 2011SN surfacer topcoated with Carboguard 890N.

The sentence in subsection, "Description of Analyses and Evaluations," of Section 2.1.7: *"Based on the higher pressure, temperature, and accumulated dose used for the Carboguard 2011SN DBA test, this test is considered to be the most limiting DBA test,"* infers, based on the grammatical reading, that the Carboguard 2011SN DBA test is the most limiting test described in the remainder of Section 2.1.7. This was not the intended meaning. To clarify, the more limiting test denotes the 1990 DBA test and is the limiting test described in the remainder of Section 2.1.7. This administrative error was entered into the vendor's corrective action program in December 2011 and does not affect the conclusions regarding the qualification of the CR-3 containment protective coatings at EPU conditions.

The DBA test profiles identified in Figures 2.1.7-1 and 2.1.7-2, and the accumulated radiation dose of 1.80 E+08 rads cited in Section 2.1.7, were obtained from the 1990 DBA test report. The

1990 DBA protective coating test is considered a more severe test of pressure and temperature conditions than those predicted in the containment during a design basis Loss-of-Coolant Accident (LOCA) at EPU conditions. Additionally, as noted in Section 2.1.7, the accumulated radiation exposure of the 1990 DBA protective coating test is greater than the 40-year predicted accumulated radiation exposure for the EPU condition. Thus, the Service Level 1 coatings at CR-3 are qualified to withstand the containment temperature, pressure, and radiation conditions during a design basis LOCA at EPU conditions.

27. (ESGB 1-2)

On page 2.8.6.2-1 of Attachment 5 of its letter dated June 15, 2011, the licensee stated that Spent Fuel Pools A and B utilize boron carbide and Boral, respectively, as the neutron absorbing materials at CR-3. It is not clear to the staff what surveillance approach will be implemented and how it will demonstrate that the neutron absorbing materials will continue to perform their intended function. As such, please discuss in detail the surveillance approach that will be used for monitoring the neutron absorber materials, specifically the methods of neutron attenuation testing, frequency of inspection, sample size, data collection, and acceptance criteria.

Response:

The Fuel Pool Rack Neutron Absorber Monitoring Program is an existing CR-3 program that manages the effects of aging on the Carborundum (B_4C) panels located in the high density spent fuel storage racks in Spent Fuel Pool A and Boral panels located in the high density spent fuel storage racks in Spent Fuel Pool B. No change is proposed regarding a CR-3 Fuel Pool Rack Neutron Absorber Monitoring Program as part of the EPU LAR.

The details of this monitoring program, including the methods of neutron attenuation testing, frequency of inspection, sample size, data collection, and acceptance criteria, have been provided to the NRC in a CR-3 letter dated January 27, 2010 (Reference 2). Also, FPC has committed to enhance the administrative controls for the CR-3 Fuel Pool Rack Neutron Absorber Monitoring Program as part of the License Renewal LAR. To avoid duplication of NRC reviews regarding a Fuel Pool Rack Neutron Absorber Monitoring Program, FPC proposes to not address it further as part of the CR-3 EPU LAR review.

In addition, to ensure compliance with 10 CFR 50.68(b)(4) at EPU conditions, CR-3 proposes a change to the Applicability of Improved Technical Specification (ITS) 3.7.14, "Spent Fuel Pool Boron Concentration." As described in Table 1, "CR-3 Operating License and Technical Specification Technical Changes," of the CR-3 EPU LAR Attachment 1 (Reference 1), this change is made to require spent fuel pool boron concentration to be maintained $\geq$ 1925 ppm at all times while fuel assemblies are stored in the spent fuel pool to ensure both CR-3 fuel storage pools remain subcritical under CR-3 licensing basis conditions. The amount of soluble boron required to maintain the spent fuel storage rack multiplication factor, k_{eff}, $\leq$ 0.95 with the worst case misloaded fuel assembly is $\geq$ 198 ppm in Pool A and $\geq$ 571 ppm in Pool B. As such, the limit of 1925 ppm specified in ITS 3.7.14 provides adequate margin to assure k_{eff} is maintained within 10 CFR 50.68(b)(4) limits significantly reducing reliance on neutron absorbing materials within the spent fuel racks.

