UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 8, 2019

Mr. Thomas D. Ray
Vice President
McGuire Nuclear Station
Duke Energy Carolinas, LLC
12700 Hagers Ferry Road
Huntersville, NC 28078-8985

SUBJECT: MCGUIRE NUCLEAR STATION, UNITS 1 AND 2 - STAFF EVALUATION RELATED TO REACTOR VESSEL INTERNALS INSPECTION PLAN BASED ON MRP-227-A (EPID L-2017-LLA-0414)

Dear Mr. Ray:

By letter dated December 13, 2017, as supplemented by letters dated May 9, 2018 and January 30, 2019, Duke Energy Carolinas, LLC submitted to the U.S. Nuclear Regulatory Commission for review and approval of Aging Management Program (AMP) and Inspection Plan for the McGuire Nuclear Station (McGuire), Units 1 and 2, Reactor Vessel Internals (RVIs).

MRP-227-A, "Pressurized Water Reactor (PWR) Internals Inspection and Evaluation [I&E] Guidelines," and its supporting reports were used as the technical bases for developing the McGuire RVI AMP and Inspection Plan. This submittal is to fulfill the inspection commitment in Section 18.2.23 of the McGuire Updated Final Safety Analysis Report (UFSAR), which was originated from License Renewal Commitment 14 for McGuire, as documented in Appendix D of NUREG-1772, "Safety Evaluation Report Related to the License Renewal of McGuire Nuclear Station, Units 1 and 2, and Catawba Nuclear Station, Units 1 and 2." The AMP includes inspection and evaluation guidelines for the RVI components at McGuire, during the period of extended operation.

The NRC staff has reviewed the inspection plan for the McGuire RVI AMP and Inspection Plan and concludes that it is consistent with I&E guidelines of MRP-227-A, and therefore, acceptable. The licensee addressed all eight licensee action items and seven conditions specified in MRP-227-A appropriately. Therefore, the NRC concludes that the licensee has met License Renewal Commitment 14, as documented in Appendix D of NUREG-1772.

If you have any questions, please contact me at (301) 415-3867 or by e-mail at Michael.Mahoney@nrc.gov.

Sincerely,

Michael Mahoney, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370

Enclosure:
Staff Evaluation

cc: Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

STAFF EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

AGING MANAGEMENT PROGRAM AND INSPECTION PLAN OF

REACTOR VESSEL INTERNALS

DUKE ENERGY CAROLINAS, LLC

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-369 AND 50-370

1.0 INTRODUCTION

By letter dated December 13, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17356A184), as supplemented by letters dated May 9, 2018 (ADAMS Accession No. ML18135A087), and January 30, 2019 (ADAMS Accession No. ML19032A094), Duke Energy Carolinas, LLC (Duke Energy or the licensee) submitted Aging Management Program (AMP) and Inspection Plan for the McGuire Nuclear Station (McGuire), Units 1 and 2, Reactor Vessel Internals (RVIs).

The McGuire RVI AMP and Inspection Plan is based on "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)" (ADAMS Accession No. ML120170453). It was submitted to fulfill the inspection commitment in Section 18.2.23, "Reactor Vessel Internals Inspection," of the McGuire Updated Final Safety Analysis Report (UFSAR), which originated from License Renewal Commitment 14 for McGuire, as documented in Appendix D of NUREG-1772, "Safety Evaluation Report Related to the License Renewal of McGuire Nuclear Station, Units 1 and 2, and Catawba Nuclear Station, Units 1 and 2" (Accession No. ML030830181). The AMP includes inspection and evaluation (I&E) guidelines for the RVI components at McGuire, during the period of extended operation (PEO).

Attachment 1 of the licensee's letter dated December 13, 2017 contains the McGuire RVI AMP and Inspection Plan.

2.0 REGULATORY EVALUATION

2.1 Regulatory Requirements

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 54, "Requirements for renewal of operating licenses for nuclear power plants," addresses the requirements for plant license renewal process. The regulation at 10 CFR 54.21, "Contents of application – technical

information," requires that each application for license renewal contain an integrated plant assessment and an evaluation of time-limited aging analyses. The plant-specific integrated plant assessment shall identify and list those structures and components subject to an aging management review and demonstrate that the effects of aging (e.g., cracking, loss of material, loss of fracture toughness, dimensional changes, and loss of preload) will be adequately managed so that their intended functions will be maintained consistent with the current licensing basis (CLB) during the PEO as required by 10 CFR 54.29(a). In addition, 10 CFR 54.22, "Contents of application – technical specifications," requires a license renewal application to include any technical specification changes or additions necessary to manage the effects of aging during the PEO as part of the license renewal application.

Structures and components subject to an AMP shall encompass those structures and components that are referred to as "passive" and "long-lived." Passive structures and components perform an intended function, as described in 10 CFR 54.4, without moving parts or without a change in configuration or properties. Long-lived structures and components are not subject to replacement based on a qualified life or specified time period. The scope of components considered for inspection under MRP-227-A includes core support structures typically denoted as Examination Category B-N-3 by the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, and those RVI components that serve an intended license renewal safety function pursuant to criteria in 10 CFR 54.4(a)(1). The scope of the program does not include consumable components such as fuel assemblies, reactivity control assemblies, and nuclear instrumentation because these components are not typically within the scope of the components that are required to be subject to an AMP, as defined by the criteria set forth in 10 CFR 54.21(a)(1).

2.2 Licensee Renewal Commitment

The U.S. Nuclear Regulatory Commission (NRC) issued NUREG-1772 in March 2003. Appendix D of NUREG-1772 included license renewal Commitment 14 related to the McGuire RVI AMP. Specifically, the licensee committed to the following activities: (1) implement the RVI inspection, (2) for items comprised of plates, forgings, and welds critical crack size will be determined by analysis and submitted for review and approval to the NRC, and (3) for items fabricated from cast austenitic stainless steel (CASS), critical crack size will be determined by analysis. Acceptance criteria for all aging effects will be developed and submitted for review and approval to the NRC. The licensee developed the McGuire RVI AMP and Inspection Plan based on MRP-227-A.

On January 12, 2009, Electric Power Research Institute (EPRI) submitted, for NRC staff review and approval, MRP-227, Revision 0 (ADAMS Accession No. ML090160212), which was intended as guidance for licensees in developing their plant-specific AMPs for RVI components. MRP-227 contains a discussion of the technical basis for the development of plant-specific AMPs for RVI components in pressurized-water reactor (PWR) vessels and also provides I&E guidelines for PWR licensees to use in their plant-specific AMPs. The NRC staff issued Revision 1 to its final safety evaluation (SE) for MRP-227 on December 16, 2011 (ADAMS Accession No. ML11308A770), with seven topical report (TR) conditions and eight licensee action items. The TR conditions were specified to ensure that certain information was revised generically in the approved version of MRP-227 and the licensee action items addressed plant-specific issues that could not be resolved generically in the December 16, 2011, SE.

