DRAFT LICENSE RENEWAL INTERIM STAFF GUIDANCE

LR-ISG-2011-04

UPDATED AGING MANAGEMENT CRITERIA FOR PWR REACTOR VESSEL INTERNAL COMPONENTS

INTRODUCTION

Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" of Title 10 of the *Code of Federal Regulations* (10 CFR Part 54), provides the staff's administrative and technical requirements for submitting applications to renew the operating licenses of nuclear power plants.[1] The license renewal applications (LRAs) for pressurized-water reactors (PWRs) include aging management review (AMR) results for reactor vessel internal (RVI) components.

On January 12, 2009, the Electric Power Research Institute (EPRI) submitted for the U.S. Nuclear Regulatory Commission (NRC) staff review and approval Materials Reliability Program (MRP) Report 1016596, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-Rev. 0)." On June 22, 2011, the NRC staff issued its safety evaluation (SE) on topical report MRP-227, Revision 0. The NRC's SE contained specific topical report condition items (TRCIs) on the use of the MRP-227 topical report and applicant/licensee action items (A/LAIs) that must be addressed by those applicants or licensees utilizing the topical report as the basis for a licensing basis submittal to the NRC, including those applicants that submit an LRA under the requirements of 10 CFR Part 54.[2] EPRI Report 1022863 (MRP-227-A) is the NRC-endorsed industry-developed guidance that PWR licensees or PWR applicants for license renewal may use to develop and implement their plant-specific aging management program (AMP) for RVI components. The staff issued Revision 1 of its SE on the report methodology (i.e., the NRC SE (Rev. 1) on MRP-227) by letter dated December 16, 2011 (ML11308A770).

After submittal of MRP-227 and prior to the issuance of the SE on MRP-227, the NRC issued NUREG-1801, Revision 2 "Generic Aging Lessons Learned Report" (GALL Report, Revision 2), which provides the new AMR items for Westinghouse-designed, Combustion Engineering (CE)-designed, and Babcock and Wilcox (B&W)-designed RVI components and the new aging management guidance for these components in Section XI.M16A, "PWR Vessel Internals." The AMR items for PWR RVI components and the version of GALL AMP XI.M16A in GALL Report, Revision 2, were based on the original guidance in MRP-227. This license renewal interim staff guidance (LR-ISG) reconciles the inconsistencies between the staff's SE (Rev. 1) on MRP-227 and the AMR items and AMP for PWR RVI components in the GALL Report, Revision 2.

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[1] Henceforth, specific references to regulatory provisions in 10 CFR Part 54 will be designated in a 10 CFR 54.xxx format, as appropriate.

[2] Henceforth this LR-ISG will use a MRP-227 reference term if the staff is referring to the unendorsed MRP-227-Rev. 0 version of the MRP report and a MRP-227-A reference term if referring to the NRC-endorsed MRP-227-A version of the report that was updated to incorporate the NRC's TRCIs on the report's methodology, and approved in the NRC SE (Rev. 1) on MRP-227.

DISCUSSION

Section 54.4 of 10 CFR provides the scope for structures, systems and components (SSCs) that need to be included within the scope of license renewal. For those SSCs in the scope of the LRA, 10 CFR 54.21, "Contents of Application - Technical Information," requires that each applicant perform an integrated plant assessment of these SSCs, and identify and list those structures and components that are required to be within the scope of an AMR. Paragraph 54.21(a)(1) of 10 CFR states that the structures and components that are required to be subject to an AMR are those 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 often referred to as "passive and long-lived" structures and components, respectively. For those structures and components subject to an AMR, 10 CFR 54.21(a)(3) requires the applicant to demonstrate that the effects of aging will be adequately managed so that the intended functions of the structures and components will be maintained consistent with the current licensing basis (CLB) for the period of extended operation.[3] Also, 10 CFR 54.21(c)(1), in part, requires an applicant to identify all analyses in the CLB that conform to the six of the criteria for defining time-limited aging analyses in 10 CFR 54.3.

Consistent with the requirements of 10 CFR 54.21(a)(1)(i), an AMR is required for "passive and long-lived" RVI components in PWRs that have intended license renewal functions in accordance with 10 CFR 54.4(a). Cracking, loss of material, loss of fracture toughness, component distortion (i.e., changes in component dimensions), and loss of preload for bolted, keyed, screwed, or fastened components in mechanical connections are among the aging effects that may be applicable to a given RVI component.

