



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

Ref: 10 CFR 50.90

August 11, 2003
3F0803-11

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

Subject: Crystal River Unit 3 – Supplemental Information Regarding Proposed License Amendment Request #276, Revision 1, “Use of M5 Advanced Alloy Fuel Cladding and Supplemental Response to Request for Additional Information”

- References:**
- 1) PEF to NRC letter dated July 25, 2003, Crystal River Unit 3 – Proposed License Amendment Request #276, Revision 1, “Use of M5 Advanced Alloy Fuel Cladding and Response to Request for Additional Information”
 - 2) NRC to PEF letter dated May 29, 2003, “Crystal River Unit 3 – Request for Additional Information Regarding Technical Specification Change Request on the Use of M5 Advanced Alloy Fuel Cladding” (TAC No. MB6590)

Dear Sir:

In Reference 1, Progress Energy Florida, Inc. (PEF) submitted License Amendment Request (LAR) #276, Revision 1 and the response the Nuclear Regulatory Commission (NRC) request for additional information (RAI) made in Reference 2. In a teleconference between PEF and members of the NRC staff on July 31, 2003, additional information was requested regarding PEF’s response to RAI question 1. The requested additional information is provided in the attachment to this letter. This additional information regarding LAR #276 does not impact the conclusions of the No Significant Hazards Consideration Determination or the Environmental Evaluation supporting this LAR.

No new regulatory commitments are made in this letter.

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

ADD1

If you have any questions regarding this submittal, please contact Mr. Sid Powell, Supervisor, Licensing and Regulatory Programs at (352) 563-4883.

Sincerely,



Dale E. Young
Site Vice President
Crystal River Nuclear Plant

DEY/pei


Attachment: Supplemental Response to Request for Additional Information Regarding LAR #276,
Revision 1

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

STATE OF FLORIDA


COUNTY OF CITRUS

Dale E. Young states that he is the Site Vice President, Crystal River Nuclear Plant for 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.



Dale E. Young
Site Vice President
Crystal River Nuclear Plant

The foregoing document was acknowledged before me this 11th day of August, 2003, by Dale E. Young.



Signature of _____
State of Florida



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

Personally Known -OR- Produced Identification

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50 - 302 / LICENSE NUMBER DPR - 72

ATTACHMENT

LICENSE AMENDMENT REQUEST #276, REVISION 1

Use of Advanced Alloy M5 Fuel Cladding

**Supplemental Response to Request for Additional Information Regarding
LAR # 276, Revision 1**

Supplemental Response to Request for Additional Information Regarding LAR # 276, Revision 1

NRC Request:

With respect to the response to Request for Additional Information (RAI) question 1 concerning the LOCA analyses performed in support of introducing M5 cladding at Crystal River Unit 3 (CR-3) the NRC reviewer indicated that the following information is required to complete review of the M5 submittal:

1. The calculated peak clad temperatures (PCTs) for both the M5 cladding (Mark-B-HTP fuel design) and the co-resident Zr-4 cladding (Mark-B10 fuel design).
2. A statement that the LOCA EM considers both the pre-loss-of-coolant accident (LOCA) and LOCA oxidation in demonstrating compliance with 10 CFR 50.46 requirements.
3. A statement that the non-M5 fuel cladding oxidation is bounded by a number which is less than or equal to the 10 CFR 50.46 acceptance criteria of 17%.

PEF Response:

Framatome ANP (FANP) performed LOCA analyses to support all co-resident fuel being inserted into Cycle 14. This includes the fresh Mark-B-HTP fuel with M5 cladding and the Mark-B10 fuel with Zr-4 cladding. The analyses were performed using the NRC-approved Babcock and Wilcox Nuclear Technology (BWNT) LOCA Evaluation Model (BAW-10192P-A Rev. 0, Reference 1), and the associated code topical. Revision 4 of the RELAP5/MOD2-B&W code topical report (BAW-10164P-A Rev. 4, Reference 2) was approved after the completion of the Mark-B10 LOCA analyses. Therefore, the full-core Mark-B10 LOCA analyses were performed with Revision 3 (Reference 3), and the Mark-B-HTP and mixed-core LOCA analyses were performed with Revision 4. Documentation linkage between the evaluation model (EM) and the newly approved Revision 4 of the RELAP5/MOD2-B&W code topical is made through Appendix U of BAW-10179P Rev. 5 (Reference 5).

The LOCA analyses performed with the BWNT LOCA EM consider the entire lifetime of the fuel rod in determining the limiting criteria with respect to 10 CFR 50.46. The results of the LOCA analyses with respect to the five 10 CFR 50.46 criteria are summarized in Table 1 and Table 2. It should be noted that the Mark-B-HTP analyses were performed to show acceptance to 10 CFR 50.46 for that fuel design, and not to evaluate a single effect related to the introduction of M5 cladding. A description of the effect of M5 cladding may be found in the NRC-approved M5 cladding topical report (Reference 4).