On January 9, 2012, EPRI submitted the NRC-approved version of the TR designated MRP-227-A. To fulfill License Renewal Commitment 14, the licensee needed to address the plant-specific issues specified in the eight licensee action items.

3.0 TECHNICAL EVALUATION

The NRC staff assessment of the McGuire RVI AMP and Inspection Plan focused on determining whether the licensee adequately incorporated the I&E guidelines recommended in MRP-227-A and the licensee's resolutions of the licensee action items and TR conditions. Specifically, the NRC staff assessment focused on the following: (1) the licensee's implementation of the MRP-227-A I&E guidelines for RVI components in the primary, expansion, and existing categories, as well as the appropriate acceptance criteria; (2) operating experience of RVI component degradation at McGuire; (3) the licensee's AMP for RVI components under the current ASME Code, Section XI, inservice inspection (ISI) program; and (4) the licensee's resolutions of the eight licensee action items.

The NRC staff notes that the seven TR conditions are generic conditions imposed on the approval of MRP-227-A, not conditions for individual licensees. The NRC staff reviewed Table 6-1, "Topical Report Conditions," in the McGuire RVI AMP and Inspection Plan in the licensees December 12, 2017, letter, and confirmed that the McGuire RVI AMP and Inspection Plan is consistent with the seven TR condition resolutions in MRP-227-A.

The following sections provide details of the NRC staff assessment of the four assessment items listed above, considering the licensee's January 30, 2019, response to the NRC staff's request for additional information (RAI) sent via e-mail on December 18, 2018 (ADAMS Accession No. ML18352A805).

3.1 Assessment Area 1 – MRP-227-A I&E Guidelines for RVI Components in the Primary, Expansion, and Existing Categories and Acceptance Criteria

In McGuire RVI AMP and Inspection Plan, the licensee implemented the MRP-227-A I&E guidelines in the primary, expansion, and existing categories in the following tables:

- Table C-1, "MRP-227-A Primary Inspection and Monitoring Recommendations for Westinghouse-Designed Internals";
- Table C-2, "MRP-227-A Expansion Inspection and Monitoring Recommendations for Westinghouse-Designed Internals"; and
- Table C-3, "MRP-227-A Existing Inspection and Aging Management Credited in Recommendations for Westinghouse-Designed Internals."

These tables were taken directly from the following tables from MRP-227-A, with plant-specific notes for some RVI components:

- Table 4-3, "Westinghouse plants Primary components";
- Table 4-6, "Westinghouse plants Expansion component"; and
- Table 4-9, "Westinghouse plants Existing Programs components;"

These plant-specific notes are placed under the Table column "Applicability" for two components in Table C-1 and two in Table C-2, stating that the component is not applicable to McGuire because of different materials or absence of the component in the McGuire RVIs.

The NRC staff reviewed the acceptance criteria in Table C-4, "MRP-227-A Acceptance Criteria and Expansion Criteria Recommendations for Westinghouse-Designed Internals," of McGuire RVI AMP and Inspection Plan and determined that, except for some plant-specific notes indicating some components are not applicable to the McGuire units because of different materials or absence of the component, the acceptance criteria are consistent with Table 5-3,

"Westinghouse plants examination acceptance and expansion criteria," of MRP-227-A. Hence, the acceptance criteria in Table C-4 are acceptable.

Based on this review, the NRC staff has determined that the licensee adequately implemented the MRP-227-A I&E guidelines into the McGuire RVI AMP and Inspection Plan.

3.2 Assessment Area 2 – Operating Experience of RVI Component Degradation

To address MRP-227-A TR Condition 7, MRP-227-A, Appendix A, "Reactor Internals Operational Experience," was updated to include the operating experience related to the aging degradation of the RVI components in the PWR fleet. The update references Section XI.M16A of NUREG-1801, "Generic Aging Lessons Learned (GALL) Report – Final Report," Revision 2 (ADAMS Accession No. ML103490041). MRP-227-A, Appendix A, addresses operating experience for some RVI components that are susceptible to various aging degradation mechanisms. These RVI components are discussed in the subsections that follow. Additionally, the GALL report states that licensees are expected to review subsequent operating experience and evaluate its impact on their AMPs.

3.2.1 Additional RVI Components Susceptible to Degradation

Licensee action item 2 requires comparison of the RVI components that are within the scope of license renewal for McGuire, to those components contained in MRP-191, Revision 1, "Screening, Categorization and Ranking of Reactor Internals Components for Westinghouse and Combustion Engineering PWR Design" (ADAMS Accession No, ML17289A515, not publically available). MRP-191, Revision 1 is the technical basis for the MRP-227-A categorization of Westinghouse RVI components. After this comparison, Section 6.2.2 of McGuire RVI AMP and Inspection Plan concluded that with the exception of the access plug assembly spring, anti-vibration sleeves, core barrel plugs, lower former plate plugs, and modified upper former plate, all of the RVI components within the scope of license renewal at the McGuire units were addressed in MRP-191. For the access plug assembly spring and anti-vibration sleeves, the licensee used the same process in MRP-191 to address them. Information regarding the access plug assembly spring and anti-vibration sleeves was provided in the licensee's letter dated May 9, 2018. For core barrel plugs, lower former plate plugs, and modified upper former plate, which are all related to the upflow conversion, an evaluation for compliance with MRP-227-A was performed by the vendor that performed the upflow conversion and was also provided to the NRC in the licensee's letter dated May 9, 2018. Based on the licensee's resolution of licensee action item 2 (discussed in Section 3.4.2 of this staff evaluation) and identifying five additional McGuire RVI components that are not in the MRP-227-A list, the NRC staff concludes that the licensee has identified all RVI components needed for aging management during the PEO.

3.2.2 Operating Experience on Pressurized-Water Stress Corrosion Cracking in Alloy X-750

Section 4.1 of McGuire RVI AMP and Inspection Plan indicated that Alloy X-750 clevis insert bolts at McGuire are inspected for wear via visual testing (VT-3) under the existing ASME Code, Section XI, ISI program. MRP-227-A, Appendix A, discusses one Westinghouse plant that reported failures of Alloy X-750 clevis insert bolts that was likely caused by pressurized-water stress corrosion cracking (PWSCC). As such, Section 4.1.2 of the McGuire RVI AMP and Inspection Plan considers the existing ASME Code, Section XI, ISI VT-3 inspection insufficient to monitor for the applicable aging effects, and the VT-3 inspection is supplemented by additional guidance specified in Westinghouse Technical Bulletin (TB) 14-5, Revision 0,

"Reactor Internals Lower Radial Support Clevis Insert Cap Screw Degradation" (ADAMS Accession No. ML15222A885, not publicly available).