The GALL Report, Revision 2, provides a set of generic AMR items for SSCs that are within the scope of license renewal, as described in 10 CFR 54.4, and that may be applicable for use in an applicant's integrated plant assessment. The GALL Report, Revision 2, also provides a set of generic AMPs that the staff has found acceptable and that may be used to manage the aging effects that are applicable to an applicant's integrated plant assessment. The corresponding standard review plan document used in the support of the GALL Report, Revision 2, is NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR, Revision 2).

The staff's current recommended AMP and program element criteria for PWR RVI components are given in GALL AMP XI.M16A. The staff's current set of license renewal further evaluation recommendations for PWR RVI components are given in SRP-LR, Revision 2, Sections 3.1.2.2.1, 3.1.2.2.3, 3.1.2.2.9, 3.1.2.2.10, 3.1.2.2.12, 3.1.2.2.13, and 3.1.2.2.14. The staff's specific commodity group-based AMR items (Table 1 AMR items) for PWR RVI components are given in specific AMR items provided in Table 3.1-1 of the SRP-LR, Revision 2. The staff's component-specific AMR items (Table 2 AMR items) for PWR RVI components are given in the following tables of the GALL Report, Revision 2:

[3] 10 CFR 54.29 would also permit an applicant to use an update of its CLB as the basis for aging management, so long as the update of the CLB is in compliance with the Atomic Energy Act of 1954 (as amended) and the Commission's regulations in 10 CFR.

- Table IV.B2 for Westinghouse-designed RVI components
- Table IV.B3 for CE-designed RVI components
- Table IV.B4 for B&W-designed RVI components

Each of the component-specific AMR items in these tables are derived and linked to a specific Table 1 AMR item in the SRP-LR, Revision 2. In addition, the column titled "further evaluation recommended" in Table 1 AMR items, and the column titled "further evaluation" in Table 2 AMR items identify whether the AMR items are tied to any of the specific further evaluation recommendation sections for PWR RVI components mentioned above.

This LR-ISG accounts for impacts of the NRC SE (Rev. 1) on MRP-227 in the sections and tables in the GALL Report, Revision 2, and in SRP-LR, Revision 2, while minimizing changes with regard to the existing program elements of GALL AMP XI.M16A. The ISG does this by updating the following AMR recommendations for PWR RVI components in lieu of changing program elements:

(a) applicable further evaluation recommendations for PWR RVI components in SRP-LR, Revision 2, Section 3.1.2.2,

(b) the Table 1 AMR items for PWR RVI components in Table 3.1-1 of the SRP-LR, Revision 2, and

(c) Table 2 AMR items for Westinghouse-design, CE-design, and B&W-design RVI components in Table IV.B2, IV.B3, and IV.B4 of the GALL Report, Revision 2.

This LR-ISG also updates the Final Safety Analysis Report (FSAR) Supplement summary description example provided for PWR vessel internal programs in Table 3.0-1 of the SRP-LR, Revision 2, and incorporates one change to the definition tables in Section IX of the GALL Report, Revision 2. Specifically, this LR-ISG modifies the material definition for stainless steel in GALL Table IX.C to expand the number of stainless steel grades or types that are subject to the definition's qualifying statement on thermal aging embrittlement. As a result of this change, if thermal aging embrittlement is an applicable aging effect mechanism for inducing loss of fracture toughness in a cast austenitic stainless steel (CASS) material, precipitation hardened (PH) stainless steel material, or martensitic stainless steel material, the AMR item will specifically identify these materials by name in the material columns of the AMR items. This change is consistent with Table 3-1 in MRP-227-A which identifies that these materials may be susceptible to thermal aging embrittlement.

