FPL

May 24, 2018

L-2018-108
10 CFR 50.68
10 CFR 50.54(f)

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

Re: St. Lucie Units 1 and 2
Docket Nos. 50-335 and 50-389

Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251

Subject: Response to Request for Supplemental Information Generic Letter 2016-01, "Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools"

References:

1. Letter from U.S. Nuclear Regulatory Commission, "NRC Generic Letter 2016-01: Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools," April 7, 2016. (ML16097A169)
2. Letter from L. Nicholson (NextEra Energy) to U.S. Nuclear Regulatory Commission, "Response to Generic Letter 2016-01, "Monitoring of Neutron Absorbing Materials in Spent Fuel Pools," Response to NRC Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f)," L-2016-188, November 3, 2016. (ML16312A050)
3. Letter from U.S. Nuclear Regulatory Commission, "Generic Letter 2016-01, Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools – Request for Supplemental Information," December 18, 2017. (ML17304B153)
4. EPRI Report 3002013119, "Evaluation of the Impact of Neutron Absorber Material Blistering and Pitting on Spent Fuel Pool Reactivity," May 2018.
5. EPRI Report 3002013122, "Roadmap for the Industrywide Learning Aging Management Program (i-LAMP)," May 2018.
6. EPRI Report 1021052, "Overview of BORAL® Performance Based Upon Surveillance Coupon Measurements," December 2010.

On April 7, 2016, the NRC issued Generic Letter 2016-01, "Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools" (Reference 1). Florida Power & Light/NextEra Energy provided the required response on November 3, 2016 (Reference 2). The response provided the information requested for each of the units in the NextEra Energy nuclear fleet.

On December 18, 2017, the NRC staff issued a request for supplemental information to a selected group of plants (Reference 3). This letter documents responses to the NRC request for supplemental information for St. Lucie, Units 1 and 2 and Turkey Point, Units 3 and 4. The responses are based on a template that was developed by the industry, compiled by NEI. The responses rely on three EPRI reports (References 4 - 6), and are provided in the enclosure to this letter.

A158
NRR

In reference to this request, CAC Nos. MF9421, MF9422, MF9412, MF9413, and the EPID numbers are as listed below for each site:

Plant	Incoming Letter	CAC No(s).	EPID
St. Lucie Units 1 and 2	ML16312A050	MF9421 MF9422	L-2016-LRC-0001
Turkey Point Units 3 and 4	ML16312A050	MF9412 MF9413	L-2016-LRC-0001

This letter contains no new or revised regulatory commitments.

Should there be any questions, please contact Steve Catron at (561) 304-6206.

for

Larry Nicholson
Nuclear Licensing and Regulatory Compliance Director

Enclosures (2)

ENCLOSURE 1
St. Lucie Units 1 and 2
NRC Generic Letter 2016-01
Responses to Request for Supplemental Information

Enclosure 1
Responses to NRC Request for Supplemental Information

The NRC request for supplemental information consists of two questions, but only the first one is applicable to St. Lucie.

St. Lucie Units 1 and 2

Generic-Boral-RAI-1

Title 10 of the Code of Federal Regulations (10 CFR) Section 50.68, "Criticality accident requirements," and 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 62, "Prevention of criticality in fuel storage and handling," provide the requirements for licensees with regard to maintaining subcriticality in the spent fuel pool (SFP). For licensees that utilize neutron absorbing materials (NAM) in the SFP, the boron-10 (^{10}B) areal density (AD) of the NAM must be known so that the assumption for the ^{10}B minimum AD in the SFP nuclear criticality safety (NCS) analysis of record (AOR) is supported. In order for the NRC staff to verify the requirements of 10 CFR 50.68 and GDC 62 are met, the staff needs to ensure that licensees are taking appropriate action to confirm that the ^{10}B AD of their NAM can reasonably be expected to remain above the minimum assumed in the SFP NCS AOR. In addition, the condition of the NAM must be considered in the SFP NCS AOR. In order to verify whether or not the requirements of 10 CFR 50.68 and GDC 62 will continue to be met, the staff needs to verify that the potential reactivity changes due to degradation or physical changes to the NAM are accounted for in the SFP NCS AOR. This includes any changes that would affect the neutron spectrum for the SFP in addition to any loss of neutron attenuation capability.