The NRC staff reviewed TB 14-5 and found it did not change the type or timing of inspections but gave recommendations for the scope and focus of the inspections to detect known indications of failure. TB 14-5, states that Westinghouse performed detailed structural evaluation of the as-found condition of the clevis insert bolts of the one plant that reported failures. The structural evaluation showed that failure of the bolts would not result in a loss of safety function of the surrounding RVI. The NRC staff notes that the function of the clevis inserts (which are secured in the vessel by the clevis insert bolts) are for alignment of the lower RVI assembly and that they do not support the lower RVI assembly weight. When the lower RVI assembly is assembled in the vessel, the clevis inserts are tightly held in place.

Therefore, if the clevis insert bolts fail, the clevis inserts would remain in place and the lower RVI assembly would remain aligned. In addition, there are significant redundancies in the clevis insert assembly that would prevent the clevis insert assembly from being nonfunctional. Based on the above, the NRC staff finds Westinghouse's conclusion that failed bolts would not lead to a loss of safety function of the surrounding RVI reasonable. Hence, the NRC staff determined that the structural evaluation discussed in the TB 14-5 adequately addresses the concern of PWSCC susceptibility of the Alloy X-750 clevis insert bolts at McGuire.

The NRC staff concludes that the VT-3 inspection for wear in the existing ASME Code, Section XI, ISI program for McGuire, supplemented by the inspection guidance specified in TB 14-5, is adequate to manage the aging degradation of the Alloy X-750 clevis insert bolts.

3.2.3 Inspection of Wear of Control Rod Guide Tube (CRGT) Cards

Appendix A of MRP-227-A includes a generic discussion of wear of the CRGT cards. McGuire RVI AMP and Inspection Plan, Table C-1 indicates that VT-3 for general degradation will be used for the CRGT cards. Table C-1 also indicates the examination schedule recommended in proprietary report WCAP-17451-P, "Reactor Internals Guide Tube Wear – Westinghouse Domestic Fleet Operational Projections," (ADAMS Accession No. ML15041A095, not publically available), will be used. The NRC staff's SE of WCAP-17096, "Reactor Internals Acceptance Criteria Methodology and Data Requirements," Revision 2 (ADAMS Accession No. ML16061A243), which contains acceptance criteria for MRP-227-A primary and expansion components, found the examination methodology for CRGT cards based on WCAP-17451-P, as acceptable. WCAP-17451-P takes into account operational experience and analyses that were not available during the development of MRP-227-A and includes a more comprehensive inspection coverage for the CRGT cards than the coverage specified in MRP-227-A.

The NRC staff finds that the licensee's use of WCAP-17451-P adequately addresses operating experience of wear in CRGT cards and, therefore, provides reasonable assurance that the McGuire CRGT cards will be managed adequately for wear during the PEO.

3.2.4 Baffle-to-Former Bolts Degradation

Section 4.2.4 of McGuire RVI AMP and Inspection Plan provides evaluation of baffle-former bolts degradation. This issue originated from a larger-than-expected number of degraded baffle-former bolts discovered in recent years in 4-loop downflow plants through MRP-227-A inspections and voluntary inspections at similar plants. The industry performed evaluations and issued EPRI Letter MRP 2016-022, "Transmittal of NEI-03-08 "Needed" Interim Guidance Regarding Baffle Former Bolt inspections for Tier 1 plants as defined in Westinghouse Nuclear

Safety Advisory Letter (NSAL) 16-01" (ADAMS Accession No. ML16211A054), recommending all Tier 1a plants perform an ultrasonic test (UT) inspection of the full population of baffle-to-former bolts. McGuire converted to upflow approximately 20 years ago as discussed in Section 4.1.7 of the McGuire RVI AMP and Inspection Plan, and is a Tier 3 plant. Since upflow plants could reduce the baffle jetting damage to fuel and reduce the bolt loads under normal operating and faulted conditions, they are least affected by this issue. Based on EPRI Letter MRP-2016-022, which the NRC staff assessed (ADAMS Accession No. ML17254A357), McGuire will continue to follow the current MRP-227-A guidelines and implement any revisions to the MRP-227-A recommendations.

The licensee's evaluation in Section 4.2.4 of the McGuire RVI AMP and Inspection Plan, supports the considerations on reinspection frequency, inspection method, and the inspection coverage for baffle-to-former bolts for Tier 3 plants such as McGuire. Therefore, McGuire AMP and Inspection Plan provides reasonable assurance that the licensee will adequately manage the aging of the baffle-to-former bolts during the PEO.

3.2.5 Conclusion of Section 3.2

Based on the discussions in Sections 3.2.1 through 3.2.4 of this staff evaluation, the NRC staff determined that the licensee has adequately considered and addressed operating experience in the McGuire RVI AMP and Inspection Plan.

3.3 Assessment Area 3 – McGuire's AMPs for RVI Components under the ASME Code, Section XI, ISI Program

Table C-3 of McGuire RVI AMP and Inspection Plan provides a list of RVI components inspected thus far under MRP-227-A "Existing" inspection program and AMPs. The Table shows that, except for the flux thimble tubes, all RVI components categorized under the "Existing" inspection category of the MRP-227-A report referenced the ASME Code, Section XI, ISI program. Table C-3 indicated that the flux thimble tubes at McGuire will be inspected under the McGuire Bottom-Mounted Instrumentation (BMI) Thimble Tube Inspection Program described in the McGuire RVI AMP and Inspection Plan. The NRC staff concluded in NUREG-1772 that the licensee has demonstrated that the BMI Thimble Tube Inspection Program will adequately manage aging effects identified for the reactor vessel thimble tubes, such that there is reasonable assurance that their intended functions will be maintained consistent with the CLB for the PEO.

Additionally, the licensee stated that the McGuire ASME Section XI Program is an existing program that includes examinations of the reactor vessel core support structure components in accordance with the ASME Section XI, Subsection IWB-2500. Each of these items has received VT-3 inspection under the ASME Code, Section XI, ISI program. In summary, operating experience indicated that the ASME Code required VT-3 is sufficient to monitor the applicable aging effects for all McGuire RVI components under the "Existing" inspection category with two exceptions: the flux thimble tubes discussed above and the clevis inserts and bolts discussed in Section 3.2.2 of this staff evaluation. The flux thimble tubes are managed through the more rigorous BMI Thimble Tube Inspection Program, and the clevis inserts and bolts are managed through the ASME Code inspection program using VT-3 examinations supplemented by TB 14-5. The examination results are contained in plant records in accordance with the ASME Code.

Based on the licensee's information in Section 4.1.2 of the McGuire RVI AMP and Inspection Plan, the NRC staff determined that the licensee is adequately implementing the ASME Code,

Section XI, ISI program for the McGuire RVI components under the "Existing" category during the PEO.

