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10 CFR 50.54(f)

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

MCGUIRE NUCLEAR STATION, UNIT NOS. 1 AND 2
DOCKET NOS. 50-369, 50-370 / RENEWED LICENSE NOS. NPF-9 AND NPF-17

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325, 50-324 / RENEWED LICENSE NOS. DPR-71 AND DPR-62

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1
DOCKET NO. 50-400 / RENEWED LICENSE NO. NPF-63

**SUBJECT: RESPONSE TO REQUEST FOR SUPPLEMENTAL INFORMATION
REGARDING DUKE ENERGY'S RESPONSE TO GL 2016-01 MONITORING OF
NEUTRON-ABSORBING MATERIALS IN SPENT FUEL POOLS**

REFERENCES:

1. NRC Generic Letter 2016-01, *Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools*, dated April 7, 2016 (ADAMS Accession No. ML16097A169)
2. Duke Energy Letter, *Response to NRC GL 2016-01 Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools*, dated October 31, 2016 (ADAMS Accession No. ML16306A036)
3. NRC Letter, *Brunswick Steam Electric Plant, Units 1 and 2; Shearon Harris Nuclear Power Plant, Unit 1; and McGuire Nuclear Station, Units 1 and 2 - Requests for Supplemental Information Regarding Generic Letter 2016-01, "Monitoring of Neutron-Absorbing Materials In Spent Fuel Pools"* (CAC Nos. MF9920, MF9452, MF9437, MF9919, and MF9432; EPID L-2016-LRC-0001), dated November 20, 2017 (ADAMS Accession No. ML17307A330)

Ladies and Gentlemen:

On April 7, 2016, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2016-01 (Reference 1) to collect information from licensees regarding neutron-absorbing material in the Spent Fuel Pool (SFP). In Reference 2, Duke Energy Progress, LLC and Duke Energy Carolinas, LLC, referred to henceforth as "Duke Energy", provided the Reference 1 requested information for, in part, McGuire Nuclear Station, Unit Nos. 1 and 2 (MNS), Brunswick Steam Electric Plant, Unit Nos. 1 and 2 (BSEP), and Shearon Harris Nuclear Power Plant, Unit 1 (HNP). In Reference 3, the NRC requested additional/supplemental information (RAI) for the

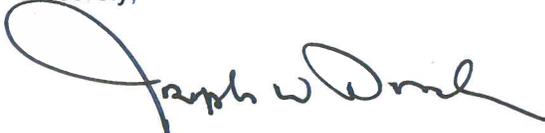
Reference 2 letter, specifically related to HNP, BSEP, and MNS. Attachments 1, 2, and 3 provide Duke Energy's response to Reference 3.

This submittal contains no new regulatory commitments. Should you have any questions concerning this letter, or require additional information, please contact Art Zaremba, Manager – Nuclear Fleet Licensing, at 980-373-2062.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on May 30, 2018.

Sincerely,

A handwritten signature in black ink, appearing to read "Joseph W. Donahue". The signature is fluid and cursive, with a large initial "J" and "D".

Joseph Donahue
Vice President – Nuclear Engineering

JBD

Attachments:

1. Response to Request for Supplemental Information, McGuire Nuclear Station (MNS)
2. Response to Request for Supplemental Information, Brunswick Steam Electric Plant (BSEP)
3. Response to Request for Supplemental Information, Shearon Harris Nuclear Power Plant (HNP)

cc: (all with Attachments unless otherwise noted)

C. Haney, Regional Administrator USNRC Region II
G. A. Hutto, III, USNRC Senior Resident Inspector – MNS
G. Smith, USNRC Senior Resident Inspector – BSEP
J. Zeiler, USNRC Senior Resident Inspector – HNP
M. Mahoney, NRR Project Manager – MNS
D. Galvin, NRR Project Manager – BSEP
M. C. Barillas, NRR Project Manager – HNP

Attachment 1
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Attachment 1

**Response to Request for Supplemental Information,
McGuire Nuclear Station (MNS)**

MNS Request for Supplemental Information (MNS-1):

The Duke Energy response to Question (2) in GL 2016-01 states that MNS only performs visual examinations of the Boral coupons in the SFP (i.e., no physical measurements or neutron attenuation testing).

Describe how the visual examinations provide assurance that the Boral material has not lost attenuation capability, ^{10}B content, weight, or density.