ACTION

The staff compared the basis in the NRC SE (Rev.1) on MRP-227 to the following recommended guidance sections and tables in the SRP-LR, Revision 2 and GALL Report, Revision 2:

- Program Element criteria in GALL AMP XI.M16A, "PWR Vessel Internals"

- Specific further evaluation "Acceptance Criteria" recommendations for PWR RVI components in Section 3.1.2.2 of the SRP-LR, Revision 2, and "Review Procedure" recommendations for PWR RVI components in Section 3.1.3.2 of the SRP-LR, Revision 2

- The NRC's recommended FSAR Supplement summary description for PWR vessel internals programs in Table 3.0-1 of the SRP-LR, Revision 2

- Specific Table 1 AMR item recommendations for PWR RVI components in Table 3.1-1 of the SRP-LR, Revision 2

- Table 2 AMR item recommendations for Westinghouse-design PWR RVI components in Table IV.B2 for the GALL Report, Revision 2

- Table 2 AMR item recommendations for CE-design PWR RVI components in Table IV.B3 for the GALL Report, Revision 2

- Table 2 AMR item recommendations for B&W-design PWR RVI components in Table IV.B4 for the GALL Report, Revision 2

- The NRC's recommended definition tables in Section IX of the GALL Report, Revision 2

As a result of this comparison, the staff developed the changes to the SRP-LR, Revision 2, and GALL Report, Revision 2, documents, which are in Appendix A of this LR-ISG.

NEWLY IDENTIFIED SYSTEMS, STRUCTURES, AND COMPONENTS UNDER 10 CFR 54.37(b)

The NRC is not proposing to treat changes to the SRP-LR, Revision 2 and GALL Report, Revision 2, on aging management of PWR RVI components as "newly identified" SSCs under 10 CFR 54.37(b). Therefore, any additional action the NRC may impose upon current holders of renewed operating licenses under 10 CFR Part 54 would not fall within the scope of 10 CFR 54.37(b). Consequently, the NRC would also have to address compliance with the requirements of 10 CFR 50.109 before it could impose any new aging management requirements on current holders of renewed operating licenses.

BACKFITTING DISCUSSION

The Executive Summary of MRP-227-A states that the augmented I&E guidelines and methodology in the MRP-227-A establishes the U.S. nuclear power industry's position on what would be needed to demonstrate that the effects of age-related degradation in PWR RVI components will be adequately managed during the period of extended operation, and will provide continued functionality of RVI components during the period of extended operation, in accordance with the requirements of 10 CFR Part 54. The MRP's executive summary also states that the proposed I&E methodology and guidelines do not "reduce, alter, or otherwise affect current ASME Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI or plant-specific licensing inservice inspection requirements that are applicable to an applicant's or licensee's RVI design." MRP-227-A left the responsibility for defining many of the

plant-specific activities of an applicant's or licensee's PWR Vessel Internals Program up to the licensee or applicant for the plant facility.

The staff has, in NRC SE (Rev. 1) on MRP-227, treated the plant-specific PWR Vessel Internals Program activities as applicant/licensee action items (A/LAIs). This LR-ISG updates the current guidance in GALL AMP XI.M16, "PWR Vessel Internals," and the AMR guidance for PWR RVI components in the SRP-LR and GALL reports based on the evaluation, action items, and conclusions that were drawn in NRC SE (Rev. 1) on MRP-227, which was issued to the MRP and its member PWR utilities on December 16, 2011 (ADAMS ML11308A770). This draft LR-ISG sets forth a supplementary set of evaluation recommendations for PWR RVI components, and would update the earlier set of staff recommendations in this area. The supplementary evaluation recommendations in this LR-ISG are based on the staff's A/LAIs in the SE on MRP-227. The backfitting implications of issuance of this LR-ISG with respect to current and future license renewal applicants, and current holders of renewed licenses, are discussed below.

Current and Prospective Applicants

The supplementary evaluation recommendations in this draft LR-ISG are intended to aid a license renewal applicant for a PWR facility in defining those plant-specific aspects of its program that would need to be identified in response to the stated A/LAIs or evaluation in the staff's SE on the MRP-227 report. The issuance of these supplementary evaluation recommendations, even if "imposed" on future applicants for license renewal, does not constitute backfitting. Applicants for licenses are not protected by the Backfit Rule, 10 CFR 50.109, inasmuch as the Backfit Rule was not intended to apply to every NRC action which substantially changes settled expectations, and does not protect either a present applicant or a prospective applicant. See 54 FR 15372, 15385-86; April 18, 1989.