28. (ESGB 1-3)

In its letter dated, June 15, 2011, the licensee stated the following about the flow accelerated corrosion (FAC) program for CR-3:

> *If a component is considered susceptible to FAC but cannot be inspected, it is analytically evaluated using the CHECKWORKS Pass 2 results. The analytical predictions are then compared to actual wear rate results for actually inspected, usually adjacent, components which have the same fluid conditions. These results are used to trend the un-inspected component and if possible, a visual inspection to confirm them.*

The CHECWORKS Pass 2 analysis uses plant inspection data to refine the Pass 1 wear rate predictions. Please explain how a component can be analytically evaluated using the CHECWORKS Pass 2 results from a different component.

Response:

The purpose of a Pass 2 analysis is to adjust the values predicted by the empirical model to more closely correlate to plant inspection data. This adjustment is made by the application of the Line Correction Factor (LCF). The LCF is established by comparing the value of measured wear with the value of predicted wear within a run definition. Once the LCF for a run definition has been determined, the predicted values for inspected and un-inspected components are adjusted by the LCF. By adjusting the Pass 1 predictions to more closely approximate plant inspection data, the Pass 2 analysis provides analytical results that can be used to trend remaining life for un-inspected components.

29. (ESGB 1-4)

The FAC monitoring program includes the use of a predictive method to calculate the wall thinning of components susceptible to FAC. In order for the staff to evaluate the accuracy of these predictions, the staff requests a sample list of components for which wall thinning is predicted and measured by ultrasonic testing or other method. Include the initial wall thickness (nominal), current (measured) wall thickness, and a comparison of the measured wall thickness to the thickness predicted by the CHECWORKS FAC model.

Response:

The enclosure to this submittal, "Wear Rate Analysis: Combined Summary Report," provides a sample list of Condensate System components for which wall thinning is predicted and measured by ultrasonic testing. This list includes the initial (nominal) wall thickness, current (measured) wall thickness, and the thickness predicted by the CHECWORKS FAC model. Specifically, the enclosure provides a combined summary of the wear rate analysis for Condensate System Train A and Train B heat exchanger piping. As noted, the summary report identifies wall thicknesses for various Condensate System piping segments; example, for Component Name 111-010P (P = piping), the initial (nominal) wall thickness is 0.375 in., the current (measured) wall thickness is 0.330 in., and the thickness predicted by the CHECWORKS FAC model is 0.309 in.

References

1. CR-3 to NRC letter dated June 15, 2011, "Crystal River Unit 3 – License Amendment Request #309, Revision 0, Extended Power Uprate." (Accession No. ML112070659)

2. CR-3 to NRC letter dated January 27, 2010, "Crystal River Unit 3 - Response to Request for Additional Information for the Review of the Crystal River Unit 3, Nuclear Generating Plant, License Renewal Application (TAC NO. ME0274) and Amendment #9." (Accession No. ML100290366)

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302/LICENSE NUMBER DPR-72

ENCLOSURE

SAMPLE OF WEAR RATE ANALYSIS: COMBINED SUMMARY REPORT

Company : PROGRESS ENERGY SERVICE COMPANY
Plant : CRYSTAL RIVER
Unit : 3
DB Name: CR3SFA_CURRENT(v3)

Report Date/Time : 16-Nov-2011 09:53 am
Analysis Date/Time : 16-Nov-2011 9:53 am

CHECWORKS SFA Version: 3.0 SP-2 (build 200)

Wear Rate Analysis: Combined Summary Report

Run Name : CD CDHE-2 TO CDHE-3
Ending Period : 17A OPERATING
Total Plant Operating Hours:216776
WRA Data Option : NFA->ARD->HBD->COMP
Line Correction Factor : 0.879

