DUKE ENERGY®

Crystal River Nuclear Plant
15760 W. Power Line Street
Crystal River, FL 34428
Docket 72-1035
Docket 50-302
Operating License No. DPR-72

10 CFR 50.54(f)

October 19, 2016
3F1016-02

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

Subject: Crystal River Unit 3 – Response to NRC Generic Letter 2016-01, Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools

Reference: NRC to CR-3 letter dated April 7, 2016, "NRC Generic Letter 2016-01: Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools" (ADAMS Accession No. ML16097A169)

Dear Sir:

On April 7, 2016, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2016-01, Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools (Reference). Pursuant to 10 CFR 50.54(f), Duke Energy Florida, LLC (DEF), hereby provides a response to Generic Letter (GL) 2016-01.

GL 2016-01 requested that addressees submit information, or provide references to previously docketed information, which demonstrates that credited neutron-absorbing materials in the Spent Fuel Pool (SFP) of power reactors and the fuel storage pool, reactor pool, or other wet locations designed for the purpose of fuel storage, as applicable, for non-power reactors, are in compliance with the licensing and design basis, and with applicable regulatory requirements; and that there are measures in place to maintain this compliance. The response required by each licensee was permitted to be based on the specific design and licensing basis applicable to the station.

The response for Crystal River Unit 3 (CR-3) is provided in the Attachment to this letter.

This letter contains no new regulatory commitments and no revisions to existing regulatory commitments on this topic have been made.

Should you have any questions regarding this response, please contact Mr. Phil Rose, Nuclear Regulatory Affairs, at (352) 563-4883.

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 19, 2016.

Sincerely,

Ronald Reising,
Senior Vice President
Operations Support

RRR/par

Attachment: Crystal River Unit 3 Response to Generic Letter 2016-01

xc: NMSS Project Manager
Regional Administrator, Region I

DUKE ENERGY FLORIDA, LLC

DOCKET NUMBER 50 - 302 / 72 - 1035
LICENSE NUMBER DPR - 72

ATTACHMENT

RESPONSE TO GENERIC LETTER 2016-01

CR-3 Response to Generic Letter 2016-01, "Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools"

On April 7, 2016, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2016-01, Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools (Reference 1). Duke Energy Florida, LLC (DEF), is providing this response to demonstrate why Crystal River Unit 3 (CR-3) belongs in response Category 3, as described in the Generic Letter, and as such only needs to refer to the evaluation in License Amendment No. 193 for the basis for our current monitoring program.

By letter dated March 13, 2013 (Reference 2), the NRC acknowledged the CR-3 certification of permanent removal of fuel from the reactor vessel pursuit to 10 CFR 50.82 (a)(1)(ii). Therefore, the 10 CFR Part 50 license for CR-3 no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel. The spent fuel assemblies stored in the CR-3 spent fuel pools (SFP) have not been in a critical reactor since September 2009.

Since CR-3 shut down for Refuel 16 in September 2009, the fuel has been decaying. Calculations performed by DEF have shown that the fuel has cooled sufficiently that significant time is available to take action if forced cooling is lost to prevent uncovering the fuel. Should water level drop due to evaporation or boiling, the boron concentration would increase providing additional margin to criticality. The pool structure and liner is a safety related, seismic Category 1 structure which is designed to withstand leakage due to a seismic event, and the pool level is alarmed such that the spent fuel pool level cannot decrease without plant staff being aware of the condition.

Spent fuel assemblies stored in the "A" SFP are contained in Carborundum racks which are monitored for degradation using a coupon monitoring program. A periodic Surveillance Test Procedure is used for monitoring and recording the results even though there is no Technical Specification requirement. Spent fuel assemblies stored in the "B" SFP are contained in BORAL racks. In Reference 3, as part of the approval for installation of the BORAL racks, CR-3 notified the NRC that no coupon monitoring program for the neutron attenuation capability would be implemented. This position was accepted as documented in the Safety Evaluation (SE) for Amendment 193 (Reference 4) based on BORAL's history of applications in SFP environments and the use of spot welding, as opposed to seal welding, in the CR-3 rack design, which permits venting of gas created by corrosion that could cause swelling. No requirements for monitoring the BORAL racks were imposed at that time. CR-3 does not have a neutron absorbing material monitoring program in the Permanently Defueled Technical Specifications (PDTS).