3.4 Assessment Area 4 - The Eight Applicable Licensee Action Items

3.4.1 Assessment of Resolution of Licensee Action Item 1

MRP-227-A, Section 4.2.1, "Applicability of Failure Modes, Effects, and Criticality Analyses (FMECA) and Functionality Analysis Assumptions," states:

> As addressed in Section 3.2.5.1 of this SE, each applicant/licensee is responsible for assessing its plant's design and operating history and demonstrating that the approved version of MRP-227 is applicable to the facility. Each applicant/licensee shall refer, in particular, to the assumptions regarding plant design and operating history made in the FMECA and functionality analyses for reactors of their design (i.e., Westinghouse, CE [Combustion Engineering], or B&W [Babcock and Wilcox]) which support MRP-227 and describe the process used for determining plant-specific differences in the design of their RVI components or plant operating conditions, which result in different component inspection categories. The applicant/licensee shall submit this evaluation for NRC review and approval as part of its application to implement the approved version of MRP-227.

This is licensee action Item 1.

The purpose of licensee action item 1 is to determine the applicability of the I&E guidelines of MRP-227-A to the specific plant. EPRI and the MRP have developed guidelines for determining the applicability of MRP-227-A in letter MRP 2013-025, "MRP-227-A Applicability Template Guideline" (ADAMS Accession No. ML13322A454). The NRC staff reviewed MRP 2013-025 and its technical basis, contained in WCAP-17780-P, "Reactor Internals Aging Management MRP-227-A Applicability for Combustion Engineering and Westinghouse Pressurized Water Reactor Designs" (ADAMS Accession No. ML131830436, not publically available). The NRC staff concluded in its evaluation of WCAP-17780-P (ADAMS Accession No. ML14309A484), that if a licensee meets the recommendations in MRP 2013-025, the licensee will have demonstrated reasonable assurance that the I&E guidelines of MRP-227-A will be applicable to the specific plant.

MRP 2013-025 lists two questions that all Westinghouse-designed plants must address to resolve licensee action item 1. The two questions, applicable to McGuire, are summarized below:

1. Do the McGuire RVI components have non-weld or non-bolting* austenitic stainless steel (SS) components with 20 percent cold work or greater, and if so, do the affected components have operating stresses greater than 30 kilo pounds per square inch (ksi)?

*Written as "bolting" in MRP 2013-025. The correct term "non-bolting" is made here.

2. Has McGuire utilized atypical fuel design or fuel management, including power changes/uprates, that could render the assumptions of MRP-227-A regarding core loading/core design non-representative for the two units?

Question 1

Section 6.2.1 of the McGuire RVI AMP and Inspection Plan states that McGuire performed a detailed material fabrication and design assessment of each unit and concluded that no non-fastener materials of 20 percent cold work or greater were used in construction. Details of this assessment are documented in a proprietary Pressurized Water Reactors Owner's Group (PWROG) report PWROG-14054-P, Revision 0, "McGuire Units 1 and 2 Summary Report for the Cold Work Assessment," dated December 2, 2014.

PWROG-15105-NP, "PWR RV Internals Cold-Work Assessment" (ADAMS Accession No. ML16222A300), addresses cold work in PWR RVI components generically. The NRC staff issued a summary assessment dated April 21, 2017 (ADAMS Accession No. ML17081A010), of this report and stated that no non-fastener RVI components were subject to cold work greater than 20 percent in Westinghouse PWR units, and that these components, therefore, are less susceptible to PWSCC.

The NRC staff finds the licensee's addressing of Question 1 is consistent with the guidance in MRP 2013-025 and PWROG-15105-NP, and that the licensee adequately demonstrated that McGuire, has no RVI components with greater than 20 percent cold work. Thus, the NRC staff determined that the licensee adequately demonstrated that MRP-227-A is applicable to McGuire, with respect to cold work concerns in RVI components.

Question 2

Section 6.2.1 of the McGuire RVI AMP and Inspection Plan states that the McGuire has not utilized atypical fuel design or fuel management that could make the assumptions of MRP-227-A regarding core loading/core design non-representative for the units, including power changes/uprates that have occurred over their operating lifetimes. This conclusion is based on comparisons of the McGuire core geometries and operating characteristics with the MRP-227-A applicability guidelines for Westinghouse-designed reactors specified in MRP 2013-025.

The NRC staff reviewed the licensee's evaluation in Attachment 2 of the licensee's letter dated December 13, 2017, regarding the reactor core regions of McGuire (beyond the outer radius of the reactor core, above the reactor core, and below the reactor core). MRP 2013-025 guidelines included limiting threshold values for three parameters in Westinghouse units related to core geometry and core loading, which are listed below:

- Active fuel to upper core plate distance > 12.2 inches
- Average core power density < 124 Watts/cm^3
- Heat generation figure of merit, F ≤ 68 Watts/cm^3

For McGuire, in the outer radius of reactor core, the average core power density is less than 124 Watts/cm^3, and the heat generation rate figure of merit is less than 68 Watts/cm^3. In the region above the reactor core, the average core power density is less than 124 Watts/cm^3, and the active fuel to upper core plate distance is greater than 12.2 inches except for a limited number of cycles when non-Westinghouse fuel was used for both units. The latter deviated from the established MRP-227-A criterion and will be further evaluated. In the region below the reactor core, both units met the general applicability assumptions in Section 2.4, "Guidelines Applicability," of MRP-227-A and, therefore, as recommended in MRP 2013-025, no further evaluation is necessary. Additionally, the licensee stated that McGuire has implemented a low leakage core designs and have no plans to return to an out-in fuel management.

Although a fuel assembly to upper core plate gap of less than 12.2 inches for a period greater than two calendar years deviated from the established MRP-227-A criterion, the licensee stated in Attachment 2 of their letter dated December 13, 2017, that further evaluation demonstrated that the small increase in neutron flux caused by the loss of attenuation over the limited number of cycles was offset by the significantly larger margins afforded by the lower operating power density over the entire plant lifetime of both McGuire units. The NRC staff reviewed the margins and finds that operating with a lower core power density over the lifetime of the unit offsets the increase in fluence associated with an active fuel to upper core plate distance of less than 12.2 inches. Therefore, the NRC staff concludes that the slight deviation from the first guideline of MRP 2013-025 for McGuire, is acceptable.

The NRC staff finds that the licensee adequately demonstrated that McGuire is consistent with the MRP-227-A assumptions regarding core loading/core design, neutron fluence, and heat generation rates, with one slight deviation, which the NRC staff finds acceptable.

As discussed above, the licensee has adequately demonstrated the applicability of the I&E guidelines of MRP-227-A to the McGuire RVI components. Accordingly, the NRC staff concludes that the licensee has adequately resolved licensee action item 1.