Duty Factor (Global) : 1.000
Exclude Measure Wear : NO

===> Grouped by Line: CD-100 CDHE-2A to CDHE-3A, Sorted by: Flow Order

Component Name	Geom Code	Average Wear Rate (mils/yr)	Current Wear Rate (mils/yr)	Thickness (in) Init.	Thickness (in) Prd.[1]	Thickness (in) Thoop	Thickness (in) Tcrit	Comp Predict [1] Time to Tcrit (hrs)	Inspected	Total Lifetime Wear (mils) Prd.[2]	Total Lifetime Wear (mils) Meas.	In-Service Comp Wear (mils) Prd.[2]	In-Service Comp Wear (mils) Meas.	In-Service Comp Tmeas (in)[4]	Method [3]	Time (hrs)[4]	Time (hrs) Last Inspected
111-001N	31	1.765	0.735	0.500	0.476	0.235	0.235	2873850	Yes	39.4	50.0	39.4	50.0	0.480	MT	169064	169064
111-002RE	16	2.384	0.993	0.375	0.316	0.235	0.235	718450	No	0.0	0.0	0.0	0.0	0.375		0	0
111-002RE (D/S)	16	3.452	1.438	0.375	0.290	0.208	0.208	493938	No	0.0	0.0	0.0	0.0	0.375		0	0
111-003P	66	2.227	0.928	0.375	0.320	0.208	0.208	1051774	No	0.0	0.0	0.0	0.0	0.375		0	0
111-004E	2	4.120	1.717	0.375	0.273	0.208	0.208	329465	No	0.0	0.0	0.0	0.0	0.375		0	0
111-005P	52	2.784	1.160	0.375	0.306	0.208	0.208	737357	No	0.0	0.0	0.0	0.0	0.375		0	0
111-006E	2	4.120	1.717	0.375	0.273	0.208	0.208	329465	No	0.0	0.0	0.0	0.0	0.375		0	0
111-007P	52	2.784	1.160	0.375	0.306	0.208	0.208	737357	No	0.0	0.0	0.0	0.0	0.375		0	0
111-008E	2	4.120	1.717	0.375	0.273	0.208	0.208	329465	No	0.0	0.0	0.0	0.0	0.375		0	0
111-009E	4	4.120	1.717	0.375	0.273	0.208	0.208	329465	No	0.0	0.0	0.0	0.0	0.375		0	0
111-010P	54	3.564	1.485	0.375	0.309	0.208	0.208	594068	Yes	67.3	44.0	67.3	44.0	0.330	MT	103510	103510
111-011E	2	4.120	1.717	0.375	0.273	0.208	0.208	329465	No	0.0	0.0	0.0	0.0	0.375		0	0
111-012EE	19	4.455	1.856	0.375	0.332	0.208	0.208	582641	Yes	103.1	61.0	103.1	61.0	0.339	MT	185384	185384
111-012EE (D/S)	19	3.815	1.589	0.375	0.303	0.235	0.235	376980	Yes	88.3	102.0	88.3	102.0	0.309	MT	185384	185384
111-013N	30	3.886	1.619	0.500	0.404	0.235	0.235	916247	No	0.0	0.0	0.0	0.0	0.500		0	0