License Amendment No. 247 to Facility Operating License No. DPR-72 (Reference 5) revised the facility operating license and associated Technical Specifications (TSs) to conform to the permanent shutdown and defueled status of CR-3. As part of the TS change approval and as acknowledged in the SE for License Amendment 247, CR-3 agreed (Reference 6) to incorporate a regulatory commitment associated with surveillance of the spent fuel racks into the Final Safety Analysis Report (FSAR). The addition of this regulatory commitment to the FSAR was to assure that the commitment could not be changed without performing a 10 CFR 50.59 review to determine if prior NRC approval for the change to the commitment is required.

In accordance with the SE, the current CR-3 licensing basis in FSAR section 9.6.2.4, Safety Provisions, states:

> If all spent fuel assemblies have not been removed from the Spent Fuel Pool by December 31, 2019, CR3 will, prior to that date, submit an Amendment Request pursuant to 10 CFR 50.90, to incorporate BORAL and Carborundum Surveillance Programs into the CR3 Permanently Defueled Technical Specifications.

NRC acceptance of the CR-3 regulatory commitment in lieu of issuing a license condition was the subject of an internal NRC review prior to approval of the SE for License Amendment 247. As a result of this review, it was determined that the combination of information provided by CR-3 regarding the ability of the neutron absorbing material to continue to safely perform its function for the short duration it will be in service, along with the incorporation of a commitment into the FSAR, allowed staff to make a regulatory finding of its acceptability without requiring imposition of a license condition as part of the approval of the PDTS.

No change has been made to this commitment since it was approved and incorporated into the CR-3 licensing basis as part of the implementation of the CR-3 PDTS. Construction of the Independent Spent Fuel Storage Installation (ISFSI) is in progress with the current schedule date for completion of the offloading of the spent fuel pool in 2018.

The safety evaluation for License Amendment 247 also contained an assessment of continued safe operations (Section 3.8) that concluded CR-3 provided an acceptable technical rationale in Reference 7 for not needing an aging management program for the neutron absorbing materials in the SFP prior to December 31, 2019. With regard to the Carborundum neutron absorbing material in the “A” SFP, past coupon tests were extrapolated to show that the neutron poison weight loss would be expected to remain well within acceptable limits in 2023. While there is no coupon program for the “B” SFP BORAL neutron absorbing material, industry operating experience was cited that suggests that fuel can be stored safely past 2020. Recent accelerated corrosion tests of BORAL samples by the Electric Power Research Institute (EPRI) (Reference 8), which were discussed at an August 10, 2016 NRC Public Meeting (Reference 9), continue to support the conclusion that the expected loss of neutron absorbing material will not be significant over the next few years prior to transfer of the CR-3 spent fuel to dry storage. The EPRI project exposed both encapsulated and un-encapsulated BORAL coupons in test baths with similar SFP water chemistry, but at an elevated temperature of approximately 196° Fahrenheit. Measurements taken show no statistically significant change in the areal density of the BORAL coupons (encapsulated and un-encapsulated) after two years of exposure to elevated temperature.

The BORAL racks were installed in the CR-3 “B” SFP in 2001 and as such have less than 20 years exposure in the pool, and will still have less than 20 years exposure when all fuel is removed and placed into the ISFSI. EPRI Report 1025204, “Strategy for Managing the Long Term Use of BORAL in Spent Fuel Pools,” July 2012, concludes that there has been no reported surveillance data or observed cases where there has been significant loss or redistribution of B-10 from BORAL. Also, no mechanisms have been identified or observed that would lead to severe degradation of the BORAL core material. CR-3 specific operating experience with BORAL coupled with industry performance cited in the EPRI document, provide reasonable assurance that the spent fuel in the “B” SFP can be safely stored beyond 2020.

Additionally, in accordance with CR-3 Maintenance Rule requirements for monitoring spent fuel rack health, when a 100% visual inspection of all spent fuel assemblies stored in the SFPs was performed in 2015, an assessment was performed of the potential for rack degradation (blistering or swelling of the neutron moderator material). As part of the visual inspection process, each fuel assembly was temporarily removed from its storage location. Any assembly that was difficult to remove from the rack was evaluated to assure that there was not an interference present that could be associated with deformation of the rack's neutron moderator material. All fuel assemblies that were difficult to remove were found to be the result of deformation of the fuel assembly itself (i.e. bowing or twisting) that occurred during previous years of operation. No indication of rack deformation was identified during the spent fuel assembly inspections.

