



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

March 27, 2015

Mr. Randall K. Edington
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**SUBJECT: PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3 –
STAFF ASSESSMENT REGARDING REVIEW OF REACTOR VESSEL
INTERNALS AGING MANAGEMENT PROGRAM PLAN (TAC NOS. MF2554,
MF2555, AND MF2556)**

Dear Mr. Edington:

By letter dated September 28, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML122780119), as supplemented by letter dated July 23, 2014 (ADAMS Accession No. ML14205A438), Arizona Public Service Company (APS, the licensee) submitted a Reactor Vessel Internals (RVI) Aging Management Program Plan (inspection plan) for Palo Verde Nuclear Generating Station, Units 1, 2, and 3 (PVNGS), in accordance with Electric Power Research Institute's MRP-227-A, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)," December 2011 (ADAMS Accession No. ML120170453), for the U.S. Nuclear Regulatory Commission (NRC) staff review and approval. The plan has been submitted pursuant to APS commitment in its letter dated October 11, 2011 (ADAMS Accession No. ML11297A118).

The NRC staff has completed its review of the licensee's RVI inspection plan and, based on the enclosed staff assessment, concludes that the PVNGS RVI inspection plan is consistent with the guidance of MRP-227-A and is acceptable. The NRC staff also concludes that the licensee has addressed all the applicant/licensee action items specified in MRP-227-A appropriately.

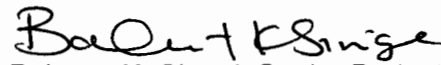
The NRC staff's approval of the PVNGS RVI inspection plan does not reduce, alter, or otherwise affect current American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI inservice inspection requirements, or any PVNGS-specific licensing requirements related to inservice inspection. The licensee must follow the implementation requirements as defined in Section 7.0 of MRP-227-A, which requires that the NRC staff be notified of any deviations from the "Needed" requirements.

R. Edington

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If you have any questions, please contact me at (301) 415-3016 or via e-mail at Balwant.Singal@nrc.gov.

Sincerely,



Balwant K. Singal, Senior Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-528, STN 50-529,
and STN 50-530

Enclosure:
Staff Assessment

cc w/encl: Distribution via Listserv



UNITED STATES
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OFFICE OF NUCLEAR REACTOR REGULATION

STAFF ASSESSMENT RELATED TO REVIEW OF REACTOR VESSEL INTERNALS

AGING MANAGEMENT PROGRAM PLAN

ARIZONA PUBLIC SERVICE COMPANY

PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3

DOCKET NOS. STN 50-528, STN 50-529, AND STN 50-530

1.0 INTRODUCTION AND BACKGROUND

By letter dated September 28, 2012 (Reference 1), as supplemented by letter dated July 23, 2014 (Reference 2), Arizona Public Service Company (APS, the licensee) submitted a Reactor Vessel Internals (RVI) Aging Management Program Plan for Palo Verde Nuclear Generating Station, Units 1, 2, and 3 (PVNGS), in accordance with MRP-227-A, "Materials Reliability Program: Pressurized Water Reactor [PWR] Internals Inspection and Evaluation Guidelines (MRP-227-A)," December 2011 (Reference 4) for U.S. Nuclear Regulatory Commission (NRC) staff review and approval. The plan has been submitted pursuant to APS commitment in its letter dated October 11, 2011 (Reference 3).

This aging management program plan (AMP) establishes appropriate monitoring and inspections to maintain the RVI functionality for the period of extended operation (PEO); the PEO begins on June 1, 2025, for Unit 1, April 24, 2026, for Unit 2, and November 25, 2027, for Unit 3. This AMP identifies all of the components that must be considered for aging management review (AMR) and identifies the augmented inspection plan for the PVNGS RVI.

2.0 REGULATORY EVALUATION

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 (LR). The regulations in 10 CFR 54.21, "Contents of application—technical information," requires that each license renewal application (LRA) contain an integrated plant assessment (IPA) and an evaluation of time-limited aging analyses. The plant-specific IPA shall identify and list those structures and components subject to an AMR and demonstrate that the effects of aging (cracking, loss of material, loss of fracture toughness, dimensional changes, loss of preload) will be adequately managed so that their intended functions will be maintained consistent with the current licensing basis for the PEO as required by 10 CFR 54.29(a). In addition, 10 CFR 54.22, "Contents of application—technical specifications," requires that a LRA include any technical specification (TS) changes or additions necessary to manage the effects of aging during the PEO as part of the LRA.

