AMPs and SRP Sections to Support July 28 Public Meeting to Discuss Comments on the Mechanical Sections of the Draft SLR Guidance Documents

AMP XI.M16A PWR VESSEL INTERNALS

Program Description

~~This program relies on implementation of the Electric Power Research Institute (EPRI) Technical Report No. 1022863, "Materials Reliability Program: Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines," (MRP-227-A) and EPRI Technical Report No. 1016609, "Materials Reliability Program: Inspection Standard for PWR Internals," (MRP-228) to manage the aging effects on the pressurized water reactor (PWR) reactor vessel internal (RVI) components. The recommended activities in MRP-227-A and additional plant-specific activities not defined in MRP-227-A are implemented in accordance with Nuclear Energy Institute (NEI) 03-08, "Guideline for the Management of Materials Issues." The staff approved the augmented inspection and evaluation (I&E) criteria for PWR RVI components in NRC Safety Evaluation (SE), Revision 1, on MRP-227 by letter dated December 16, 2011.~~

This program is used to manage the effects of age-related degradation mechanisms that are applicable ~~in general~~ to the pressurized water reactor (PWR) reactor vessel internal (RVI) components ~~at the facility~~. These aging effects include:
(a) cracking, including stress corrosion cracking (SCC), primary water stress corrosion cracking (PWSCC), irradiation-assisted stress corrosion cracking (IASCC), and cracking due to fatigue/cyclic loading; (b) loss of material induced by wear; (c) loss of fracture toughness due to ~~either~~ thermal aging and~~or~~ neutron irradiation embrittlement; (d) changes in dimensions due to void swelling or distortion; and (e) loss of preload due to thermal and irradiation-enhanced stress relaxation or creep.

In the absence of an acceptable generic methodology such as an approved revision of MRP-227 that considers an operating period of 80 years, t~~T~~his program may be based~~ relies on implementation of the~~ an existing plant program that is ~~based~~consistent with ~~on~~ Electric Power Research Institute (EPRI) Technical Report No. 1022863, "Materials Reliability Program: Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines," (MRP-227-A) ~~and EPRI Technical Report No. 1016609, "Materials Reliability Program: Inspection Standard for PWR Internals," (MRP-228)~~, which ~~) to manage the aging effects on the pressurized water reactor (PWR) reactor vessel internal (RVI) components. The recommended activities in MRP-227-A and additional plant-specific activities not defined in MRP-227-A are~~is implemented in accordance with Nuclear Energy Institute (NEI) 03-08, "Guideline for the Management of Materials Issues." The staff approved the augmented inspection and evaluation (I&E) criteria for PWR RVI components in NRC Safety Evaluation (SE), Revision 1, on MRP-227 by letter dated December 16, 2011.

Because the guidelines of MRP-227-A are based on an analysis of the RVI that considers the operating conditions up to a 60-year operating period, these guidelines are supplemented through a gap analysis that identifies enhancements to the program that are needed to address an 80-year operating period. In this program, the term "MRP-227-A (as supplemented)" is used to describe either MRP-227-A as supplemented by this gap analysis, or an acceptable generic methodology such as an approved revision of MRP-227 that considers an operating period of 80 years.

The program applies the guidance in MRP-227-A (as supplemented) for inspecting, evaluating, and, if applicable, dispositioning non-conforming RVI components at the facility. These examinations provide reasonable assurance that the effects of age-related degradation mechanisms will be managed during the period of extended operation. The

program includes expanding periodic examinations and other inspections, if the extent of the degradation identified exceeds the expected levels.

MRP-227-A guidance for selecting RVI components for inclusion in the inspection sample is based on a four-step ranking process. Through this process, the RVIs for all three PWR designs were assigned to one of the following four groups: "Primary," "Expansion," "Existing Programs," and "No Additional Measures." Definitions of each group are provided in MRP-227-A. ~~"Generic Aging Lessons Learned Report" (GALL Report), Revision 2, Chapter IX.B.~~

In the absence of an acceptable generic methodology such as an approved revision of MRP-227 that considers an operating period of 80 years, the gap analysis described ~~above~~below is used to ensure that the aging management for the RVI components ~~are appropriately~~ identified in the four groups is appropriate for 80 years of operation.