3.4.2 Assessment of Resolution of Licensee Action Item 2

MRP-227-A, Section 4.2.2, "PWR Vessel Internal Components Within the Scope of License Renewal," states:

> As discussed in Section 3.2.5.2 of this SE, consistent with the requirements addressed in 10 CFR 54.4, each applicant/licensee is responsible for identifying which RVI components are within the scope of LR [license renewal] for its facility. Applicants/licensees shall review the information in Tables 4-1 and 4-2 in MRP-189, Revision 1, and Tables 4-4 and 4-5 in MRP-191 and identify whether these tables contain all of the RVI components that are within the scope of LR for their facilities in accordance with 10 CFR 54.4. If the tables do not identify all the RVI components that are within the scope of LR for its facility, the applicant or licensee shall identify the missing component(s) and propose any necessary modifications to the program defined in MRP-227, as modified by this SE, when submitting its plant-specific AMP. The AMP shall provide assurance that the effects of aging on the missing component(s) will be managed for the period of extended operation.

This is licensee action Item 2.

Both McGuire units are Westinghouse-designed plants; therefore, only Table 4-4 of MRP-191 is applicable. The licensee stated in McGuire RVI AMP and Inspection Plan Section 6.2.2, "SE Applicant/Licensee Action Item 2: PWR Vessel Internal Components within Scope of License Renewal," that a detailed tabulation of the McGuire RVI components was completed and compared to typical Westinghouse PWR RVI components in Table 4-4 of MRP-191. The licensee identified one McGuire RVI component (access plug assembly spring) that has no corresponding MRP-191 component. Further, several components outside the aging management review have been identified as having potential aging degradation, but have no corresponding MRP-191 components: the anti-vibration sleeves, core barrel plugs, lower former plate plugs, and modified upper former plate. MRP-191, Revision 2 (to be published) is expected to assess the access plug assembly spring and anti-vibration sleeves, but will not be published in time to support the current application. Therefore, by Commitments 2 and 3 in Attachment 6 in their letter dated December 13, 2017, the licensee is committed to provide a

separate submittal to address licensee action items 1 and 2 for the access plug assembly spring and anti-vibration sleeves at a later date.

McGuire had an upflow conversion, which resulted in the following new or modified RVI components to be evaluated: core barrel plugs, lower former plate plugs, and modified upper former plate. By Commitment 4 in Attachment 6, the licensee is committed to address licensee action items 1 and 2 for these three RVI components. Evaluation for all five RVI components was provided in their letter dated May 9, 2018. Therefore, Commitments 2 to 4 were fulfilled.

The following is the NRC staff's evaluation of the licensee's assessment of the five additional RVI components related to Commitments 2 to 4:

Commitments 2 and 3 to address the access plug assembly spring and anti-vibration sleeves

Regarding the access plug assembly spring, the licensee's stated in Attachment 1 of their letter dated May 9, 2018, that the McGuire access plug assembly spring is made of Inconel X-750, and no degradation mechanisms were identified through the process of MRP-191 employed by the McGuire-specific expert panel. Attachment 1 further states that the McGuire anti-vibration sleeves are made of 304-SS, and although several degradation mechanisms have been identified, the McGuire-specific expert panel considered the likelihood of failure and damage to be low.

The licensee's letter dated January 30, 2019, indicated that, like the MRP-191 expert panel, the McGuire-specific expert panel consisted of knowledgeable individuals with expertise in the areas of reactor internals designs, materials age-related degradation mechanisms, safety analysis, and asset management. It further stated that the McGuire-specific expert panel applied the current FMECA approach (same process, definitions, and inputs) for Westinghouse designed plants as described in MRP-191, to determine the failure likelihood and damage likelihood of the two RVI components. Specifically, justification for low failure and damage ranking of anti-vibration sleeves is provided in the supplement by assessing the effects of all screened in degradation mechanisms. Based on these, the NRC staff finds that the access plug assembly spring and anti-vibration sleeves are Category A components and need no additional inspections per MRP-227-A.

Commitment 4 to address modified upper former plate, core barrel plugs, and lower former plate plugs

Regarding the modified upper former plate with holes, the licensee examined the screening parameters identified in Table A-1 of MRP-191 for the formal plates and found all seven screening parameters and temperature are not affected by the modification. The NRC staff reviewed the parameters and determined that existence of new holes does not change the material, introduce new welds, create preload, or affect stress, temperature, or fluence. Therefore, wear and fatigue potential will stay the same, and the NRC staff concludes that managing the upper former plate in accordance with MRP-227-A needs not be revised to include an additional item for the modified upper former plate with holes.

Regarding the core barrel and lower former plate plugs, the licensee stated in Attachment 2 of their letter dated May 9, 2018, that the McGuire core barrel and lower former plate plugs are made of Type 316L SS, and the same process used in MRP-191, including screening, FMECA, and final categorization and ranking was used for these plugs. Section 3 of this Attachment 2 presented the time-limited aging analyses for the plugs, specifically, Section 3.3.1 states that the transient design cycles for 60 years of operation are assumed to be equal to the design

cycles for 40 years. Based on this, the attachment concludes that a change in fatigue of the RVIs need not be addressed. The NRC staff noted that, for fatigue and wear, the plugs function as rigid bodies in the core barrel and the lower former plates. Therefore, the wear and the bending stress in the plugs should be small. Further, the thermal stress in the plugs is about the same as in core barrel and lower former plates, which are not among the MRP-227-A Primary, Expansion, and Existing components.

The NRC staff also noted that compressive stresses in the plugs caused by the interface (contact) pressure between the plugs and the host components are beneficial, but loss of pressure due to stress relaxation could be an issue. To address this, Attachment 2 of the May 9, 2018 letter states that the minimum required stress ratios were calculated for the core barrel plugs and the lower former plate plugs based on their respective loads and required end of license interface pressure for 60 years. These stresses ratios were less than the estimated stress ratios based on experimental data for these two types of plugs. Therefore, Attachment 2 concludes that the core barrel and lower former plate plugs meet the requirements to remain in place for 60 years. The licensee's letter dated January 30, 2019 further substantiates the application of the experimental data to McGuire. The January 30, 2019, letter evaluates experimental data from five sources and, based on the dose and material type, selects the most appropriate data for the current application. These experimental data were further analyzed considering material type, specimen type, and material property to determine the most conservative one to be compared with the McGuire plug stress ratios. Considering the above, and the licensee's information that the transient design cycles for 60 years are equal to 40 years, the NRC staff determined that the time-limited aging analysis (TLAA) regarding wear, fatigue, and ISR/IC for core barrel and lower former plate plugs need not be addressed, and no additional inspections are required per MRP-227-A for them.

Additional CASS RVI components

In addition, Section 6.2.2 of McGuire RVI AMP and Inspection Plan identified several McGuire RVI components that have the potential to be Grade CF8 CASS (CF8 CASS): upper guide tube enclosures, guide plates/cards (Unit 2), brackets, clamps, terminal blocks, and conduit straps – conduit positioners (Units 1 and 2). Table 4-4 of MRP-191 does not identify these same components as CASS.