Enclosure

Structures and components subject to an AMP shall encompass those structures and components that (1) perform an intended function, as described in 10 CFR 54.4, "Scope," without moving parts or without a change in configuration or properties and (2) are not subject to replacement based on a qualified life or specified time period. These structures and components are referred to as "passive" and "long-lived" structures and components, respectively.

On January 12, 2009, the Electric Power Research Institute (EPRI) submitted for NRC staff review and approval the Report MRP-227, Revision 0, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-Rev. 0)," (Reference 5), which was intended as guidance for applicants in developing their plant-specific AMP for RVI components. The scope of components considered for inspection under the guidance of MRP-227, Revision 0, includes core support structures, which are typically denoted as Examination Category B-N-3 by American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, and those RVI components that serve an intended safety function consistent with the criteria in 10 CFR 54.4(a)(1). The scope of the program does not include consumable items such as fuel assemblies, reactivity control assemblies, and nuclear instrumentation because these components are not subject to an AMR, as defined in 10 CFR 54.21(a)(1).

Revision 1 to the final safety evaluation (SE) for MRP-227, Revision 0, was issued on December 16, 2011 (Reference 6). This NRC SE contains specific conditions on the use of the topical report and licensee action items that must be addressed by those utilizing the topical report as the basis for a submittal to the NRC. On January 9, 2012, EPRI published the NRC approved version of topical report, designated MRP-227-A (Reference 4). MRP-227-A contains a discussion of the technical basis for the development of plant-specific AMPs for RVI components in PWR vessels and also provides inspection and evaluation (I&E) guidelines for PWR applicants to use in their plant-specific AMPs. MRP-227-A provides the basis for renewed license holders to develop plant-specific inspection plans to manage aging effects on RVI components.

Subsequent to the submittal of MRP-227 and prior to the issuance of the SE on MRP-227, NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report – Final Report" (the GALL Report, Rev. 2, (Reference 7) was issued, providing new AMR line items and aging management guidance in AMP XI.M16A (Section XI of NUREG-1801), "PWR Vessel Internals." This AMP was based on NRC staff expectations for the guidance to be provided in MRP-227-A. License Renewal Interim Staff Guidance LR-ISG-2011-04, "Updated Aging Management Criteria for Reactor Vessel Internal Components for Pressurized Water Reactors," was published on May 28, 2013 (Reference 8), to update AMP XI.M16A for consistency with MRP-227-A.

3.0 TECHNICAL EVALUATION

3.1 Organization of the PVNGS RVI AMP

Section 1.0, "Introduction," of the AMP describes the objective, license renewal background, and provides a high level description of the program elements. Section 2.0, "Aging

Management Approach," contains an explanation of the mechanisms of age-related degradation in PWR internals, which the program was designed to monitor. It also contains discussion of the aging management strategy of the program that comes directly from MRP-227-A. This section also identifies and confirms compliance with the 10 AMP program elements of NUREG-1801. Section 3.0, "Palo Verde Reactor Vessel Internals Design and Operating Experience," describes the unique features of the RVI design and plant-specific operating experience (OpE) related to RVI components. Section 4.0, "Examination and Acceptance and Expansion Criteria," outlines how the program works. This includes the specific visual, surface, volumetric, and physical measurement examinations used at PVNGS for RVI as well as the expansion criteria, evaluation, repair, and replacement strategy, implementation schedule, and commitment tracking process. Section 5.0, "Responses to the NRC Safety Evaluation Applicant/Licensee Action Items," contains the licensee's responses to the Applicant/Licensee Action Items (Licensee Action Items) from the staff's final SE of MRP-227, Revision 0. In addition, the tables summarizing the augmented primary, expansion, and existing inspections incorporated into the PVNGS inservice inspection (ISI) for the license renewal period are included at the end. Section 6.0, "References," contains the references. Appendix A lists all the ASME Code, Section XI, Inspection Category B-N-2 and B-N-3 inspections applicable to the PVNGS RVI. Appendix B contains aging management evaluations for the RVI components in the PVNGS LRA. Appendices C, D, and E contain a cross index of all RVI components and materials for Units 1, 2, and 3, respectively.

Many sections of the inspection plan are similar to what has already been approved in MRP-227-A and contain no specific technical information which would affect the review and approval of the inspection plan. Therefore, the discussion in the following sections is focused on Section 5 of the PWR Internals Aging Management Program Plan for PVNGS provided as Enclosure to Reference 1 that includes the majority of the specific technical information for PVNGS.