The result of this four-step sample selection process is a set of "Primary" internals component locations for each of the three plant designs that are inspected because they are expected to show the leading indications of the degradation effects, with another set of "Expansion" internals component locations that are specified to expand the sample should the indications be more severe than anticipated.

The degradation effects in a third set of internals locations are deemed to be adequately managed by "Existing Programs," such as American Society of Mechanical Engineers

(ASME) Code, Section XI,[1] Examination Category B-N-3, examinations of core support structures. A fourth set of internals locations are deemed to require "No Additional Measures."

If the program is based on MRP-227-A with a gap analysis, ~~the following information is provided in certain of the elements:~~all changes to the inspection categories, inspection criteria, and other program characteristics required by ~~from those in~~ MRP-227-A ~~(including all components that screen in for additional aging effects)~~ are identified and justified for each component in the applicable ~~"Scope of Program"~~ program elements. The justification should focus on the aging management of the additional degradation that occurs between 60 and 80 years of operation. The acceptance criteria in ~~(Refer to the acceptance criteria in~~ NUREG-2192, Section 3.1.2.2.9 and the review procedures in NUREG-2192, Section 3.1.3.2.9 provide additional ~~for addition~~ information.~~)~~ ~~.~~

Evaluation and Technical Basis

1. ***Scope of Program:*** The scope of the program includes all RVI components based on the plant's applicable nuclear steam supply system design. The scope of the program applies the methodology and guidance in MRP-227-A (as supplemented), which provides an augmented inspection and flaw evaluation methodology for assuring the functional integrity of safety-related internals in commercial operating U.S. PWR nuclear power plants designed by Babcock & Wilcox (B&W), Combustion Engineering (CE), and Westinghouse. The scope of components ~~considered for inspection in MRP-227-A~~ includes core support structures, those RVI components that serve an intended license renewal safety function pursuant to

[1] Refer to the GALL-SLR Report, Chapter I, for applicability of various editions of the ASME Code, Section XI.

criteria in 10 CFR 54.4(a)(1), and other RVI components whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1)(i), (ii), or (iii). In addition, ASME Code, Section XI includes inspection requirements for PWR removable core support structures in Table IWB-2500-1, Examination Category B-N-3, which are in addition to any inspections that are implemented in accordance with MRP-227-A (as supplemented).

The scope of the program does not include consumable items, such as fuel assemblies, reactivity control assemblies, and nuclear instrumentation. The scope of the program also does not include welded attachments to the internal surface of the reactor vessel because these components are considered to be ASME Code Class 1 appurtenances to the reactor vessel and are managed in accordance with an applicant's AMP that corresponds to GALL-SLR AMP XI.M1, "ASME Code, Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."

This program element specifies if the program is based on an existing program that is consistent with MRP-227-A with a gap analysis or if it is based on an acceptable generic methodology such as an approved revision of MRP-227 that considers an operating period of 80 years. If based on MRP-227-A with a gap analysis, the scope of the program focuses on identification and justification of the following:

a. Components that screen in for additional aging effects or mechanisms when assessed for the 60-80 year operating period
b. Components that previously screened in for an aging effect or mechanism and the severity of that aging effect or mechanism could significantly increase for the 60-80 year operating period
c. Changes to the existing MRP-227-A program characteristics or criteria, including but not limited to changes in inspection categories, inspection criteria, or primary-to-expansion component criteria and relationships

2. ***Preventive Actions:*** ~~MRP-227-A~~The program relies on PWR water chemistry control to prevent or mitigate aging effects that can be induced by corrosive aging mechanisms (e.g., loss of material induced by general, pitting corrosion, crevice corrosion, or stress corrosion cracking or any of its forms [SCC, PWSCC, or IASCC]). Reactor coolant water chemistry is monitored and maintained in accordance with the Water Chemistry Program, as described in GALL-SLR AMP XI.M2, "Water Chemistry."