Duke Energy Response:

The biannual visual examination was to detect physical degradation of the coupons. The intent was that once degradation was observed, the corrective action program would drive further solutions. Duke Energy is implementing an updated monitoring program to satisfy its requirements for license renewal.

The updated monitoring program generally follows the recommendations in NEI 16-03-A, "Guidance for Monitoring of Fixed Neutron Absorbers in Spent Fuel Pools" and is documented in the MNS UFSAR as an aging management program. Boral coupons, one from each unit, will be pulled from the coupon tree and sent to a vendor to perform various tests and examinations, which include dimensional measurements, weight and density measurements, pit and blister characterization, and neutron attenuation measurements. The acceptance criteria for these tests will include physical and B-10 requirements to provide assurance that the Boral in region 1 of McGuire's spent fuel pools can perform its safety function.

Duke Energy will initially pull one Boral coupon from each unit's SFP on or before December 31, 2019. The results of the tests will be used to determine the frequency of future coupon testing, not to exceed 10 years. Any unsatisfactory results will require entry in the corrective action program for evaluation and, if necessary, remediation.

Finally, as indicated in the original Generic Letter response for McGuire, the site will continue to monitor industry operating experience (OE) related to Boral, including participation in the Electric Power Research Institute (EPRI) Neutron Absorber Users Group (NAUG) and its related programs (e.g., industrywide learning aging management).

Attachment 2
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Attachment 2

**Response to Request for Supplemental Information,
Brunswick Steam Electric Plant (BSEP)**

BSEP Request for Supplemental Information:

BSEP 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 how industry operating experience bounds the condition of the Boral at BSEP, thereby providing assurance that any degradation or deformation that may affect the Boral at BSEP is identified.*
- b. *In addition, please discuss the criticality impact due to relevant material deformation identified in general industry operating experience, and how it can be accommodated by the [nuclear criticality safety analysis of record] for BSEP without exceeding NRC subcriticality requirements.*

Duke Energy Response:

Response to Part (a)

Through its Nuclear Safety Culture, procedures, and processes, BSEP 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 BSEP OE Program and Corrective Action Program.

As indicated in the original Generic Letter response for BSEP, the site will continue to monitor industry OE related to Boral, which includes ongoing participation in the EPRI NAUG and its related programs (e.g., industrywide learning aging management). Industrywide, 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, Reference BRef-1). BSEP 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 BSEP spent fuel racks or SFP environment are not bounded by the industrywide OE. Finally, EPRI Report 3002013119 (Reference BRef-2) documents that observed or foreseen degradation or deformation of the Boral has an insignificant impact on SFP criticality. The industry OE aligns with the BSEP licensing basis.

The NAUG, through EPRI, is currently developing an industrywide program/database to aid in monitoring indications of potential Boral degradation and deformation. Tens of thousands of water chemistry data points have been collected to date, from multiple SFPs across the industry, for this program. Surveillance data from coupons across more than twenty SFPs have also been collected to date. The program, supported by EPRI NAUG and industry participants, is described in EPRI Report 3002013122 (Reference BRef-3) and includes insights and feedback received from numerous communications with the NRC. Relevant issues emerging from this industry effort will be monitored through the BSEP OE Program and Corrective Action Program.

Response to Part (b)

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, Reference BRef-2) which analyzes the criticality impact of blisters and pits on Boral. Simulations were performed at unborated conditions (i.e., 0 ppm) to ensure applicability to BWRs such as BSEP. 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.

BSEP Response References:

- BRef-1. EPRI Report 1021052, *Overview of BORAL Performance Based Upon Surveillance Coupon Measurements*, December 2010
- BRef-2. EPRI Report 3002013119, *Evaluation of Impact of Blisters and Pits in Neutron Absorber Panels on Spent Fuel Pool Reactivity*, May 2018
- BRef-3. EPRI Report 3002013122, *Roadmap for Industrywide Learning Aging Management Program (i-LAMP)*, May 2018

Attachment 3
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Attachment 3

**Response to Request for Supplemental Information,
Shearon Harris Nuclear Power Plant (HNP)**

HNP Request for Supplemental Information (HNP-1):

In the response to Question 2)a) of GL 2016-01 regarding racks using Boral, Duke Energy describes the monitoring of Boral coupons for one set of racks but then states there is currently not a commitment to have a Boral coupon monitoring program. Regarding the several racks using Boral at HNP that do not have coupons installed specifically for those racks, the response states that coupons installed under EC package 95-00278 are used as an indicator of neutron absorber performance. In addition, the response states, "Industry operating experience is used to assess impact on neutron absorber material [Boral]."