The licensee stated that MRP-191, Revision 1 considers the use of CF8 materials for the above mentioned RVI components and determined that although CF8 for these RVI components introduces thermal embrittlement (TE), or combined TE and irradiation embrittlement (IE), the components were still placed in the same FMECA categories in MRP-191, Revision 1 as their material counterparts in MRP-191 by the industry expert panel. The NRC staff has evaluated these additional CASS components in Section 3.4.6 of this staff evaluation, where all McGuire RVI components fabricated from CASS materials are discussed.

Based on the above evaluation, the NRC staff concludes that, pending the evaluation of the additional CASS RVI components in Section 3.4.6 of this staff evaluation, the licensee's conclusion that no change to the MRP-227-A program is needed is acceptable. Hence, the NRC staff concludes that the licensee has adequately resolved licensee action item 2.

3.4.3 Assessment of Resolution of Licensee Action Item 3

MRP-227-A, Section 4.2.3, "Evaluation of the Adequacy of Plant-Specific Existing Programs," states:

> As addressed in Section 3.2.5.3 in this SE, applicants/licensees of CE and Westinghouse are required to perform plant-specific analysis either to justify the acceptability of an applicant's/licensee's existing programs, or to identify changes to the programs that should be implemented to manage the aging of these components for the period of extended operation. The results of this plant-specific analysis and a description of the plant-specific programs being relied on to manage aging of these components shall be submitted as part of the applicant's/licensee's AMP application. The CE and Westinghouse components identified for this type of plant-specific evaluation include: CE thermal shield positioning pins and CE in-core instrumentation thimble tubes (Section 4.3.2 in MRP-227), and Westinghouse guide tube support pins (split pins) (Section 4.3.3 in MRP-227).

This issue is licensee action Item 3.

Section 6.2.3, "SE Applicant/Licensee Action Item 3: Evaluation of the Adequacy of Plant-Specific Existing Programs," of McGuire RVI AMP and Inspection Plan states that the Alloy X-750 CRGT support pins were replaced by support pins made of strain-hardened Type 316 SS material. MRP-227-A, Table 3-3, "Final disposition of Westinghouse internals," identifies only Alloy X-750 CRGT support pins as requiring monitoring for aging during the PEO. Further, Subsection 4.4.3, "Westinghouse Components," of MRP-227-A states that guidance for monitoring the CRGT support pins is limited to plant-specific recommendations. Specifically, Subsection 4.4.3 of MRP-227-A states that subsequent performance monitoring of the support pins should follow the recommendations of the original equipment manufacturer (OEM). Section 6.2.3 states that there are no supplier recommendations for performance monitoring of the Type 316 SS support pins. The licensee, therefore, concluded that no additional inspections of the Type 316 SS support pins are required by the supplier or per MRP-227-A.

The NRC staff finds that the licensee followed the recommendation of the OEM for plant-specific performance monitoring of the Type 316 SS CRGT support pins, consistent with the guidance in Subsection 4.4.3 of MRP-227-A. Furthermore, 316 SS CRGT support pins are in Category A in MRP-191, Revision 1, and binned into the "No Additional Measures" category in Figure 2-2 of MRP-227-A. Hence, the NRC staff determined there is reasonable assurance that the licensee will adequately manage the aging of the McGuire Type 316 SS CRGT support pins during the PEO. Accordingly, the NRC staff concludes that the licensee has adequately resolved licensee action item 3.

3.4.4 Assessment of Resolution of Licensee Action Items 4 and 6

MRP-227-A licensee action items 4 and 6 are only applicable to plants designed by Babcock and Wilcox and, therefore, not applicable to McGuire.

3.4.5 Assessment of Resolution of Licensee Action Item 5

MRP-227-A, Section 4.2.5, "Application of Physical Measurements as part of I&E Guidelines for B&W, CE, and Westinghouse RVI Components," states:

> As addressed in Section 3.3.5 in this SE, applicants/licensees shall identify plant-specific acceptance criteria to be applied when performing the physical measurements required by the NRC-approved version of MRP-227 for loss of compressibility for Westinghouse hold down springs, and for distortion in the gap between the top and bottom core shroud segments in CE units with core barrel

> shrouds assembled in two vertical sections. The applicant/licensee shall include its proposed acceptance criteria and an explanation of how the proposed acceptance criteria are consistent with the plants' licensing basis and the need to maintain the functionality of the component being inspected under all licensing basis conditions of operation during the period of extended operation as part of their submittal to apply the approved version of MRP-227.

This is licensee action Item 5.

Section 6.2.5, "SE Applicant/Licensee Action Item 5: Application of Physical Measurements as part of I&E Guidelines for B&W, CE, and Westinghouse RVI Components," of McGuire RVI AMP and Inspection Plan states that McGuire contains Type 403 hold down springs (HDS). It further states that MRP-227-A requirements apply only to plants with Type 304 SS hold-down springs, and, therefore, this licensee action item is not applicable to McGuire.

The NRC staff finds that Type 304 SS, which was identified to be the material causing the concern of the HDS, is not the material for the McGuire HDS. Hence, licensee action item 5 is not applicable to McGuire, and there is reasonable assurance that the HDS will perform their intended function of maintaining compression during the PEO.

3.4.6 Assessment of Resolution of Licensee Action Item 7

MRP-227-A, Section 4.2.7, "Plant-Specific Evaluation of CASS Materials," states:

> As discussed in Section 3.3.7 of this SE, the applicants/licensees of B&W, CE, and Westinghouse reactors are required to develop plant-specific analyses to be applied for their facilities to demonstrate that B&W in-core monitoring instrumentation guide tube assembly spiders and CRGT spacer castings, CE lower support columns, and Westinghouse lower support column bodies will maintain their functionality during the period of extended operation or for additional RVI components that may be fabricated from CASS, martensitic stainless steel or precipitation hardened stainless steel materials. These analyses shall also consider the possible loss of fracture toughness in these components due to thermal and irradiation embrittlement, and may also need to consider limitations on accessibility for inspection and the resolution/sensitivity of the inspection techniques. The requirement may not apply to components that were previously evaluated as not requiring aging management during development of MRP-227. That is, the requirement would apply to components fabricated from susceptible materials for which an individual licensee has determined aging management is required, for example during their review performed in accordance with Applicant/Licensee Action Item 2. The plant-specific analysis shall be consistent with the plant's licensing basis and the need to maintain the functionality of the components being evaluated under all licensing basis conditions of operation. The applicant/licensee shall include the plant-specific analysis as part of their submittal to apply the approved version of MRP-227.

This is licensee action item 7.

The licensee evaluated the McGuire RVI components for potentially being made of CASS and their susceptibility to TE in the McGuire RVI AMP and Inspection Plan, Section 6.2.7, "SE Applicant/Licensee Action Item 7: Plant-Specific Evaluation of Cast Austenitic Stainless Steel

(CASS) Materials." As a result of the evaluation, the licensee determined that some RVI components are potentially made of CF8 CASS.