3. ***Parameters Monitored/Inspected:*** The program manages the following age-related degradation effects and mechanisms that are applicable in general to RVI components at the facility: (a) cracking induced by SCC, PWSCC, IASCC, or fatigue/cyclic loading; (b) loss of material induced by wear; (c) loss of fracture toughness induced by ~~either~~ thermal aging ~~or~~ and neutron irradiation embrittlement; (d) changes in dimensions due to void swelling or distortion; and (e) loss of preload due to thermal and irradiation-enhanced stress relaxation or creep.

For the management of cracking, the program monitors for evidence of surface-breaking linear discontinuities if a visual inspection technique is used as the non-destructive examination (NDE) method, or for relevant flaw presentation signals if a volumetric

ultrasonic testing (UT) method is used as the NDE method. For the management of loss of material, the program monitors for gross or abnormal surface conditions that may be indicative of loss of material occurring in the components. For the management of loss of preload, the program monitors for gross surface conditions that may be indicative of loosening in applicable bolted, fastened, keyed, or pinned connections. The program does not directly monitor for loss of fracture toughness that is induced by thermal aging or neutron irradiation embrittlement. Instead, the impact of loss of fracture toughness on component integrity is indirectly managed by: (1) using visual or volumetric examination techniques to monitor for cracking in the components, and (2) applying applicable reduced fracture toughness properties in the flaw evaluations, in cases where cracking is detected in the components and is extensive enough to necessitate a supplemental flaw growth or flaw tolerance evaluation. The program uses physical measurements to monitor for any dimensional changes due to void swelling or distortion.

Specifically, the program implements the parameters monitored/inspected criteria consistent with the applicable tables in Section 4, "Aging Management Requirements," in MRP-227-A (as supplemented).

4. ***Detection of Aging Effects:*** The inspection methods are defined and established in Section 4 of MRP-227-A (as supplemented). Standards for implementing the inspection methods are defined and established in MRP-228. In all cases, well-established inspection methods are selected. These methods include volumetric UT examination methods for detecting flaws in bolting and various visual (VT-3, VT-1, and EVT-1) examinations for detecting effects ranging from general conditions to detection and sizing of surface-breaking discontinuities. Surface examinations may also be used as an alternative to visual examinations for detection and sizing of surface- breaking discontinuities.

   Cracking caused by SCC, IASCC, and fatigue is monitored/inspected by either VT-1 or EVT-1 examination (for internals other than bolting) or by volumetric UT examination (bolting). VT-3 visual methods may be applied for the detection of cracking in non-redundant RVI components only when the flaw tolerance of the component, as evaluated for reduced fracture toughness properties, is known and the component has been shown to be tolerant of easily detected large flaws, even under reduced fracture toughness conditions. VT-3 visual methods are acceptable for the detection of cracking in redundant RVI components (e.g., redundant bolts or pins used to secure a fastened RVI assembly).

   In addition, VT-3 examinations are used to monitor/inspect for loss of material induced by wear and for general aging conditions, such as gross distortion caused by void swelling and irradiation growth or by gross effects of loss of preload caused by thermal and irradiation-enhanced stress relaxation and creep.

   The program adopts the guidance in MRP-227-A (as supplemented) for defining the "Expansion Criteria" that need to be applied to the inspection findings of "Primary" components and for expanding the examinations to include additional "Expansion" components. RVI component inspections are performed consistent with the inspection frequency and sampling bases for "Primary" components, "Existing Programs" components, and "Expansion" components in MRP-227-A (as supplemented).

In some cases (as defined in MRP-227-A), physical measurements are used as supplemental techniques to manage for the gross effects of wear, loss of preload due to stress relaxation, or for changes in dimensions due to void swelling or distortion.

Inspection coverages for "Primary" and "Expansion" RVI components are implemented consistent with Sections 3.3.1 and 3.3.2 of the NRC SE, Revision 1, on MRP-227-A, or as modified by a gap analysis.