3.2 Reactor Vessel Internals Aging Management Program Attributes

Licensee Evaluation

The licensee provided its evaluation of each of the ten AMP Program Elements in subsections 2.3.1 through 2.3.10 against the corresponding elements in Section XI.M16A, "PWR Vessel Internals," of the GALL Report, Revision 2." The licensee determined that its AMP is consistent, with the corresponding aging management attributes in the GALL Report, Revision 2.

In its description of the "Acceptance Criteria" program element, the licensee stated that components with degradation exceeding the examination acceptance criteria will be evaluated per MRP-227-A and the most appropriate ASME Code, Section XI paragraph, but will also use the supplemental guidance of WCAP-17096-NP, Revision 2, "Reactor Internals Acceptance Criteria Methodology and Data Requirements," December 2009 (Reference 9), including any guidance resulting from the ongoing NRC review of that report.

For Element 10, "Operating Experience," the licensee provided a summary of existing RVI inspections to date for Appendix A of MRP-227-A. The licensee is expected to review subsequent OpE for impact on its program and to participate in industry initiatives that perform

this function. The licensee reviewed RVI-specific OpE from the Institute of Nuclear Power Operation (INPO) and other information sources as required by XI.M16A of the GALL Report, but there has not been any PVNGS-specific OpE related to RVI. The licensee noted one example at a domestic Combustion Engineering (CE) designed plant where fuel leakage from the assemblies adjacent to the core shroud had occurred. The licensee stated that it will incorporate the lessons learned from the OpE at the other CE plant.

NRC Staff Evaluation

The NRC staff reviewed the licensee's AMP against the ten elements of the revised version of GALL Report, Section XI.M16A, as provided in Reference 8.

For the "Acceptance Criteria" program element, the NRC staff notes that WCAP-17096-NP was originally included in GALL, Revision 2, XI.M16A, but was removed from the LR-ISG because the RVI inspection plan cannot reference an unapproved document. The staff concludes that the licensee's proposed evaluation methodologies are acceptable, provided the licensee uses MRP-227-A recommended evaluation methodologies and/or NRC-approved guidance when available. Based on its review of the AMP for PVNGS, the NRC staff concludes that the elements of the RVI AMP for PVNGS are consistent with the ten elements described in LR-ISG-2011-04 and the implementation of these ten elements, using NRC-approved guidance, is acceptable.

3.3 Reactor Vessel Internals Design and Operating Experience

Licensee Evaluation

Sections 3.0 through 3.5 of the AMP contain descriptive information regarding the nature and configuration of the RVI, which is then summarized in Section 3.6 with the following features of the CE System 80 design:

- Bottom-mounted instrumentation,
- Control element assembly guide tubes were rolled and welded to the fuel alignment plate,
- Full-height welded core shroud plates,
- No zirconium alloy based top-mounted thimble tubes,
- No cast austenitic stainless steel in the RVI,
- No baffle or core shroud bolts, and
- No core support columns or plates

The licensee states in Section 3.7, "PVNGS Unit Operating Experience," that PVNGS has not had any OpE with degradations or non-conforming conditions during the past existing ASME Code inspections of the RVI.

NRC Staff Evaluation

The NRC staff reviewed Section 3.0 of the AMP and notes that the unique features of the System 80 design were considered in the development of MRP-227-A through discussion presented in MRP-232 (Reference 10), Section 4.1.4. The staff reviewed these design-specific issues and concludes that the licensee's submittal has appropriately evaluated the PVNGS RVI design as compared to MRP-227-A.

The NRC staff reviewed the industry summary of OpE for CE RVI in Appendix A of MRP-227-A and did not find any PVNGS-specific examples of degradation and, therefore, the licensee's description of plant-specific OpE is accurate and acceptable to the staff.

3.4 Examinations of RVI

Licensee Evaluation

Section 4.0 of the AMP provides details of the various examination techniques, expansion criteria, and evaluation, and repair and replacement strategy if conditions not meeting the acceptance criteria are found during examinations. The augmented inspections associated with MRP-227-A are similar to existing ASME Code, Section XI inspections in most cases. The licensee noted that volumetric examination like ultrasonic testing (UT) is not used for the PVNGS RVI because there are no baffle-former bolts in the design.