Industry operating experience, as described in Information Notice (IN) 2009-26, "Degradation of Neutron Absorbing Materials in the Spent Fuel Pool," dated October 28, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML092440545), and IN 1983-29, "Fuel Binding Caused by Fuel Rack Deformation," dated May 6, 1983 (ADAMS Accession No. ML14043A291), has demonstrated that certain manufacturing processes and plant conditions (dose, chemistry, length of time installed, and installation configuration) have resulted in material deformation as a result of blisters or bulging associated with Boral.

St. Lucie Plant, Units 1 and 2, does not have a site-specific monitoring program, and consequently, is relying on general industry operating experience as a surrogate for the condition of the Boral installed in the SFP.

a. Please describe whether industry operating experience bounds the condition of the Boral at St. Lucie Plant, Units 1 and 2, thereby ensuring that any degradation or deformation that may affect the Boral at St. Lucie Plant, Units 1 and 2, is identified.

Enclosure 1
Responses to NRC Request for Supplemental Information

RESPONSE:

Through its Nuclear Safety Culture, procedures, and processes, St. Lucie Plant, Units 1 and 2, systematically and effectively collects, evaluates, and implements relevant internal and external operating experience (OE) in a timely manner. Issues emerging from the use of Boral in the spent fuel racks are monitored through the St. Lucie Plant, Units 1 and 2, OE Program and Corrective Action Program.

As indicated in the original Generic Letter response for St. Lucie Plant, Units 1 and 2, the site will continue to monitor industry OE related to Boral, which includes ongoing participation in the EPRI Neutron Absorber Users Group (NAUG) and its related programs (e.g., industrywide learning aging management). Industry-wide, to date there have been no indications of a loss of Boral material of a nature that diminished the neutron-absorbing capability of the Boral (EPRI Report 1021052). St. Lucie Plant, Units 1 and 2, follows the EPRI Water Chemistry Control Program and there have been no indications of a loss of Boral neutron-absorbing capabilities at a plant following the guidelines. In addition, to date there are no plant-specific operating conditions or rack attributes that would merit concern that the St. Lucie Plant, Units 1 and 2, spent fuel racks or SFP environment are not bounded by the industry-wide OE. Finally, EPRI Report 3002013119 documents that observed or foreseen degradation or deformation of the Boral has an insignificant impact on SFP criticality. The industry OE aligns with the St. Lucie Plant, Units 1 and 2, licensing basis.

The NAUG, through EPRI, is currently developing an industrywide program/database to aid in monitoring indications of potential Boral degradation and deformation. Over 70,000 water chemistry data points have been collected to date, from over 30 SFPs, for this program. Surveillance data from 50 coupons across 25 SFPs has also been collected to date. The program, supported by EPRI NAUG and industry participants, is described in EPRI document 3002013122 and includes insights and feedback received from numerous communications with the NRC. Relevant issues emerging from this industry effort will be monitored through the St. Lucie Plant, Units 1 and 2, OE Program and Corrective Action Program.

The St. Lucie Plant, Units 1 and 2 criticality analyses only credit Boral in the cask pit racks. As noted in the original response to Generic Letter 2016-01 (NextEra Energy Letter L-2016-188, ML16312A050), these racks were installed in 2004 for Unit 1 and 2006 for Unit 2. The original response also notes that these racks are primarily used during refueling outages; in between outages, the racks are left nearly empty in the spent fuel pool. Just prior to outages, fresh fuel is loaded into these racks. Therefore, in terms of implementation date and dose, these racks have considerable margin to the rest of the industry.

b. In addition, discuss the criticality impact due to relevant material deformation identified in general industry operating experience, and whether it can be accommodated by the NCS AOR for St. Lucie Plant, Units 1 and 2, without exceeding NRC subcriticality requirements.

