



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

Ref: 10CFR50.90

May 22, 2009  
3F0509-07

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

Subject: Crystal River Unit 3 – License Amendment Request #303, Revision 1, Supplement 1: Revision to Final Safety Analysis Report Sections 5.4.3, “Structural Design Criteria,” and 5.4.5.3, “Missile Analysis” - Response to Request for Additional Information

Reference: Crystal River Unit 3 to NRC Letter dated April 8, 2009, “Crystal River Unit 3 – License Amendment Request #303, Revision 1: Revision to Final Safety Analysis Report Sections 5.4.3, “Structural Design Criteria,” and 5.4.5.3, “Missile Analysis” - Response to Request for Additional Information”

Dear Sir:

Florida Power Corporation (FPC), doing business as Progress Energy Florida, Inc., in accordance with 10 CFR 50.90, hereby provides a response to a request for additional information (RAI) related to License Amendment Request (LAR) #303, Revision 1. The RAI was received by electronic mail on May 12, 2009.

The amendment would change the methodology used to qualify the east wall of the Auxiliary Building. The current methodology used the methods in American Concrete Institute (ACI) standard 318-63, “Building Code Requirements for Reinforced Concrete,” June 1963. The proposed methodology is based on ACI 349-97, “Code Requirements for Nuclear Safety Related Concrete Structures,” as endorsed by the Standard Review Plan (NUREG 0800, Revision 2 – March 2007).

This License Amendment Request is being submitted per the requirements of 10 CFR 50.59, “Changes, Tests and Experiments,” as this change was determined to require prior NRC approval.

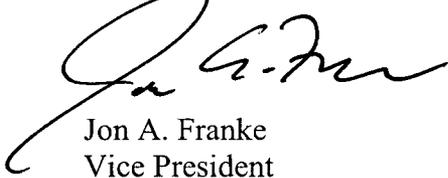
FPC is providing, in accordance with 10 CFR 50.91, a copy of the RAI response to the designated representative for the State of Florida.

This correspondence contains no new regulatory commitments.

A001  
NRR

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

Sincerely,



Jon A. Franke  
Vice President  
Crystal River Nuclear Plant

JAF/par

Attachment(s):

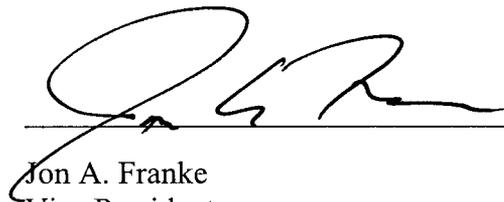
- A. Response to Request for Additional Information
- B. Calculation S07-037, Revision 2

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

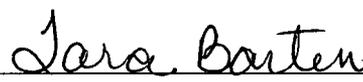
**STATE OF FLORIDA**

**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 22 day of May, 2009, by Jon A. Franke.

  
\_\_\_\_\_  
Signature of Notary Public  
State of Florida



Tara Barten  
\_\_\_\_\_  
(Print, type, or stamp Commissioned  
Name of Notary Public)

Personally Produced  
Known  -OR- Identification

**PROGRESS ENERGY FLORIDA, INC.**

**CRYSTAL RIVER UNIT 3**

**DOCKET Number 50-302 /License Number DPR-72**

**LICENSE AMENDMENT REQUEST #303, Revision 1,  
Supplement 1**

**Revision to Final Safety Analysis Report Sections 5.4.3, “Structural  
Design Criteria,” and 5.4.5.3, “Missile Analysis”**

**Attachment A**

**Response to Request for Additional Information**

### Response to Request for Additional Information

Based on an electronic mail transmission received on May 12, 2009, and a telephone conference call between the NRC Staff and Crystal River Unit 3 (CR-3) personnel, held on May 13, 2009, the following Request for Additional Information was provided to CR-3.