The licensee listed these RVI components and their susceptibility to TE in Tables 6-2 and 6-3 for McGuire, Units 1 and 2, respectively. Table 6-2 indicates that the ferrite content of Unit 1 conduit positioners is more than 20 percent. This value is not based on measured data from certified material test reports (CMTRs) for all conduit positioners because the licensee could not locate all CMTRs. Instead, the ferrite content is calculated based on chemistry specifications. This type of calculation was also adopted to calculate the ferrite contents for upper guide tube enclosures, guide plates/cards, intermediate flanges, and seven of the 520 conduit positioners in Table 6-3. They are all above 20 percent. Of these potential CF8 CASS RVI components, CRGT cards are of particular interest to the NRC staff because they are binned in Category C in MRP-191, Revision 1. For clarity, the NRC staff presents a generic assessment of all potential CF8 CASS RVI components in the next section, followed by a separate assessment of CRGT cards.

3.4.6.1 Assessment of Potential CASS Components Identified In Tables 6-2 and 6-3

The McGuire RVI CASS components and the licensee's assessment of their susceptibility to TE based on May 19, 2000, NRC SE (ADAMS Accession No. ML003717179, known as the "Grimes letter") are presented in Section 6.2.7 with the summary in Tables 6-2 (Unit 1) and 6-3 (Unit 2). Regarding licensee action item 7, the NRC issued on June 11, 2014, new staff guidance for evaluation of CASS materials due to the combined effects of TE and IE, titled "NRC position on Aging Management of CASS Reactor Vessel Internal Components" (ADAMS Accession No. ML14163A112). The NRC staff also issued its latest screening criteria for CASS RVI components (applicable to CF3 and CF8 grades) in the NRC staff's SE of BWRVIP-234, "Thermal Aging and Neutron Embrittlement Evaluation of Cast Austenitic Stainless Steel for BWR Internals" (ADAMS Accession No. ML16096A002). According to this latest screening criteria, there is no significant loss of fracture toughness for statically cast CF3 CASS and CF8 CASS with less than 20 percent delta ferrite exposed to fluence levels between 0.00015 displacements per atom (dpa) to 1 dpa.

Thermal Embrittlement (TE)

Due to the licensee's use of outdated criteria to consider TE, the NRC staff requested the licensee to address the difference between the June 2014 guidance for TE susceptibility of CASS and the evaluation the licensee performed for McGuire CASS RVI components based on the "Grimes Letter". The licensee stated in their letter dated January 30, 2019, that the new guidelines are almost the same as those used for the evaluation of the McGuire CASS materials, except that the TE threshold for centrifugally cast materials with molybdenum content < 0.5 weight% is 20 percent ferrite content for the McGuire evaluation and 25 percent for the new guidance. The NRC staff finds that the CASS components for McGuire are static cast materials. Therefore, the NRC staff determined that the new guidance has no impact to the McGuire CASS evaluations.

The NRC staff noted that, based on the conclusions of the statistical assessment of CASS RVI components in report PWROG-15032-NP, Revision 0, "PA-MSC-1288, Statistical Assessment of PWR RV Internals CASS Materials (ADAMS Accession Nos. ML16068A245 and ML16068A246, Parts 1 and 2, respectively) and the NRC staff assessment of PWROG-15032-NP, Revision 0 (Accession No. ML16250A001), the CF8 CASS RVI components In Tables 6-2 and 6-3 having delta ferrite contents below 20 percent would not be considered susceptible to TE.

The NRC staff also noted that the CASS RVI components in Tables 6-2 and 6-3 having delta ferrite contents above 20 percent are all grade CF8, and, therefore, the updated screening criteria in the NRC staff's SE of BWRVIP-234 are applicable to them. The NRC staff reviewed the relevant sections in the NRC staff's SE of BWRVIP-234 and the NRC staff assessment of PWROG-15032-NP, Revision 0, and concluded that the licensee's susceptibility to TE determination for CF8 CASS RVI components in Tables 6-2 and 6-3 of the submittal are acceptable.

Irradiation Embrittlement (IE)

For IE, Section 6.2.7 of the McGuire RVI AMP and Inspection Plan indicated that the CASS upper head injection flow column bases, the CASS upper support column bases, and the CASS BMI column cruciforms (the last three RVI components in Tables 6-2 and 6-3) were screened-in at the MRP-191, Revision 1 irradiation level. Therefore, IE was already considered in the development of MRP-227-A. Since these components are not susceptible to TE due to their delta ferrite contents of below 20 percent, considering IE alone is sufficient, and the NRC staff concludes that the licensee's categorization of these three RVI components at both McGuire units, in accordance MRP-227-A, is acceptable.

For the remaining RVI components in Tables 6-2 and 6-3, the CF8 intermediate flanges and brackets, clamps, terminal blocks, and conduit straps did not screen in for IE within MRP-191, and were, therefore, designated as Category A. The CF8 upper guide tube enclosures were screened in for IE, but were designated as Category A through the subsequent FMECA and ranking process of MRP-191, Revision 1. The January 30, 2019 supplement states that MRP-191, Revision, 1 applied the current FMECA approach for Westinghouse designed plants as of MRP-191 Revision 1, confirming that the definitions and categories regarding component failure, failure likelihood, core damage, damage likelihood from MRP-191, Revision 1, were used throughout the FMECA. The NRC staff reviewed information related to the above and determined that sufficient justification has been given for the designation of Category A for these three RVI components.

Category A components are further binned into the "No Additional Measures" category in Figure 2-2 of MRP-227-A. Therefore, the NRC staff determined that IE has already been addressed during the categorization process for these three CF8 CASS RVI components, similar to a process in MRP-227-A for CF8 CASS RVI components, and no change to the McGuire MRP-227-A inspection requirements is needed.

3.4.6.2 Assessment of CRGT Cards

Section 6.2.7 of McGuire RVI AMP and Inspection Plan designated CRGT cards for Unit 2 as Category C using the MRP-191, Revision 1 process, the same as previously categorized using the MRP-191, Revision 0 process. Therefore, the CRGT cards must be adequately managed during the PEO. Although the licensee included the CRGT cards as a component in the "Primary" inspection category in Table C-1 of the McGuire RVI AMP and Inspection Plan consistent with MRP-227-A, the only degradation mechanism considered was wear because in the MRP-191 categorization, only CRGT cards made of wrought stainless steel were considered. Since the CRGT cards of McGuire, Unit 2 are components the licensee identified as being potentially made of CF8 CASS and considered by the NRC staff susceptible to loss of fracture toughness due to TE and IE, their functionality during the PEO needs to be addressed. This issue has been addressed in an SE dated November 21, 2017 for the Salem Nuclear Generating Station (Salem), Unit Nos. 1 and 2, AMP and Inspection Plan (ADAMS Accession

No. ML17320A859). The NRC staff reviewed the Salem SE and determined that the evaluation of TE does not depend on plant-specific data and can be applied to McGuire. Therefore, the Salem SE conclusion, "the CRGT cards should not be considered susceptible to loss of fracture toughness due to TE," is also applicable to McGuire.