The licensee also noted that components with degradation exceeding the examination acceptance criteria for Primary and Expansion category items will be evaluated per the latest, NRC-approved methodologies.

In Appendix A of the AMP, the licensee listed its ASME Code, Section XI, ISI Program, which is credited as an existing program implementing ASME Code, Section XI, IWB-2500. The B-N-3 inspections consist of visual VT-3 examinations of core support structures, once every 10-year inspection interval. The licensee also stated that the implementation schedule for the augmented examinations for MRP-227-A are included in Section 5.0 of the AMP; the first PVNGS ASME Code, Section XI 10-year ISI inspection to be included as part of this license renewal AMP is currently scheduled for the fall 2026 refueling outage (1R26) for Unit 1, spring 2026 2R26 for Unit 2, and fall 2028 3R27 for Unit 3.

NRC Staff Evaluation

The NRC staff reviewed the information in Section 4.0 of the AMP and found it to be consistent with the examination acceptance criteria of MRP-227-A. The staff notes that significant changes could be incorporated into new revisions of MRP-227-A by the time when the first augmented inspections will be done in 2026.

3.5 Licensee Action Items from Safety Evaluation for MRP-227, Revision 0

The NRC staff's final SE for MRP-227, Revision 0, contained eight plant-specific licensee action items. The licensee's response and the staff's evaluation for each of these action items is described in the subsections below.

3.5.1 Licensee Action Item 1

Each licensee is responsible for assessing its plant's design and operating history and demonstrating that MRP-227-A is applicable to the facility. Each licensee shall refer, in particular, to the assumptions regarding plant design and operating history made in the failure modes, effects, and consequences analysis and functionality analyses for reactors of their design (i.e., Westinghouse, CE, or Babcock & Wilcox (B&W)), which support MRP-227-A 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 licensee shall submit this evaluation for NRC review and approval as part of its application to implement MRP-227-A.

Licensee Evaluation

In Section 5.1 of the AMP, the licensee listed the assumptions found in Section 2.4 of MRP-227-A, followed by their applicability to PVNGS as follows:

- 30 years of operation with high leakage core loading patterns (fresh fuel assemblies loaded in peripheral locations) followed by implementation of a low-leakage fuel management strategy for the remaining 30 years of operation.

PVNGS Applicability - The fuel management program for PVNGS has historically followed the core management practices required by MRP-227-A.

- base load operation, i.e., typically operates at fixed power levels and does not usually vary power on a calendar or load demand schedule.

PVNGS Applicability - For Units 1, 2, and 3, each operates as a base load unit.

- no design changes beyond those identified in general industry guidance or recommended by the original vendors.

PVNGS Applicability – The licensee stated that PVNGS has followed all industry guidance and that no modifications have been made to the RVI at any unit since May 2007.

NRC Staff Evaluation

In its response to Action Item 1, the licensee addressed the three general assumptions made in the analyses used to develop the MRP-227-A inspection. The licensee's response confirms that PVNGS has operated consistently with the three general assumptions in MRP-227-A Section 2.4, and restated above. The licensee further stated that it would continue to implement a low-leakage core design; for any future power uprates, the licensee will evaluate the effect of the uprate on the RVI Inspection Program at that time.

MRP-227-A, Section 2.4 also states:

The guidelines are based on a broad set of assumptions about plant operation, which encompass the range of current plant conditions for the U.S. domestic fleet of PWRs. The functionality assessments and supporting aging management strategies in MRP-231 (Reference 17) and MRP-232 (Reference 18) provide the basis for these guidelines. These evaluations were based on representative configurations and operational histories, which were generally conservative, but not necessarily bounding in every parameter.

In its review of MRP-227, Revision 0, the NRC staff did not endorse the three basic assumptions above as sufficient to verify plant-specific applicability of the guidelines. Section 3.2.5.1 of the staff's final SE of MRP-227-A provides additional background on the staff's concerns regarding plant-specific applicability verification.