This program element should justify the appropriateness of the inspection methods, sample size criteria, and inspection frequency criteria for managing the effects of degradation between 60 and 80 years of operation, including any changes to these criteria from their prior assessment in MRP-227-A. ~~As part of this element, each component that has moved from either the "Primary, "Expansion", "Existing Program", or "No Additional Measures" category to another category should be identified and the corresponding inspection method, sample size criteria, and inspection frequency criteria (including reinspection criteria) for the component should be defined and justified (as compared to Section 4 of MRP-227-A).~~

5. ***Monitoring and Trending:*** The methods for monitoring, recording, evaluating, and trending the data that result from the program's inspections are given in Section 6 of MRP-227-A (as supplemented) and its subsections. ~~Flaw evaluation methods, including recommendations for flaw depth sizing and for crack growth determinations as well as for performing applicable limit load, linear elastic and elastic-plastic fracture analyses of relevant flaw indications, are defined in MRP-227-A.~~Component reinspection frequencies for "Primary" and "Expansion" category components are defined in specific tables in Section 4 of the MRP-227-A report (as supplemented). The examination and re-examinations that are implemented in accordance with MRP-227-A (as supplemented), together with the criteria specified in MRP-228 for inspection methodologies, inspection procedures, and inspection personnel, provide for timely detection, reporting, and implementation of corrective actions for the aging effects and mechanisms managed by the program.

   The program applies applicable fracture toughness properties, including reductions for thermal aging or neutron embrittlement, in the flaw evaluations of the components in cases where cracking is detected in a RVI component and is extensive enough to warrant a supplemental flaw growth or flaw tolerance evaluation.

   For singly-represented components, the program includes criteria to evaluate the aging effects in the inaccessible portions of the components and the resulting impact on the intended function(s) of the components. For redundant components (such as redundant bolts, screws, pins, keys, or fasteners, some of which are accessible to inspection and some of which are not accessible to inspection), the program includes criteria to evaluate the aging effects in the population of components that are inaccessible to the applicable inspection technique and the resulting impact on the intended function(s) of the assembly containing the components.

   Flaw evaluation methods, including recommendations for flaw depth sizing and for crack growth determinations as well as for performing applicable limit load, linear elastic and elastic-plastic fracture analyses of relevant flaw indications, are defined in MRP-227-A (as supplemented).

~~This program element should justify the appropriateness of the inspection methods, sample size criteria, and inspection frequency criteria for managing the effects of degradation between 60 and 80 years of operation. As part of this element, each component that has moved from either the "Primary, "Expansion", "Existing Program", or "No Additional Measures" category to another category should be identified and the corresponding inspection method, sample size criteria, and inspection frequency criteria (including reinspection criteria) for the component should be defined and justified (as compared to Section 4 of MRP-227-A).~~

6.

Acceptance Criteria: Section 5 of MRP-227-A (as supplemented), which includes Table 5-1 for B&W-designed RVIs, Table 5-2 for CE-designed RVIs, and Table 5-3 for Westinghouse-designed RVIs, provides the specific examination and flaw evaluation acceptance criteria for the "Primary" and "Expansion" RVI component examination methods. For RVI components addressed by examinations performed in accordance with the ASME Code, Section XI, the acceptance criteria in IWB-3500 are applicable. For RVI components covered by other "Existing Programs," the acceptance criteria are described within the applicable reference document. As applicable, the program establishes acceptance criteria for any physical measurement monitoring methods that are credited for aging management of particular RVI components.

This program element should justify the appropriateness of the acceptance criteria for managing the effects of degradation between 60 and 80 years of operation, including any changes to acceptance criteria based on the gap analysis. ~~Any newly defined acceptance criteria or proposed changes to acceptance criteria defined in the MRP-227-A report are to be appropriately defined and justified as part of the enhancement of this program element.~~

~~6.~~7. ***Corrective Actions:*** Any detected conditions that do not satisfy the examination acceptance criteria are required to be dispositioned through the plant corrective action program, which may require repair, replacement, or analytical evaluation for continued service until the next inspection. The disposition will ensure that design basis functions of the reactor internals components will continue to be fulfilled for all licensing basis loads and events. The implementation of the guidance in MRP-227-A (as supplemented), plus the implementation of any ASME Code requirements, provides an acceptable level of aging management of safety-related components addressed in accordance with the corrective actions of 10 CFR Part 50, Appendix B or its equivalent, as applicable.

Other alternative corrective actions bases may be used to disposition relevant conditions if they have been previously approved or endorsed by the NRC. Alternative corrective actions not approved or endorsed by the NRC will be submitted for NRC approval prior to their implementation.