For racks using Boral:

- 1. Clarify whether the Boral coupon monitoring described in the response is an ongoing program used to confirm that the credited neutron-absorbing material is performing its safety function.*
- 2. Describe how the combination of surrogate coupons, and industry operating experience, is used to inform the condition of the Boral given that there does not appear to be a formal Boral monitoring program in place, and only one set of coupon data is available.*
- 3. Describe how the surrogate coupons are representative (or bounding) of the other racks given the coupons were installed 6 years after one rack, and some of the racks hold different fuel types that may subject the Boral to different conditions in the SFP.*

This information is requested to provide assurance that any degradation or deformation that may affect the Boral at HNP is detected.

In addition, please discuss the criticality impact due to relevant material deformation identified in general industry operating experience, and how it can be accommodated by the [nuclear criticality safety analysis of record] for HNP without exceeding NRC subcriticality requirements.

Duke Energy Response:

Response to Part (1)

The Boral coupon monitoring is an ongoing program at HNP performed in accordance with site technical procedures. The Boral coupon monitoring includes the items described in the original Generic Letter response to item (2)(a)(ii). As such, the coupon monitoring program is used to confirm the Boral is performing its intended function. Any unsatisfactory results from the monitoring require entry in the Corrective Action program for evaluation and remediation as necessary.

Response to Part (2)

As described above, HNP does have a formal Boral monitoring program in place. As described in the original Generic Letter response, the earliest installation of Boral at HNP occurred six years prior to the installation that included coupons. Both installations of Boral were produced by the same manufacturer, have similar physical characteristics, and have similar fuel resident within them, as described in the original Generic Letter response. In addition, based on the industrywide OE related to Boral to-date, and based on information such as the EPRI accelerated corrosion testing on Boral that has been performed, the six year difference is judged to be negligible in terms of impact on the material.

As indicated in the original Generic Letter response for HNP, the site will continue to monitor industry operating experience (OE) related to Boral, including ongoing participation in the EPRI

NAUG and its related programs (e.g., industrywide learning aging management). Industry OE provides another indicator of overall Boral performance and supplements the formal Boral monitoring program.

Response to Part (3)

As noted above, the first two installations of Boral at HNP, although six years apart, contain similar fuel, and the material was produced by the same manufacturer and has similar physical characteristics. The racks were manufactured to the same design specification and requirements. In addition, based on the industrywide OE related to Boral to-date, and based on information such as the EPRI accelerated corrosion testing on Boral that has been performed, the six year difference is judged to be negligible in terms of impact on the material. To date, there are no plant-specific operating conditions or rack attributes that would merit concern that the HNP spent fuel racks or SFP environment are not bounded by the industrywide OE. As described in the original Generic Letter response to questions (1)(a) and (2)(a), different fuel resides in the Boral racks installed subsequent to the Boral racks with coupons. The differences in fuel characteristics (such as reactivity and enrichments, BWR or PWR) are not significant enough amongst the SFP racks with Boral material installed subsequent to the installation with coupons to warrant any concern the coupons are not representative of the other Boral racks.

For all the Boral racks, both with and without coupons, HNP will continue to monitor industry OE related to Boral, including ongoing participation in the EPRI NAUG and its related programs (e.g., industrywide learning aging management). The NAUG is currently developing an industrywide program/database to aid in monitoring indications of potential Boral degradation and deformation. Tens of thousands of water chemistry data points have been collected to date, from multiple SFPs across the industry, for this program. Surveillance data from coupons across more than twenty SFPs have also been collected to date. The program, supported by EPRI NAUG and industry participants, is described in EPRI Report 3002013122 (Reference HRef-2) and includes insights and feedback received from numerous communications with the NRC. Relevant issues emerging from this industry effort will be monitored through the HNP OE Program and Corrective Action Program.

Response to Last Paragraph

To date, 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, Reference HRef-1) which analyzes the criticality impact of blisters and pits on Boral. Simulations were performed at conditions (i.e., 0 ppm with PWR lattices) to ensure applicability to both BWRs and PWRs. 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.

HNP Response References:

- HRef-1. EPRI Report 3002013119, *Evaluation of Impact of Blisters and Pits in Neutron Absorber Panels on Spent Fuel Pool Reactivity*, May 2018
- HRef-2. EPRI Report 3002013122, *Roadmap for Industrywide Learning Aging Management Program (i-LAMP)*, May 2018