To address the NRC staff's concerns, the MRP developed additional guidance to help licensees address Action Item 1, as discussed in WCAP-17780-P, "Reactor Internals Aging Management MRP-227-A Applicability for Combustion Engineering and Westinghouse Pressurized Water Reactor Designs" (Reference 11), and summarized in MRP-2013-025, "MRP-227-A Applicability Guidelines for Combustion Engineering and Westinghouse Pressurized Water Reactor Designs" (Reference 12). After additional review, the staff has determined that the sensitivity analyses described in WCAP-17780-P are adequate to define additional screening criteria for the typical fuel design and core loading representative of the assumptions used in the development of MRP-227 (Reference 13). Therefore, the staff requested for additional information to verify the applicability of MRP-227-A for each unit at PVNGS. The two specific generic issues that needed to be addressed are summarized as follows:

1. Do the RVI for the units at PVNGS have any non-weld or bolting austenitic stainless steel components with 20 percent cold work or greater, and if so do the affected components have operating stresses greater than 30 kips per square inch (ksi)? If so, perform a plant-specific evaluation to determine the aging management requirements for the affected components.
2. Have the units at PVNGS ever utilized atypical fuel design or fuel management that could make the assumptions of MRP-227-A regarding core loading/core design non-representative for that plant, including power changes/uprates? If so, describe how the differences were reconciled with the assumptions of MRP-227-A or provide a plant-specific aging management program for affected components as appropriate.

By letter dated July 23, 2014 (Reference 2), the licensee provided its response to the request for additional information (RAI). To answer the first part, the licensee retrieved and reviewed plant-specific drawings, procurement specifications, American Society of Testing and Materials (ASTM) and ASME standards, and related information to determine components and locations that may have been cold-worked during fabrication or if materials could have been ordered as strain hardened. The review also considered replacement parts.

No core support component materials were found to be in the greater than 20 percent cold-worked condition. However, the licensee discovered one set of socket head cap screws (SHCS), which attach shims to the core barrel for alignment of the upper guide structure, with an unidentified amount of cold work on the head to shank fillet of the screws. In this case, the licensee assumed that these cap screws are cold-worked to greater than the 20 percent threshold and have operating stresses greater than 30 ksi.

The licensee noted that the cap screws are used for alignment of the upper guide structure assembly and the SHCS have no core support function. In addition, the licensee's review noted that the screws are visually examined during removal as well as insertion of the upper guide structure assembly, and, in the event of a failure of any of the SHCS, the upper guide structure physically captures/contains these components during operation; they would not become loose parts. Therefore, the licensee determined that no additional examination of these components or others are required because of potential for more than 20 percent cold work.

In summary, the licensee has discovered one potential issue with SHCS that could have greater than 20 percent cold work and has dispositioned it. The NRC staff reviewed MRP-191, "Materials Reliability Program: Screening, Categorization, and Ranking of Reactor Internals Components for Westinghouse and Combustion Engineering PWR Design (MRP-191) (Reference 14), Table 6-6, and notes that the upper guide structure assembly as a whole contains only one component that could preclude a safe shutdown, which is the fuel alignment plate (a Primary inspection listed in Table 5-1 of the AMP). Therefore, because the SHCS, which could have greater than 20 percent cold work, are not a safety-significant component, would not create loose parts if they did fail, and are visually examined during refueling operations, the staff concludes that the licensee's review of plant-specific records meets the criteria of the MRP-227-A Applicability Guidelines. The staff's concerns expressed in the first part of the RAI are thus considered resolved.

Regarding the second part of the question for fuel management at PVNGS, the license has compared plant-specific information to the assumptions of MRP-227-A and the screening criteria of MRP-2013-025. The PVNGS units operated for approximately 1.5 years with high leakage cores, followed by greater than 26 years of low leakage core operation.

Considering the fuel design question, the licensee compared the screening criteria in MRP-2013-025 to the actual values for PVNGS Unit 3, for Cycle 19 (considered low leakage), which is representative of current and planned future core designs at PVNGS. The screening was applied to three boundary regions, the regions above and below the core as well as radially removed from the core. The licensee compared the plant-specific information to the parameters defined in MRP-2013-025 for each of the three boundary regions, which are summarized below.

MRP-2013-025 Radial Boundary Limitation (components around the core)

Plant-specific applicability of MRP-227-A in the radial direction is demonstrated by satisfying the following limits for CE plants:

Heat generation figure of merit, F , less than or equal to 68 Watts/cm^3 [cubic centimeter] and average core power density being less than 110 Watts/cm^3 [Watts per cubic centimeter].

Heat generation figure of merit is calculated from average core power density, generic inside corner weighting factors, and relative fuel assembly power. All three units at PVNGS satisfy each of these limits. Specifically, the core design for PVNGS Unit 3, Cycle 19, is representative of current and planned future core designs for all three units at PVNGS and is considered a low-leakage core design. Unit 3, Cycle 19, has a maximum F of 58.59 Watts/cm³. The current rated power level at PVNGS results in an average core power density of 100.23 Watts/cm³. Both of the radial boundary limits are satisfied.