CR-3 PDTS 3.7.14, "Spent Fuel Pool Boron Concentration," requires that the SFP boron concentration be greater than 1925 ppm during fuel movement to maintain margin to criticality in case of a fuel miss-loading event. The SE for Amendment 193 stated that the fuel is normally about 25 percent subcritical when stored with at least 1925 ppm of soluble boron in the pool water, as required by TS 3.7.14. This minimum concentration is verified weekly under a surveillance test procedure. The current boron concentration is consistently maintained at greater than 2700 ppm and the boron concentration will be increased prior to dry shielded canister (DSC) loading to approximately 3250 ppm to comply with the license requirements for the DSC design purchased for use at CR-3. The elevation of boron level in the SFPs is scheduled to begin in 2016 in preparation for loading DSCs in 2017. This additional shutdown margin is not credited in the steady state spent fuel storage rack criticality analysis, but provides further assurance that spent fuel will remain safely stored until its transition to dry storage is complete in 2018.

Conclusion

DEF believes that CR-3 belongs in response Category 3 for the following reasons:

Category 3 is described in the GL as power reactor licensees that have incorporated their neutron absorbing monitoring programs into their licensing basis through an NRC-approved TS change or license condition. The NRC SE for Amendment 247 acknowledges that the regulatory commitment made is to be inserted into the CR-3 licensing basis as part of implementing the TS amendment and did not have to be a License Condition to be effective. No changes to the CR-3 SFP neutron absorber monitoring program have been made since the approval of the commitment in Amendment No. 147 (Reference 5).

Additionally, adequate justification is provided to assure that the CR-3 SFPs will remain in a safe condition through the removal of all spent fuel assemblies from the pools prior to the end of 2019.

References

1. NRC to CR-3 letter dated April 7, 2016, "NRC Generic Letter 2016-01: Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools" (ADAMS Accession No. ML16097A169)

2. NRC to CR-3 letter dated March 13, 2013, "Crystal River Unit 3 Nuclear Generating Plant Certification of Permanent Cessation of Operation and Permanent Removal of Fuel from the Reactor" (ADAMS Accession No. ML13058A380)

3. CR-3 to NRC letter dated September 16, 1999, "License Amendment Request #239, Revision 0, Enhanced Spent Fuel Storage" (ADAMS Accession No. 9909210126)

4. NRC to CR-3 letter dated September 13, 2000, "Crystal River Unit 3 – Issuance of Amendment Regarding Spent Fuel Pool Storage Capacity Increase" (Adams Accession No. ML003752886)

5. NRC to CR-3 letter dated September 4, 2015, "Crystal River Unit 3 Nuclear Generating Plant – Issuance of Amendment for Permanently Shutdown and Defueled Operating License and Technical Specifications" (ADAMS Accession No. ML15224B286)

6. NRC to CR-3 letter dated January 8, 2015, "Crystal River Unit 3 Nuclear Generating Plant – Request for Additional Information Regarding the Transition to the Defueled License and Technical Specifications" (ADAMS Accession No. ML14274A139)

7. CR-3 to NRC letter dated March 6, 2015, "Response to Requests for Additional Information and Supplement 3 to License Amendment Request #316, Revision 0" (Adams Accession No. ML15076A035)

8. ANS Winter 2016 Meeting, EPRI Publication, "Accelerated Corrosion Tests to Evaluate Long-Term Performance of BORAL in Spent Fuel Pools," Hatice Akkurt, Ashleigh Quigley, Matt Harris

9. NRC Public Meeting to discuss NEI 16-03, August 10, 2016, EPRI Neutron Absorber Projects-Zion and Accelerated Corrosion Tests, Powerpoint Presentation (Adams Accession No. ML16221A182)

10. CR-3 to NRC letter dated October 29, 2013, "Crystal River Unit 3 – License Amendment Request #316, Revision 0, Revise and Remove License Conditions and Revision to Improved Technical Specifications to Establish Permanently Defueled Technical Specifications" (ADAMS Accession No. ML13316C083)