~~7.~~8. ***Confirmation Process:*** Site quality assurance procedures, review and approval processes, and administrative controls are implemented in accordance with the recommendations of NEI 03-08 and the requirements of 10 CFR Part 50, Appendix B, or their equivalent, as applicable. The implementation of the guidance in MRP-227-A (as supplemented), in conjunction with NEI 03-08 and other guidance documents, reports, or methodologies referenced in this AMP, provides an acceptable level of quality and an acceptable basis for confirming the quality of inspections, flaw evaluations, and corrective actions.

9. ***Administrative Controls:*** The administrative controls for these types of programs, including their implementing procedures and review and approval processes, are implemented in accordance with the recommended industry guidelines and criteria in NEI 03-08, and are under existing site 10 CFR 50 Appendix B, Quality Assurance Programs, or their equivalent, as applicable. The evaluation in Section 3.5 of the NRC's SE, Revision 1, on MRP-227 provides the basis for endorsing NEI 03-08. This includes endorsement of the criteria in NEI 03-08 for notifying the NRC of any deviation from the I&E methodology in MRP-227-A and justifying the deviation no later than 45 days after its approval by a licensee executive.

10. ***Operating Experience:*** The review and assessment of relevant operating experience for its impacts on the program, including implementing procedures, are governed by NEI 03-08 and Appendix A of MRP-227-A. Consistent with MRP-227-A, the reporting of inspection results and operating experience is treated as a "Needed" category item under the implementation of NEI 03-08.

    The program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience, as discussed in Appendix B of the GALL-SLR Report~~, which is documented in LR-ISG-2011-05~~.

    ~~Examples of relevant operating experience includes reports of cracking in specific types of core baffle or core shroud bolting and reports of cracking in Westinghouse-design clevis insert bolts.~~

References

10 CFR Part 50, Appendix B, *Quality Assurance Criteria for Nuclear Power Plants*, Office of the Federal Register, National Archives and Records Administration, 2011.

10 CFR Part 50.55a, *Codes and Standards*, Office of the Federal Register, National Archives and Records Administration, 2011.

ASME Boiler & Pressure Vessel Code, Section V, *Nondestructive Examination*, 2004 Edition, American Society of Mechanical Engineers, New York, NY.

ASME Boiler & Pressure Vessel Code, Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*, The ASME Boiler and Pressure Vessel Code, 2004 edition as approved in 10 CFR 50.55a, The American Society of Mechanical Engineers, New York, NY.

EPRI Technical Report No. 1016596, *Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227, Revision 0)*, Electric Power Research Institute, Palo Alto, CA: 2008.

EPRI Technical Report No.1022863, *Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)*, December 2011, ADAMS Accession No. ML12017A193 (Transmittal letter from the EPRI-MRP) and ADAMS Accession Nos. ML12017A194, ML12017A196, ML12017A197, ML12017A191, ML12017A192, ML12017A195 and ML12017A199, (Final Report).

EPRI 1016609, *Materials Reliability Program: Inspection Standard for PWR Internals (MRP-228)*, Electric Power Research Institute, Palo Alto, CA, July 2009 (Non-publicly available

ADAMS Accession No. ML092120574). The non-proprietary version of the report may be accessed by members of the public at ADAMS Accession No. ML092750569.

NRC Interim Staff Guidance LR-ISG-2011-05, *Ongoing Review Of Operating Experience*, March 16, 2012, (ADAMS Accession No. ML12044A215).

Nuclear Energy Institute (NEI) Report No. 03-08, Revision 2, *Guideline for the Management of Materials Issues*, ADAMS Accession No. ML101050334).

NRC Safety Evaluation from Robert A. Nelson (NRC) to Neil Wilmshurst (EPRI), *Revision 1 to the Final Safety Evaluation of Electric Power Research Institute (EPRI) Report, Materials Reliability Program (MRP) Report 1016596 (MRP-227), Revision 0, Pressurized Water Reactor Internals Inspection and Evaluation Guidelines*, December 16, 2011, ADAMS Accession No. ML11308A770.

NRC LR-ISG-2011-04, *Updated Aging Management Criteria for Reactor Vessel Internal Components for Pressurized Water Reactors*, June 3, 2013, ADAMS Accession No. ML12270A436.