MRP-2013-025 Upper Axial Boundary Limitation (components above the core)

Plant-specific applicability of MRP-227-A in the upper axial direction is demonstrated by satisfying the following limits for CE plants:

Active fuel to fuel alignment plate distance being greater than 12.4 inches and the average core power density being less than 110 Watts/cm³.

PVNGS satisfies these limits. The distance from the active fuel to the bottom of the fuel alignment plate is greater than 29 inches. This distance from the fuel to the upper internals results in a decrease in fluence to the upper internals compared to that assumed in MRP-227-A.

PVNGS has an additional design feature not considered in MRP-227-A. PVNGS has control element assembly (CEA) shroud tubes that extend below the fuel alignment plate. The bottom of these tubes is considered the lowest point of the upper internals instead of the fuel alignment plate. The distance from the active fuel to the CEA shroud tubes at PVNGS is greater than 19 inches.

As stated previously, the current rated power level at PVNGS results in an average core power density of 100.23 Watts/cm³. Each of the upper axial boundary limits are satisfied.

MRP-2013-025 Lower Axial Boundary Limitation (components below the core)

Plant-specific applicability of MRP-227-A in the lower axial direction is demonstrated by satisfying the three MRP-227-A, Section 2.4 assumptions stated earlier (assumptions are repeated for sake of clarity):

- i. 30 years of operation with high leakage core loading patterns (fresh fuel assemblies loaded in peripheral locations) followed by implementation of a low leakage fuel management strategy for the remaining 30 years of operation;*

PVNGS OpE shows approximately 1.5 years of high leakage cores (one cycle), followed by greater than 26 years of low-leakage core operation. This shows significant margin to the assumed fluence in MRP-227-A. This assumption is, therefore, satisfied.

- ii. *base load operation, i.e., typically operates at fixed power levels and does not usually vary power on a calendar or load demand schedule.*

PVNGS has not operated in a load follow capacity; therefore, this assumption is satisfied.

- iii. *no design changes beyond those identified in general industry guidance or recommended by the original vendors.*

PVNGS has not implemented any fuel design changes beyond those identified in general industry guidance or those recommended by the fuel vendor. PVNGS has, therefore, satisfied each of the assumptions of MRP-227-A, Section 2.4. As a result, no further evaluation of fluence in the lower axial direction is necessary.

In summary, while the licensee has performed numerous core reload designs, including two NRC staff-approved power uprates over the course of the PVNGS operating history, the staff concludes that PVNGS meets the criteria of the MRP-227-A Applicability Guidelines and the screening criteria in MRP-2013-025 in the areas of core designs or fuel management and, therefore, no further evaluation should be required. The staff's concerns expressed in the second part of the RAI are, therefore, resolved.

Licensee Action Item 1 - Conclusion

Based on its independent evaluation, the NRC staff determined that the component aging management recommendations in MRP-227-A for generic CE-designed RVI components will not be affected by PVNGS plant-specific information. Therefore, the staff concludes that the licensee's response to Licensee Action Item 1, along with its July 23, 2014, response to the RAI and the plans to continue to use a low-leakage core (characterized by Unit 3, for Cycle 19) in the future for all three units, is sufficient to resolve the issues related to the RAI and Licensee Action Item 1 for PVNGS.

3.5.2 Licensee Action Item 2

Per Section 4.2.2 of NUREG-1801, Revision 2 (Reference 7), this action item requires that, consistent with the requirements addressed in 10 CFR 54.4, each licensee is responsible for identifying which RVI components are within the scope of LR for its facility. Licensees shall review the information in MRP-189, Revision 1 (Reference 19) and MRP-191 (Reference 14) 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. (Note: Table 4-5 of MRP-191 is the applicable table for CE-design RVI). If the tables do not identify all the RVI components that are within the scope of LR for its facility, the 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 PEO.

Licensee Evaluation

The aging management review done as part of the PVNGS LRA was described in Section 1.7.1 and was summarized in Appendix B, Table B-1 of the September 28, 2012 submittal. The

licensee stated that a review of the PVNGS LR Project documentation shows that all RVI sub-components in the scope of LR and included in Table 4-5 in MRP-191 are included in Table B-1.