Current Holders of Renewed Licenses

The supplementary evaluation recommendations in this draft LR-ISG, if finalized, would not require current holders of renewed licenses for PWR facilities to resubmit updated LRAs for their facilities based on the issuance and contents of this LR-ISG. Nor would the draft LR-ISG, if finalized, require such licensees, in the future, to comply with the provisions of the draft LR-ISG. As discussed above, the staff recommends that current holders of renewed licenses for PWR facilities follow the guidance in the future; but this is not a mandatory requirement. Inasmuch as the supplementary evaluation guidelines are not requirements, and the staff does not intend to require current holders of renewed licenses for PWR facilities to comply with the recommendations if the LR-ISG is finalized, the issuance of the draft LR-ISG in final form would not constitute backfitting as defined in 10 CFR 50.109(a)(1) with respect to such licensees.

For the reasons set forth above, the issuance of this draft LR-ISG in final form would not constitute backfitting. Therefore, the staff did not prepare a backfit analysis for this LR-ISG.

APPENDICES

Appendix A provides the staff's proposed changes to the NRC's current license renewal guidance recommendations in the SRP-LR, Revision 2, and GALL Report, Revision 2, for managing aging in PWR RVI components and includes the following sections:

- Section 1 – provides the changes to the program description and program element criteria in GALL AMP XI.M16A

- Section 2 – provides the proposed changes to the NRC's further evaluation recommendations for PWR RVI components in Sections 3.1.2.2 and 3.1.3.2 of the SRP-LR, Revision 2, and to the NRC's FSAR Supplement summary description for PWR Vessel Internals Programs in Table 3.0-1 of the SRP-LR, Revision 2

- Section 3 – provides the proposed changes to the commodity group-based AMR items (i.e., Table 1 AMR items) for PWR RVI components in Table 3.1-1 of the SRP-LR, Revision 2

- Section 4 – provides the proposed changes to the component-specific AMR items (i.e., Table 2 AMR items) for Westinghouse-designed PWR RVI components in Table IV.B2 of the GALL Report, Revision 2

- Section 5 – provides the proposed changes to the component-specific AMR items (i.e., Table 2 AMR items) for CE-designed PWR RVI components in Table IV.B3 of the GALL Report, Revision 2

- Section 6 – provides the proposed changes to the component-specific AMR items (i.e., Table 2 AMR items) for B&W-designed PWR RVI components in Table IV.B4 of the GALL Report, Revision 2

- Section 7 – provides a proposed change to the definition for "stainless steel" materials in Table IX.C of the GALL Report, Revision 2.

Appendix B provides a summary and the definitions of abbreviated terminology commonly used in this LR-ISG.

REFERENCES

10 CFR Part 54, *Requirements for Renewal of Operating Licenses for Nuclear Power Plants*, Office of the Federal Register, National Archives and Records Administration, 2011.

U.S. NRC. *Generic Aging Lessons Learned (GALL) Report*. Washington, D.C. NUREG-1801, Revision 2. (December 2010). ADAMS Accession No. ML103490041.

U.S. NRC. *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*. Washington, D.C. NUREG-1800, Revision 2. (December 2010). ADAMS Accession No. ML103490036.

U.S. NRC. Final Safety Evaluation of EPRI Report, Materials Reliability Program Report 1016596 (MRP-227), Revision 0, *Pressurized Water Reactor Internals Inspection and Evaluation Guidelines*. (June 22, 2011). ADAMS Accession No. ML111600498.

U.S. NRC. 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.

U.S. NRC. Regulatory Information Summary (RIS) No. 2011-07, *License Renewal Submittal Information For Pressurized Water Reactor Internals Aging Management*. (July 21, 2011). ADAMS Accession No. ML111990086.

Electric Power Research Institute (EPRI). EPRI Report No. 1016596, *Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-Rev. 0)*, (December 2008). ADAMS Accession Nos. ML090160204 for the MRP cover letter and ML090160206 for the MRP-227-Rev. 0 version of the report (The report was downgraded to Non-Proprietary status in ADAMS Accession No. ML111600498).

Electric Power Research Institute (EPRI). EPRI Report No. 1022863, *Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A).* (Final Report, December 2011). ADAMS Accession Number ML12017A193 for the transmission letter from the EPRI MRP; ADAMS Accession Numbers ML12017A194, ML12017A196, ML12017A197 and ML12017A191 for the report in four parts.

Nuclear Energy Institute (NEI). NEI Report No. 03-08 (latest version), *Guideline for the Management of Materials Issues.* (Most recent edition is given in Revision 2 of the report, April 5, 2010) ADAMS Accession No. ML101050334.