3.1.2.2.9 Aging Management of Pressurized Water Reactor Vessel Internals (Applicable to Subsequent License Renewal Periods Only)

Electric Power Research Institute (EPRI) Topical Report ~~(TR) No.~~ 1022863, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)" ~~[henceforth TR Materials Reliability Program (MRP) 227-A, which may be accessed at(~~ ADAMS Accession Nos. ML12017A191 through ML12017A197 and ML12017A199~~])~~, provides the industry's current aging management recommendations for the reactor vessel internal (RVI) components that are included in the design of a PWR facility. In this report, the EPRI MRP identified that the following aging mechanisms may be applicable to the design of the RVI components in these types of facilities: (a) SCC, (b) irradiation-assisted stress corrosion cracking (IASCC), (c) fatigue, (d) wear, (e) neutron irradiation embrittlement, (f) thermal aging embrittlement, (g) void swelling and irradiation growth, or (h) thermal or irradiation-enhanced stress relaxation or irradiation enhanced creep. The methodology in ~~TR~~ MRP-227-A was approved by the NRC in a safety evaluation dated December 16, 2011 (ML11308A770), which includes those plant-specific applicant/licensee action items that a licensee or applicant applying the MRP-227-A report would need to address and resolve and apply to its licensing basis.

The EPRI MRP's functionality analysis and failure modes, effects, and criticality analysis (FMECA) bases for grouping Westinghouse-designed, B&W-designed and Combustion Engineering (CE)-designed RVI components into these inspection categories was based on an assessment of aging effects and relevant time-dependent aging parameters through a cumulative 60-year licensing period (i.e., 40 years for the initial operating license period plus an additional 20 years during the initial period of extended operation). The EPRI MRP has ~~yet to~~ not assess~~ed~~ whether ~~potential~~ operation~~s~~ of Westinghouse-designed, B&W-designed and CE-designed reactors during an SLR operating period would have any impact on the existing susceptibility rankings and inspection categorizations for the RVI components in these designs, as defined in ~~TR~~ MRP-227-A or its applicable MRP background documents (e.g., ~~TR~~ MRP-191 for Westinghouse-designed or CE-designed RVI components or MRP-189 for B&W-designed components).

~~Therefore, for PWR facility SLRAs, it is recommended that a plant-specific AMP for the RVI components will be defined in the SLRA to demonstrate that the RVI components will be managed in accordance with the requirements of 10 CFR 54.21(a)(3) during the proposed SLR period. Components for inspection, parameters monitored, monitoring methods, inspection sample size, frequencies, expansion criteria, and acceptance criteria are to be justified in the SLRA. The NRC staff will assess the adequacy of the plant-specific AMP against the criteria for the 10 AMP program elements that are defined in Sections A.1.2.3.1 through A.1.2.3.10 of SRP-SLR Appendix A.1.~~

As described in GALL-SLR Report AMP XI.M16A, ~~T~~the applicant may ~~also~~ use the MRP-227-A based AMP as an initial reference basis for developing and defining the AMP that will be applied to the RVI components for the SLR operating period. However, to use this alternative basis, GALL-SLR Report AMP XI.M16A recommends that the MRP-227-A based AMP be enhanced to include a gap analysis of the components that are within the scope of the AMP. The gap analysis is a basis for ~~determining~~ identifying and justifying ~~whether the inspection and evaluation (I&E) categorizations of RVI components assessed in the MRP-227-A report are sufficient or need to be changed if the components were evaluated for aging mechanisms over a cumulative, 80-year licensed plant life~~ changes to the MRP-227-A based program that are necessary to provide reasonable assurance that the effects of age-related degradation will be

managed during the subsequent period of extended operation. The criteria for the gap analysis are ~~also given~~described in GALL-SLR Report AMP XI.M16A.

Alternatively, the PWR SLRA may define a plant-specific AMP for the RVI components to demonstrate that the RVI components will be managed in accordance with the requirements of 10 CFR 54.21(a)(3) during the proposed SLR operating period. Components to be inspected, parameters monitored, monitoring methods, inspection sample size, frequencies, expansion criteria, and acceptance criteria are justified in the SLRA. The NRC staff will assess the adequacy of the plant-specific AMP against the criteria for the 10 AMP program elements that are defined in Section A.1.2.3 of SRP-SLR Appendix A.1.

