3.5 AGING MANAGEMENT OF STRUCTURES AND COMPONENT SUPPORTS

Review Responsibilities

Primary - Branch responsible for structural engineering
Secondary - None

3.5.1 Areas of Review

This review plan section addresses the aging management review of the Structures and Component Supports. For a recent vintage plant, the information related to the structures and component supports is contained in Chapter 3, "Design of Structures, Components, Equipment, and Systems," of the plant's Final Safety Analysis Report (FSAR), consistent with the Standard Review plan for the Review of Safety Analysis Reports for Nuclear Power Plants (NUREG-0800) (Ref. 1). The structures and component supports consist of PWR and BWR containment structures, Class I structures, and component supports. The PWR containment structures consist of concrete (reinforced or prestressed) and steel containments. The BWR containment structures consist of Mark I steel containments, Mark II concrete (reinforced or prestressed) and steel containments, and Mark III concrete and steel containments.

The Class I structures are organized into nine groups: Group 1: BWR reactor building, PWR shield building, control room/building; Group 2: BWR reactor building with steel superstructure; Group 3: auxiliary building, diesel generator building, radwaste building, turbine building, switchgear room, auxiliary feedwater pump house, utility/piping tunnels; Group 4: containment internal structures, excluding refueling canal; Group 5: fuel storage facility, refueling canal; Group 6: water-control structures (intake structure, cooling tower, and spray pond); Group 7: concrete tanks; Group 8: steel tanks; and Group 9: BWR unit vent stack (Ref. 2).

The component supports are organized into seven groups: Group B1.1: supports for ASME Class I piping and components; Group B1.2: supports for ASME Class 2 and 3 piping and components; Group B1.3: supports for ASME Class MC piping and components; Group B2: supports for cable tray, conduit, HVAC ducts, tube track, instrument tubing, non-ASME piping and components; Group B3: anchorage of racks, panels, cabinets, and enclosures for electrical equipment and instrumentation; Group B4: supports for miscellaneous equipment (e.g., EDG, HVAC components); and Group B5: supports for miscellaneous structures (e.g., platforms, pipe whip restraints, jet impingement shields, masonry walls) (Ref. 2).

The staff has issued a Generic Aging Lessons Learned (GALL) report addressing aging management for license renewal (Ref. 2). The GALL report documents the staff's basis for determining when generic existing programs are adequate to manage aging without change and when generic existing programs should be augmented for license renewal. The GALL report may be referenced in a license renewal application and should be treated in the same manner as an approved topical report.

Because a license renewal applicant may or may not be able to reference the GALL report as explained below, the following areas are reviewed:

3.5.1.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

An applicant may reference the GALL report in a license renewal application to demonstrate that the applicant's programs at its facility correspond to those reviewed and approved in the GALL report, and that no further staff review is required. If the material presented in the GALL report is applicable to the applicant's facility, the staff should find the applicant's reference to the GALL report acceptable. In making this determination, the staff should consider whether the applicant has identified specific programs described and evaluated in the GALL report. The staff, however, should not repeat its review of the substance of the matters described in the GALL report. Rather, the staff should ensure that the applicant verifies that the approvals set forth in the GALL report for generic programs apply to the applicant's programs.

3.5.1.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report provides the basis for identifying those programs that warrant further evaluation during the staff review of a license renewal application. The staff review should focus on augmented programs for license renewal.

3.5.1.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

The GALL report provides a generic staff evaluation of certain aging management programs. If an applicant does not rely on a particular program for license renewal, or if the applicant indicates that the generic staff evaluation of the elements of a particular program does not apply to its plant, the staff should review each such aging management program to which the GALL report does not apply.

3.5.1.4 Components or Aging Effects that Are Not Addressed in the GALL Report

The GALL report provides a generic staff evaluation of certain components and aging effects. If an applicant has identified particular components subject to aging management review for its plant, or particular aging effects for a component that are not addressed in the GALL report, the staff should review the applicant’s aging management programs applicable to these particular components and aging effects.

3.5.1.5 FSAR Supplement

The FSAR supplement summarizing the programs and activities for managing the effects of aging for the period of extended operation is reviewed.

3.5.2 Acceptance Criteria

The acceptance criteria for the areas of review define methods for determining if the applicant has met the requirements of the Commission’s regulations in 10 CFR 54.21.

3.5.2.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

Acceptable methods for managing aging of the structures and component supports are described and evaluated in Chapters II and III of the GALL report (Ref. 2). In referencing the GALL report, an applicant should indicate that the material presented in the GALL report is applicable to the specific plant involved and provide the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report. An applicant should also verify that the approvals set forth in the GALL report for generic programs apply to the applicant's programs. An applicant may reference appropriate programs as described and evaluated in the GALL report.

3.5.2.2 Further Evaluation of Aging Management as Recommended by the GALL Report

The GALL report indicates that further evaluation should be performed for:

3.5.2.2.1 PWR and BWR Containments

3.5.2.2.1.1 Aging of Inaccessible Concrete Areas

Increases in porosity and permeability, cracking, and spalling due to leaching of calcium hydroxide and aggressive chemical attack; and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in inaccessible areas of PWR concrete and steel containments, BWR Mark II concrete containments, and Mark III concrete and steel containments. The GALL report recommends further evaluation to manage the aging effects for inaccessible areas, when conditions do not exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

3.5.2.2.1.2 Cracking, Distortion, and Increases in Component Stress Level Due to Settlement and Reduction of Foundation Strength Due to Erosion of Porous Concrete Subfoundations

Cracking, distortion, and increases in components stress level due to settlement could occur in PWR concrete and steel containments, BWR Mark II concrete containments and Mark III concrete and steel containments. Also, reduction of foundation strength due to erosion of porous concrete subfoundations could occur in all types of PWR and BWR containments. Some plants may rely on a de-watering system to lower the ground water level. If the plant's CLB credits a de-watering system, the GALL report recommends verification of the continued functionality of the de-watering system during the period of extended operation.