Enclosure 1
Responses to NRC Request for Supplemental Information

RESPONSE:

To date, the industry OE has revealed no instances of an impact on SFP criticality due to observed Boral deformation (e.g. blistering) or degradation (e.g. pitting). The NAUG, through EPRI, has recently completed a study (EPRI Report 3002013119) which analyzes the criticality impact of blisters and pits on Boral. Simulations were performed for varying enrichment, burnup, areal density values, at unborated conditions (0 ppm), which is conservative for PWRs such as St. Lucie Plant, Units 1 and 2. The study results demonstrate that pitting and blistering, on a scale much larger than any that has been observed in the industry OE, has an insignificant impact on SFP criticality. Therefore, the SFP criticality safety analysis of record remains applicable.

Furthermore, the St. Lucie Plant, Units 1 and 2 criticality analysis for the Boral cask pit racks have margin to the regulatory limit. For Unit 1, the rack can be fully loaded with fuel of the maximum allowed enrichment, and that results in a rack k_{eff} of 0.9190. Unit 2 allows two different configurations; the 2 out of 4 configuration has a rack k_{eff} of 0.8126, whereas the 3 out of 4 configuration has a rack k_{eff} of 0.9900. All rack k_{eff} noted are for the unborated cases, after including all biases and uncertainties.

ENCLOSURE 2
Turkey Point Units 3 and 4
NRC Generic Letter 2016-01
Responses to Request for Supplemental Information

Enclosure 2
Responses to NRC Request for Supplemental Information

The NRC request for supplemental information consists of two questions, but only the first one is applicable to Turkey Point.

Turkey Point Units 3 and 4

Generic-Boral-RAI-1

Title 10 of the Code of Federal Regulations (10 CFR) Section 50.68, "Criticality accident requirements," and 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 62, "Prevention of criticality in fuel storage and handling," provide the requirements for licensees with regard to maintaining subcriticality in the spent fuel pool (SFP). For licensees that utilize neutron absorbing materials (NAM) in the SFP, the boron-10 (^{10}B) areal density (AD) of the NAM must be known so that the assumption for the ^{10}B minimum AD in the SFP nuclear criticality safety (NCS) analysis of record (AOR) is supported. In order for the NRC staff to verify the requirements of 10 CFR 50.68 and GDC 62 are met, the staff needs to ensure that licensees are taking appropriate action to confirm that the ^{10}B AD of their NAM can reasonably be expected to remain above the minimum assumed in the SFP NCS AOR. In addition, the condition of the NAM must be considered in the SFP NCS AOR. In order to verify whether or not the requirements of 10 CFR 50.68 and GDC 62 will continue to be met, the staff needs to verify that the potential reactivity changes due to degradation or physical changes to the NAM are accounted for in the SFP NCS AOR. This includes any changes that would affect the neutron spectrum for the SFP in addition to any loss of neutron attenuation capability.

Industry operating experience, as described in Information Notice (IN) 2009-26, "Degradation of Neutron Absorbing Materials in the Spent Fuel Pool," dated October 28, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML092440545), and IN 1983-29, "Fuel Binding Caused by Fuel Rack Deformation," dated May 6, 1983 (ADAMS Accession No. ML14043A291), has demonstrated that certain manufacturing processes and plant conditions (dose, chemistry, length of time installed, and installation configuration) have resulted in material deformation as a result of blisters or bulging associated with Boral.

Turkey Point Nuclear Generating, Units 3 and 4, does not have a site-specific monitoring program, and consequently, is relying on general industry operating experience as a surrogate for the condition of the Boral installed in the SFP.

a. Please describe whether industry operating experience bounds the condition of the Boral at Turkey Point Nuclear Generating, Units 3 and 4, thereby ensuring that any degradation or deformation that may affect the Boral at Turkey Point Nuclear Generating, Units 3 and 4, is identified.