Regarding loss of fracture toughness of the CRGT cards due to IE, the updated screening criteria of Reference 21 should be used, i.e., there is no significant loss of fracture toughness for statically cast CF3 CASS and CF8 CASS with less than 20 percent delta ferrite exposed to fluence levels between 0.00015 dpa to 1 dpa. The NRC staff reviewed the evaluation of IE on the CRGT cards in the same November 21, 2017, SE for Salem, and noted the following:

> The NRC staff accepts that the CRGT cards are exposed to fluence levels less than 1 dpa because they are above the active core, typical of Westinghouse reactor designs. Also, the NRC staff agrees that CF8 CASS components are likely to have delta ferrite less than 20 percent, based on the fact that only two of 404 statically cast CF8 heats have delta ferrite content above 20 percent in the NRC staff assessment of PWROG-15032-NP. The NRC staff assessment of PWROG-15032-NP states that the two heats that have delta ferrite content above 20 percent would still have significant fracture toughness throughout their service life. Therefore, the NRC staff concludes that it is reasonable to screen out the CRGT cards for significant loss of fracture toughness due to TE and IE per the updated screening criteria in the NRC staff's SE of BWRVIP-234.

Consistent with the quoted SE, the NRC staff concludes that although the ferrite content could be greater than 20 percent for the CRGT cards, It is acceptable to screen out the CRGT cards for significant loss of fracture toughness, considering

(1) the CRGT cards are significantly above the active core and are exposed to fluence levels significantly below 1 dpa, and

(2) CF8 CASS components are more likely to have delta ferrite less than 20 percent based on the statistical evaluations in PWROG-15032-NP, Revision 0.

Hence, CRGT cards are not susceptible to loss of fracture toughness due to TE or IE (or their synergistic effect), a functionality analysis for these components is not needed, and the MRP-191, Revision 1 categorization for CRGT cards is unaffected. Therefore, the NRC staff concludes that there is reasonable assurance that the McGuire, Unit 2, CRGT cards will be adequately managed during the PEO.

3.4.6.3 Assessment of Lower Support Column Caps

For some Westinghouse-designed internals, the lower internals assembly column cap is a CASS piece welded onto the top of the core support column shaft, and these two pieces together constitute the lower internals assembly - column body. Section 6.2.7 of McGuire RVI AMP and Inspection Plan states, "The lower support column bodies are not CASS material for either McGuire Unit 1 or Unit 2." To ensure that the McGuire units do not have a two-piece lower support column bodies previously described, the NRC staff requested the licensee to confirm that the lower support column caps are not CASS material either. The licensee confirmed in its letter dated January 30, 2019, that the lower support columns at both McGuire, units are fabricated from one piece of Type 304 SS. Therefore, licensee action item 7 in the NRC SE enclosed in MRP-227-A does not apply to McGuire, and RAI-3(c) is resolved.

3.4.6.4 Conclusion of Section 3.4.6

Based on the discussions in Sections 3.4.6.1 through 3.4.6.3 of this SE, the NRC staff determined that the licensee will adequately manage the functionality of McGuire CASS RVI components during the PEO. Accordingly, the NRC staff concludes that the licensee has adequately resolved licensee action item 7.

3.4.7 Assessment of Resolution of Licensee Action Item 8

MRP-227-A, Section 4.2.8, "Submittal of Information for Staff Review and Approval," states:

> As addressed in Section 3.5.1 of this SE, applicants/licensees shall make a submittal for NRC review and approval to credit their implementation of MRP-227, as amended by this SE, as an AMP for the RVI components at their facility. This submittal shall include the information identified in Section 3.5.1 of this SE.

This is licensee action item 8.

The licensee stated in Section 6.2.8, "SE Applicant/Licensee Action Item 8: Submittal of Information for Staff Review and Approval," of the McGuire RVI AMP and Inspection Plan that the RVI AMP addressed Final License Renewal Interim Staff Guidance (LR-ISG)-2011-04, "Updated Aging Management Criteria for Reactor Vessel Internal Components for Pressurized Water Reactors" (ADAMS Accession No. ML12270A436), and the 10 program elements are addressed in Section 5 of the McGuire RVI AMP and Inspection Plan. The NRC staff found that both McGuire units fall under Category B per NRC Regulatory Issue Summary (RIS) 2011-07, "License Renewal Submittal Information for Pressurized Water Reactor Internals Aging Management" (ADAMS Accession No. ML111990086). RIS 2011-07 reminds license renewal holders and applicants that Category B plants will be expected to submit RVI AMPs/inspection plans in accordance with MRP-227-A. Regarding the information in MRP-227-A, Section 3.5.1, as stated in licensee action item 8 above, the NRC staff confirmed that the McGuire RVI AMP and Inspection Plan addresses the ten program elements of the GALL Report. Accordingly, the NRC staff concludes that the licensee has adequately resolved licensee action item 8.

4.0 CONCLUSION

As described above, the NRC staff has reviewed the McGuire RVI AMP and Inspection Plan and concludes that it is consistent with the I&E guidelines of MRP-227-A and is, therefore, acceptable. The NRC staff finds that the licensee has adequately addressed and resolved the eight licensee action items specified in MRP-227-A. Therefore, the NRC concludes that the licensee has met its License Renewal Commitment 14, as documented in Appendix D of NUREG-1772.

The NRC staff's approval of the McGuire RVI AMP and Inspection Plan does not reduce, alter, or otherwise affect current ASME Code, Section XI, ISI requirements, or any McGuire, Units 1 and 2, specific licensing basis requirements related to ISI.

Principal Contributor: S. Sheng

Date: March 8, 2019

SUBJECT: MCGUIRE NUCLEAR STATION, UNITS 1 AND 2 - STAFF EVALUATION RELATED TO REACTOR VESSEL INTERNALS INSPECTION PLAN BASED ON MRP-227-A (EPID NO. L-2017-LLA-0414) DATED MARCH 8, 2019

DISTRIBUTION:
PUBLIC
LPL2-1 R/f
RidsNrrLpl2-1 Resource
RidsACRS_MailCTR Resource
RidsNrrDmlrMvib Resource
RidsRgn2MailCenter Resource
RidsNrrPMMcGuire Resource
RidsNrrLAKGoldstein Resource
SSheng, NRR/DMLR/MVIB

ADAMS Accession No.: ML19058A416 ***via E-mail**

OFFICE	DORL/LPL2-1/PM	DORL/LPL2-1/LA	DMLR/MVIB/BC*
NAME	MMahoney	KGoldstein	DAlley
DATE	03/06/2019	03/06/2019	02/16/2019
OFFICE	DORL/LPL2-1/BC	DORL/LPL2-1/PM	
NAME	MMarkley	MMahoney	
DATE	03/08/2019	03/08/2019	

OFFICIAL RECORD COPY