The maximum local oxidation reported in Tables 1 and 2 is calculated based on the approved EM guidelines, which includes specification of a minimum pre-accident oxidation to maximize the predicted PCT. Therefore, the reported maximum local oxidation is the sum of the minimum pre-accident oxidation and the oxidation increase predicted during the LOCA transient (Large Break and Small Break LOCA) that provides the limiting PCT.

Additionally, Appendix I of the M5 cladding topical report (BAW-10227P-A, Reference 4) commits FANP to consider realistic pre-accident oxidation to ensure that the 17% criteria would

continue to be met. The realistic pre-accident oxidation is 5.5% for Mk-B-HTP fuel at 62 gigawatt day per metric ton uranium (GWd/mtU) and 12.6% for Mark-B10 fuel at 60 GWd/mtU. The maximum burnup reported corresponds to the maximum time in life considered in the LOCA analyses. When the realistic pre-accident oxidation is conservatively combined with the analyzed transient oxidation increase (maximum), the sum total also remains less than 17%. Therefore, this criterion is met for both the fresh Mark-B-HTP fuel with M5 cladding and the co-resident Mark-B10 fuel with Zr-4 cladding.

Coolable geometry is ensured when the combined effects of the fuel assembly disfiguration from the dynamic seismic plus LOCA loading and transient fuel rod swelling and rupture do not result in gross core flow blockage that prevents adequate core cooling. The analysis of the dynamic loads on the Mark-B-HTP spacer grids from a combined LOCA and seismic event predicts that there is no permanent grid deformation that alters the fluid coolant channels. In addition, the LOCA analyses predict that the assembly flow area reduction from the transient M5 cladding swell and rupture in the Mark-B-HTP assembly has considerable margin to the gross flow blockage criteria. Therefore, the calculated change in the Mark-B-HTP fuel assembly core geometry results in a fuel pin lattice that remains amenable to cooling.

Table 1: LBLOCA Analysis Results Demonstrating 10 CFR 50.46 Compliance [1]

	Whole Core		Mixed Core	
	Mark-B-HTP M5 Cladding	Mark-B10 Zr-4 Cladding	Mark-B-HTP M5 Cladding	Mark-B10 [2] Zr-4 Cladding
PCT	2050.8 °F (@17.0 kW/ft)	2010 °F (@16.2 kW/ft)	2022.2 °F (@16.8 kW/ft)	2010 °F (@16.2 kW/ft)
Maximum Local Oxidation	< 4%	< 2.5%	< 4%	< 2.5%
Whole Core H ₂ Generation	< 0.2%	< 0.3%	< 0.2%	< 0.3%
Coolable Geometry	Demonstrated	Demonstrated	Demonstrated	Demonstrated
Long Term Cooling	Demonstrated	Demonstrated	Demonstrated	Demonstrated

kW/ft=kilowatts per foot

Table 2: SBLOCA Analysis Results Demonstrating 10 CFR 50.46 Compliance [1]

	Mixed Core	
	Mark-B-HTP M5 Cladding	Mark-B10 [2] Zr-4 Cladding
PCT	1248 F (@ 17.0 kW/ft)	1415 F (@17.0 kW/ft)
Maximum Local Oxidation	< 1%	< 1%
Whole Core H ₂ Generation	< 0.1%	< 0.1%
Coolable Geometry	Demonstrated	Demonstrated
Long Term Cooling	Demonstrated	Demonstrated

Notes applicable to Tables 1 and 2:

[1] The Mark-B-HTP analyses were performed based on Revision 4 of BAW-10164P-A (Reference 2), while the Mark-B10 analyses were performed based on Revision 3 of BAW-10164P-A (Reference 3).

[2] The Mark-B10 mixed core results neglects the beneficial flow diversion from the higher resistance Mark-B-HTP assembly into the Mark-B10 assembly. Thus, the whole-core results conservatively represent the mixed-core configuration.

References

1. BAW-10192P-A Revision 0, "BWNT Loss of Coolant Accident Evaluation Model for Once-Through Steam Generator Plants," June 1998.
2. BAW-10164P-A Revision 4, "An Advanced Computer Program for LWR LOCA and Non-LOCA Transient Analysis," November 2002.
3. BAW-10164P-A Revision 3, "An Advanced Computer Program for LWR LOCA and Non-LOCA Transient Analysis," July 1996.
4. BAW-10227P-A Revision 0, "Evaluation of Advanced Cladding and Structural Material in PWR Reactor Fuel," February 2000.
5. BAW-10179P Revision 5, "Safety Criteria and Methodology for Acceptable Core Reload Analysis," December 2002.