NRC Staff Evaluation

The NRC staff reviewed the information provided by the licensee in Appendix B of the inspection plan against the components subject to AMR in the PVNGS LRA and the components evaluated in MRP-191 for CE plants. The staff concludes that MRP-227-A (through MRP-191) addresses all the PVNGS components subject to AMR and a review of Appendices C, D, and E showed that all of the materials in the PVNGS RVI are also included in Table 4-5 in MRP-191. Therefore, the staff concludes that the licensee's response to Licensee Action Item 2 is sufficient to resolve Action Item 2 for PVNGS.

3.5.3 Licensee Action Item 3

This action item requires that the CE licensees perform plant-specific analysis to either justify the acceptability of their existing programs, or to identify changes to their existing programs that should be made to manage the aging of the in-core instrument (ICI) thimble tubes or thermal shield positioning pins.

Licensee Evaluation

This action item is not applicable because PVNGS does not have ICI thimble tubes or a thermal shield.

NRC Staff Evaluation

Since the licensee confirmed via examination of design records that PVNGS does not have ICI thimble tubes or a thermal shield, the NRC staff concludes that the response to Action Item 3 is acceptable.

3.5.4 Licensee Action Item 4

This action item is not applicable to CE design units.

3.5.5 Licensee Action Item 5

The NRC-approved version of MRP-227 requires licensees with a CE-designed reactor vessel, which include core barrel shrouds assembled in two vertical sections, shall identify plant-specific acceptance criteria to be applied when performing the physical measurements for distortion in the gap between the top and bottom core shroud segments.

Licensee Evaluation

Not applicable to PVNGS because PVNGS does not have gaps in the core shroud segments. The shroud panels are full height.

NRC Staff Evaluation

Since the licensee confirmed via examination of design records that PVNGS has full-height core shroud panels, the NRC staff concludes that the licensee's response to Licensee Action Item 5 is acceptable.

3.5.6 Licensee Action Item 6

Not applicable to CE design units.

3.5.7 Licensee Action Item 7

This action item requires the licensees of CE reactor vessels to develop plant-specific analyses to be applied for their facilities to demonstrate that cast lower support columns and additional RVI components requiring aging management as part of Action Item 2 that may be fabricated from cast austenitic stainless steel (CASS), martensitic, or precipitation-hardened (PH) stainless steel, will maintain their functionality during the PEO. These analyses should also consider the possible loss of fracture toughness in these components due to thermal embrittlement and irradiation embrittlement. 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 licensees shall include the plant-specific analysis as part of their submittal to apply the approved version of MRP-227.

Licensee Evaluation

PVNGS, Units 1, 2, and 3 do not have any components fabricated from CASS, martensitic, or PH stainless steel. Therefore, Action Item 7 does not apply to PVNGS.

NRC Staff Evaluation

Since the licensee confirmed via examination of design records that PVNGS Units 1, 2, and 3 do not have any components fabricated from CASS, martensitic, or PH stainless steel, the NRC staff concludes that the licensee's response to Licensee Action Item 7 is acceptable.

3.5.8 Licensee Action Item 8

This Licensee Action Item requires licensees to make a submittal for NRC review and approval to credit their implementation of MRP-227, as amended by this staff assessment, as an AMP for the RVI components at their facility. This submittal shall include the information identified in Section 3.5.1 of the NRC staff's final SE.

Section 3.5.1 of this SE states that in addition to the implementation of MRP-227, Revision 0, in accordance with Nuclear Energy Institute (NEI) 03-08, Revision 2, "Guideline for the Management of Material Issues," January 2010 (Reference 20), licensees whose licensing basis contains a commitment to submit a PWR RVI AMP and/or inspection program shall also make a submittal for NRC review and approval to credit their implementation of MRP-227, as amended by the staff's final SE. Section 3.5.1 of the staff SE for MRP-227, Revision 0, further states that an licensee's application to implement MRP-227 shall include the following items:

1. An AMP for the facility that addresses the 10 program elements as defined in NUREG-1801, Revision 2, AMP XI.M16A.
2. To ensure the MRP-227, Revision 0, program and the plant-specific action items will be carried out by licensees, licensees are to submit an inspection plan which addresses the identified plant-specific action items for NRC staff review and approval consistent with the licensing basis for the plant. If an licensee plans to implement an AMP, which deviates from the guidance provided in MRP-227, as approved by the NRC, the licensee shall identify where its program deviates from the recommendations of MRP-227, as approved by the NRC, and shall provide a justification for any deviation, which includes a consideration of how the deviation affects both "Primary" and "Expansion" inspection category components.
3. Include a summary of the inspection plan in the Updated Final Safety Analysis Report (UFSAR).
4. This item relates to any changes to the Technical Specifications (TS) required for implementation of the inspection plan.
5. This item relates to how the licensee will address the cumulative usage factor (CUF) analyses that are time-limited aging analyses for the RVI.