===> Grouped by Line: CD-101 CDHE-2B to CDHE-3B, Sorted by: Flow Order

Component Name	Geom Code	Average Wear Rate (mils/yr)	Current Wear Rate (mils/yr)	Thickness (in) Init.	Thickness (in) Prd.[1]	Thickness (in) Thoop	Thickness (in) Tcrit	Comp Predict [1] Time to Tcrit (hrs)	Inspected	Total Lifetime Wear (mils) Prd.[2]	Total Lifetime Wear (mils) Meas.	In-Service Comp Wear (mils) Prd.[2]	In-Service Comp Wear (mils) Meas.	In-Service Comp Tmeas (in)[4]	Method [3]	Time (hrs)[4]	Time (hrs) Last Inspected
108-001N	31	4.857	2.024	0.500	0.380	0.235	0.235	628935	No	0.0	0.0	0.0	0.0	0.500		0	0
108-001P	61	2.575	1.073	0.375	0.442	0.235	0.235	1697418	Yes	51.1	76.0	51.1	76.0	0.455	MT	119830	119830
108-002RE	16	2.384	0.993	0.375	0.371	0.235	0.235	1206493	Yes	47.3	54.0	47.3	54.0	0.383	MT	119830	119830
108-002RE (D/S)	16	3.452	1.438	0.375	0.387	0.208	0.208	1088056	Yes	68.5	51.0	68.5	51.0	0.404	MT	119830	119830
108-003P US	66	2.227	0.928	0.375	0.333	0.208	0.208	1176618	Yes	44.2	63.0	44.2	63.0	0.344	MT	119830	119830
108-003P DS	66	2.227	0.928	0.375	0.320	0.208	0.208	1051774	No	0.0	0.0	0.0	0.0	0.375		0	0
108-004E	2	4.120	1.717	0.375	0.273	0.208	0.208	329465	No	0.0	0.0	0.0	0.0	0.375		0	0
108-005P	52	2.784	1.160	0.375	0.306	0.208	0.208	737357	No	0.0	0.0	0.0	0.0	0.375		0	0
108-006E	2	4.120	1.717	0.375	0.273	0.208	0.208	329465	No	0.0	0.0	0.0	0.0	0.375		0	0
108-007P US	52	2.784	1.160	0.375	0.306	0.208	0.208	737357	No	0.0	0.0	0.0	0.0	0.375		0	0
108-007P DS	52	2.784	1.160	0.375	0.349	0.208	0.208	1058328	No	0.0	0.0	0.0	0.0	0.360	MT	135675	0
108-008E	2	4.120	1.717	0.375	0.347	0.208	0.208	707587	Yes	85.1	67.0	85.1	67.0	0.364	MT	135675	135675
108-009EE	19	4.455	1.856	0.375	0.371	0.208	0.208	766067	Yes	92.0	92.0	92.0	92.0	0.389	MT	135675	135675

Component Name	Geom Code	Average Wear Rate (mils/yr)	Current Wear Rate (mils/yr)	Thickness (in) Init.	Thickness (in) Prd.[1]	Thickness (in) Thoop	Thickness (in) Tcrit	Comp Predict [1] Time to Tcrit (hrs)	Inspected	Total Lifetime Wear (mils) Prd.[2]	Total Lifetime Wear (mils) Meas.	In-Service Comp Wear (mils) Prd.[2]	In-Service Comp Wear (mils) Meas.	In-Service Comp Tmeas (in)[4]	Method [3]	Time (hrs)[4]	Time (hrs) Last Inspected
108-009EE (D/S)	19	3.815	1.589	0.375	0.363	0.235	0.235	710215	Yes	78.8	65.0	78.8	65.0	0.379	MT	135675	135675
108-010N	30	3.886	1.619	0.500	0.404	0.235	0.235	916247	No	0.0	0.0	0.0	0.0	0.500		0	0

Notes:

[1] Predictions are based on last Tmeas to analysis ending period.

[2] Predictions are for the time of last known meas. wear. Can be P-to-P value depending on meas. wear method.

[3] GW = Tmeas is minimum thickness from Band, Blanket or Area Method of greatest wear.
MT = Tmeas is component minimum thickness.
PW = Tmeas is Tinit - predicted wear.
US = Tmeas is user specified.

[4] If no Tmeas has been determined from measured data, then Tmeas = Tinit and Time = current component installation time.
Tmeas is used to determine Predicted Thickness and Component Predicted Time to Tcrit.