3.1.3.2.9 Aging Management of PWR Reactor Vessel Internals (Applicable to Subsequent License Renewal Periods Only)

EPRI ~~TR~~ Topical Report~~No.~~ 1022863, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)" (~~henceforth TR MRP-227-A, which may be accessed at~~ ADAMS Accession Nos. ML12017A191 through ML12017A197 and ML12017A199), provides the industry's current aging management recommendations for the RVI components that are included in the design of a PWR facility, based on an analysis of plant operation for 60 years. The methodology in ~~TR~~ MRP-227-A was approved by the NRC in a safety evaluation dated December 16, 2011 (ML11308A770), which includes those plant-specific applicant/licensee action items that a licensee or applicant applying the MRP-227-A report would need to address and resolve and apply to its licensing basis.

The assessments of RVI components in the MRP-227-A report and the MRP-defined background reports for MRP-227-A have not ~~yet~~ been updated based on an assessment of aging effects over a~~n cumulative,~~ 80-year ~~plant licensing life~~operating period.

~~Therefore, for SLRAs of PWR facilities, i~~If a plant-specific AMP is proposed for the RVI components ~~is used to demonstrate that the RVI components will be managed during a proposed subsequent period of extended operation~~, the reviewer ~~reviews~~ evaluates the adequacy of the applicant's AMP on a case-by-case basis against the criteria for plant-specific AMP programs in Section A.1.2.3 of SRP-SLR Appendix A.1. The reviewer verifies that the applicant has defined and justified both the type of performance monitoring, condition monitoring, preventative monitoring, or mitigative monitoring AMP that will be used for aging management of the RVI components and the specific program element criteria for the AMP that will be used to manage age-related effects in the RVI components during the SLR period.

If a PWR applicant for SLR proposes to use GALL-SLR AMP XI.M16A, PWR Vessel Internals, as the basis for aging management, the staff reviews the program elements of the AMP against the program element criteria defined in AMP XI.M16A. The staff verifies that the ~~applicant has enhanced the MRP-227-A based AMP accordingly and that the~~ proposed program includes a gap analysis that provides the ~~applicant's basis for establishing whether any of the component inspection categories for components in the plant design need to be amended from those specified for these components in the MRP-227-A report or whether new component inspections need to be proposed~~ identification and justification of:

- Components that screen in for additional aging effects or mechanisms when assessed for the 60-80 year operating period
- Components that previously screened in for an aging effect or mechanism and the severity of that aging effect or mechanism could significantly increase for the 60-80 year operating period
- Changes to the existing MRP-227-A program characteristics or criteria, including but not limited to changes in inspection categories, inspection criteria, or primary-to-expansion component criteria and relationships

~~.~~ The staff evaluates ~~that~~ the adequacy and justification of the ~~methodology of the~~ gap analysis, specifically:

- The gap analysis methodology
- The components that screened in for additional aging effects or mechanisms when assessed for the 60-80 year operating period
- The components for which a previously screened in aging effect or mechanism has been identified as potentially more severe for the 60-80 year operating period
- Proposed changes to the aging management program characteristics or criteria identified in the SLRA

~~provides a sufficient basis for making potential changes to these inspection categories and evaluates the results of the gap analysis to determine whether changes to the inspection categories or criteria for the components need to be incorporated into enhancements of the "scope of program," "monitoring and trending," or "acceptance criteria" elements for the AMP.~~ For those RVI components that screened in for additional aging effects or mechanisms~~whose inspection categories have changed from those given in MRP-227-A~~, the staff also confirms that the applicant has included and justified ~~plant-specific~~appropriate AMR line items for the components.

Otherwise an applicant may use an NRC-approved generic methodology such as an approved revision of ~~the~~ MRP~~-227-Report~~ that considers an operating period of 80 years. I~~n this case~~f ~~industry reports are relied on for aging management~~, the staff reviews any responses to ~~applicable~~ action items on the aging management methods that may be identified in the NRC approval of the generic methodology.