Further, as stated by the staff SE for MRP-227, Revision 0, licensees that submit LRAs before the issuance of the NRC staff's final SE are only required to submit the first two additional information items.

Licensee Evaluation

The licensee has responded to all five items listed for Action Item 8.

Item 1 - The licensee included its 10-element AMP in Section 2.3 of its RVI Inspection Plan.

Item 2 - The licensee stated that the plant-specific inspection plans, as described in Table 5-1 through 5-4 of the AMP submitted by letter dated September 28, 2012, are consistent with MRP-227-A, contains no apparent deviations, and addresses PVNGS specific action items.

Item 3 - Following NRC approval of this plant-specific aging management plan, the licensee will incorporate a summary of it into the UFSAR no later than the next scheduled update that is required by 10 CFR 50.71(e).

Item 4 - No changes to the TS are required at PVNGS.

Item 5 - The licensee plans to satisfy this action item using the PWR Vessel Internals Program and the Reactor Coolant System Transient and Operating Cycles Program as the basis for verifying CUF analyses in accordance with 10 CFR 54.21 (c)(1)(iii).

NRC Staff Evaluation

The NRC staff notes that since the PVNGS LRA was submitted prior to the issuance of the staff's final SE, the licensee is only required to submit the first two information items.

The licensee provided the information for Item 1 of Licensee Action Item 8 in the AMP as described in Sections 2.3.1 through 2.3-10 of the AMP, as reviewed in Section 3.2 of this staff evaluation. The licensee provided the information required by Item 2 of Licensee Action Item 8 via its submittal of the RVI Inspection Plan (Reference 1), including evaluation of the Licensee Action Items, as supplemented by RAI response (Reference 2). The NRC staff also reviewed the PVNGS LRA dated December 11, 2008 (Reference 15) and the LR SE dated April 2011 (Reference 16), and noted no time-limited aging analyses related to the RVI. Therefore, the staff concludes that the licensee has adequately addressed Licensee Action Item 8.

3.5.9 Conclusion of Licensee Action Item Evaluation

As discussed above, Licensee Action Items 1, 2, and 8 have been addressed by the licensee. Licensee Action Items 3 through 7 do not apply to PVNGS.

3.6 Topical Report Conditions for MRP-227, Revision 0

With respect to the seven conditions in Revision 1 of the NRC staff's SE for MRP-227, Revision 0, the staff reviewed Table 5-5 in Section 5.0 of the AMP. The staff has determined that all seven conditions placed on MRP-227, Revision 0 have been addressed.

3.7 Summary of Technical Evaluation

Based on the above, the NRC staff concludes that the AMP submitted by the licensee by letter dated September 28, 2012, as supplemented by letter dated July 23, 2014, is consistent with MRP-227-A and has provided acceptable responses to all of the topical report conditions and action items.

4.0 CONCLUSION

The NRC staff has reviewed the inspection plan for the PVNGS RVI components, as submitted in the licensee's letter dated September 28, 2012, as supplemented by letter dated July 23, 2014, and concludes that the licensee's RVI Inspection Plan is acceptable because it is consistent with the inspection and evaluation guidelines of MRP-227-A and the licensee has adequately addressed the licensee action items specified in MRP-227-A that are applicable to PVNGS. Consequently, the updated commitment made in the letter dated October 11, 2011 (Reference 3), is considered fulfilled. The NRC staff's approval of the PVNGS RVI Inspection

Plan does not reduce, alter, or otherwise affect current ASME Code, Section XI ISI requirements, or any PVNGS-specific licensing requirements related to ISI. The licensee must follow the implementation requirements as defined in Section 7.0 of MRP-227-A, which require that the NRC be notified of any deviations from the "Needed" requirements.

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If you have any questions, please contact me at (301) 415-3016 or via e-mail at Balwant.Singal@nrc.gov.

Sincerely,

/RA/

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