#### **NRC Request:**

1. *With regard to the assumed resistance-displacement relationship in Figure C.3.1, since  $M_{cr} > M_u$ , there will likely be initial distress at cracking and no progressive transition into the plastic range. Therefore, the value of  $R_m$  predicted by the yield line theory will likely be overestimated. Hence, the staff requests the licensee to predict a value of  $R_m$  that would cause the wall to crack based on  $M_{cr}$ . To account for this in the calculation, the staff requests the licensee to: (i) Calculate  $R_{m1}$  as the collapse load based on the yield line theory (using  $0.75A_s$  – which was already done), and (ii) Calculate  $R_{m2}$  to determine the load that would cause  $M_{cr}$  based on the elastic method for the uncracked section. The licensee should use  $R_m = \min(R_{m1}, R_{m2})$  for performing the response calculation under the impact load.*

#### **CR-3 Response:**

CR-3 along with consultants, Sargent & Lundy, have revised Calculation S07-0037 (included as Attachment B) to show the above requested calculation. The calculation shows a collapse load predicted by yield-line theory,  $R_{m1}$ , equal to 314 kips (Page 24 of calculation) and shows a collapse load based on the cracking moment strength of the wall,  $R_{m2}$  equal to 294 kips. As suggested by the NRC, the lesser of these two values is used in subsequent calculations. The ductility demand calculated using the lesser collapse load is determined to be 6.0 (Page 27 of calculation), which is below the limit of 10 per Section C.3.3.

#### **NRC Request:**

2. *With regard to the provision C3.1 of ACI 349-97, the staff requests the licensee to explicitly quantify the deformation (in terms displacement and rotation) based on the calculated ductility demand to make the assessment of loss of function in accordance with C.3.1 and Regulatory Position 10.1 in RG 1.142. Also, the staff requests that the licensee explicitly document the calculated strain in the rebar.*

#### **CR-3 Response:**

To respond to this question, Calculation S07-0037 has been revised to quantify the deformation of the wall in terms of both displacement and rotation. These values are outlined in CR-3's response to NRC Request #3. As shown, the calculated displacements and rotations are within code limits and there is no loss of function of the wall. CR-3 concludes the requirements of Section C.3 of ACI 349-97 are satisfied and that there is no loss of function resultant from a design basis tornado missile impact.

The calculated strain of the exterior layer of reinforcement is 0.045 in/in (Page 18 of calculation). This is well below the strain at ultimate stress for 40 ksi reinforcement bars and thus the steel remains ductile.

**NRC Request:**

3. *With regard to C3.4, the staff requests that the licensee address C3.4 in its calculation. Specifically, the staff requests the licensee to correctly calculate the maximum rotation under the impact load and compare this to min (0.0065d/c, 0.07) radians. The staff noted that the licensee's one-page follow-up calculation of rotation is in error because it does not account for the calculated ductility demand response of 5.2. The staff requests that the licensee calculate the rotation under impact load by: (i) Calculating the yield displacement,  $X_y = R_m/K$ ; (ii) Calculating the response displacement,  $X_r = \mu_d X_y$ ; and (iii) Calculating the rotation  $\theta = 2 \times \text{atan}(X_r/(L/2))$ .65*

**CR-3 Response:**

Calculation S07-0037 contains a revision showing the wall meets the requirements of ACI 349-97, Appendix C, Section C.3.4. The calculation (Page 27) shows a Yield Displacement,  $X_y$ , equal to 0.06 inches with a corresponding Response Displacement,  $X_r$ , equal to 0.38 inches when the calculated demand of 6.0 is applied. The displacement is then used to calculate a maximum anticipated rotation equal to 0.01 radians. This is below the limit of 0.07 radians per C.3.4.

**NRC Request:**

4. *The staff notes that C.3.8 applies to the wall. The licensee's calculation is based on the assumption (which was not stated) that C.3.8(b) will be satisfied. The staff requests that the licensee demonstrate that this is the case.*

**CR-3 Response:**

Since the east wall experiences both axial loads due to the floor loading above and flexure due to impactive loads, Section C.3.8 applies. Section C.3.8.b limits compressive load to  $(0.1)(f'c)(Ag)$  or one-third of that which would produce balanced design. For the east wall this calculates to 86 kip/ft (Page 22 of calculation). Based on calculations that take into account the floor framing and tributary areas, the factored compression load on the wall is 24.6 kip/ft. Since the applied loading is less than the limiting load, application of the permissible ductility ratio as prescribed by Section C.3.3 and C.3.4 of ACI 349-97 is appropriate.

**PROGRESS ENERGY FLORIDA, INC.**

**CRYSTAL RIVER UNIT 3**

**DOCKET Number 50-302 /License Number DPR-72**

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Supplement 1**

**Revision to Final Safety Analysis Report Sections 5.4.3, "Structural  
Design Criteria," and 5.4.5.3, "Missile Analysis"**

**Attachment B**

**Calculation S07-0037, Revision 2**