RESPONSE:

Through its Nuclear Safety Culture, procedures, and processes, Turkey Point Nuclear Generating, Units 3 and 4, systematically and effectively collects, evaluates, and implements relevant internal and external operating experience (OE) in a timely manner. Issues emerging from the use of Boral in the spent fuel racks are monitored through the Turkey Point Nuclear Generating, Units 3 and 4, OE Program and Corrective Action Program.

As indicated in the original Generic Letter response for Turkey Point Nuclear Generating, Units 3 and 4, the site will continue to monitor industry OE related to Boral, which includes ongoing participation in the EPRI Neutron Absorber Users Group (NAUG) and its related programs (e.g., industrywide learning aging management). Industry-wide, to date there have been no indications of a loss of Boral material of a nature that diminished the neutron-absorbing capability of the Boral (EPRI Report 1021052). Turkey Point Nuclear Generating, Units 3 and 4, follows the EPRI Water Chemistry Control Program and there have been no indications of a loss of Boral neutron-absorbing capabilities at a plant following the guidelines. In addition, to date there are no plant-specific operating conditions or rack attributes that would merit concern that the Turkey Point Nuclear Generating, Units 3 and 4, spent fuel racks or SFP environment are not bounded by the industry-wide OE. Finally, EPRI Report 3002013119 documents that observed or foreseen degradation or deformation of the Boral has an insignificant impact on SFP criticality. The industry OE aligns with the Turkey Point Nuclear Generating, Units 3 and 4, licensing basis.

The NAUG, through EPRI, is currently developing an industrywide program/database to aid in monitoring indications of potential Boral degradation and deformation. Over 70,000 water chemistry data points have been collected to date, from over 30 SFPs, for this program. Surveillance data from 50 coupons across 25 SFPs has also been collected to date. The program, supported by EPRI NAUG and industry participants, is described in EPRI document 3002013122 and includes insights and feedback received from numerous communications with the NRC. Relevant issues emerging from this industry effort will be monitored through the Turkey Point Nuclear Generating, Units 3 and 4, OE Program and Corrective Action Program.

The Turkey Point Nuclear Generating, Units 3 and 4 criticality analyses only credit Boral in the cask pit racks. As noted in the original response to Generic Letter 2016-01 (NextEra Energy Letter L-2016-188, ML16312A050), these racks were both installed in 2004. The original response also notes that these racks are primarily used during refueling outages; in between outages, the racks are left nearly empty in the spent fuel pool. Just prior to outages, fresh fuel is loaded into these racks. Therefore, in terms of implementation date and dose, these racks have considerable margin to the rest of the industry.

b. In addition, discuss the criticality impact due to relevant material deformation identified in general industry operating experience, and whether it can be accommodated by the NCS AOR for Turkey Point Nuclear Generating, Units 3 and 4, without exceeding NRC subcriticality requirements.

RESPONSE:

To date, the industry OE has revealed no instances of an impact on SFP criticality due to observed Boral deformation (e.g. blistering) or degradation (e.g. pitting). The NAUG, through EPRI, has recently completed a study (EPRI Report 3002013119) which analyzes the criticality impact of blisters and pits on Boral. Simulations were performed for varying enrichment, burnup, areal density values, at unborated conditions (0 ppm), which is conservative for PWRs such as Turkey Point Nuclear Generating, Units 3 and 4. The study results demonstrate that pitting and blistering, on a scale much larger than any that has been observed in the industry OE, has an insignificant impact on SFP criticality. Therefore, the SFP criticality safety analysis of record remains applicable.

Furthermore, the Turkey Point Nuclear Generating, Units 3 and 4 criticality analysis for the Boral cask pit racks have margin to the regulatory limit. For both units, the rack can be fully loaded with fuel of the maximum allowed enrichment, and that results in an unborated rack k_{eff} of 0.9735, after including all biases and uncertainties.