3.5.2.2.1.3 Loss of Strength and Modulus of Concrete Structures Due to Elevated Temperature

Loss of strength and modulus of elasticity due to elevated temperatures could occur in PWR concrete and steel containments, BWR Mark II concrete containments, and Mark III concrete and steel containments. The GALL report recommends further evaluation if any portion of the concrete containment components exceeds specified temperature limits, i.e., general temperature 66^0C (150^0 F) and local area temperature 93^0C (200^0 F).

3.5.2.2.1.4 Loss of Material due to Corrosion in Inaccessible Areas of Liner Plate and Steel Structures

Loss of material due to corrosion could occur in inaccessible areas of steel structures and liner plate for all types of PWR and BWR containments. The GALL report recommends further evaluation to manage the aging effects for inaccessible areas, when conditions do not exist in accessible areas that could indicates the presence of, or result in, degradation to such inaccessible areas.

3.5.2.2.1.5 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature

Loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for PWR prestressed concrete containments and BWR Mark II prestressed concrete containments is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.5 of this standard review plan.

3.5.2.2.1.6 Cumulative Fatigue Damage

Fatigue of containment liner plate (including welded joints) and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) for all types of PWR and BWR containments and BWR vent header and downcomers (designed to a fatigue analysis) is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.6 of this standard review plan.

3.5.2.2.1.7 Cracking due to Cyclic Loading and SCC

Cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cyclic loading could occur in all types of PWR and BWR containments. A similar cracking could also occur in vent header and downcomers due to SCC for BWR containments. These cracks are inspected by a visual VT-3 examination. However, this inspection may not detect such cracks. A combination of E-B, E-F (Ref. 4), and enhanced VT-1 is an acceptable method. The GALL report recommends further evaluation of programs to manage these aging effects.

3.5.2.2.2 Class I Structures

3.5.2.2.2.1 Aging of Supports Not Covered by Structures Monitoring Program

The management of aging of structures subject to an aging management review, but not covered by structures monitoring program, should be further evaluated. This relates to the management of scaling, cracking, and spalling due to repeated freeze–thaw; increase in porosity, permeability, scaling, cracking, and spalling due to leaching of calcium hydroxide and aggressive chemical attack; expansion and cracking due to reaction with aggregates; cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel; cracks, distortion, and increases in components stress level due to settlement; reduction of foundation strength due to erosion of porous

concrete subfoundation for Group 1-3, 5-9 Class I structures; loss of material due to corrosion of structural steel components for Groups 1-5, 7-8 Class I structures; loss of strength and modulus of concrete structures due to elevated temperatures for Groups 2-5; and crack initiation and growth due to stress corrosion cracking and loss of material due to corrosion of steel liner for Groups 7-8 Class I structures. The GALL report recommends no further evaluation if the structure monitoring program covers the structure/aging effect combinations for Class 1 structures.

3.5.2.2.2.2 Aging Management of Inaccessible Areas

Increases in porosity and permeability, cracking, and spalling due to aggressive chemical attack; cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in inaccessible areas in Groups 1-3, 5, 7-9 Class I structures; and loss of material due to corrosion of structural steel components for Groups 1-5, 7-8 Class I structures. The GALL report recommends further evaluation to manage these aging effects in inaccessible areas.

3.5.2.2.3 Component Supports

3.5.2.2.3.1 Aging of Supports Not Covered by Structures Monitoring Program

The management of aging of supports subject to an aging management review, but not covered by structures monitoring program, should be further evaluated. This relates to the management of: loss of material due to environmental corrosion for Groups B2, B3, B4, and B5 component supports; reduction in concrete capacity due to vibration loads or other effects on concrete surrounding anchor bolts, and grout pads for all groups of component supports; loosening and slipping of bolted friction connections due to thermal cycling/vibration for Group B2 component support; reduction/loss of isolation function due to sustained vibration loading of vibration isolation elements for Group B4 component support. The GALL report recommends no further evaluation if the structures monitoring program covers the component supports/aging effect combinations for components supports.

3.5.2.2.3.2 Cumulative Fatigue Damage Due to Cyclic Loading

Fatigue of component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component support is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.3 of this standard review plan.

3.5.2.2.4 Quality Assurance for Aging Management of Non-Safety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1, Appendix A.2 of this standard review plan.

3.5.2.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.5.2.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.5.2.5 FSAR Supplement

The summary description of the programs and activities for managing the effects of aging for the period of extended operation in the FSAR supplement should provide appropriate description such that later changes can be controlled by 10 CFR 50.59. The description should contain information associated with the bases for determining that aging effects are managed during the period of extended operation.

3.5.3 Review Procedures

For each area of review, the following review procedures are to be followed:

3.5.3.1 Aging Management Programs Evaluated in the GALL Report that Are Relied on for License Renewal

An applicant may reference the GALL report in its license renewal application, as appropriate. The staff should not repeat its review of the substance of the matters described in the GALL report. If the applicant has provided the information necessary to adopt the finding of program acceptability as described and evaluated in the GALL report, the staff should find the applicant's reference to the GALL report in a license renewal application acceptable. In making this determination, the reviewer verifies that the applicant has provided a brief description of the system, components, materials, and environment. The reviewer also verifies that the applicant has stated that the applicable aging effects and industry and plant-specific operating experience had been reviewed by the applicant and are evaluated in the GALL report. The reviewer verifies that the applicant has identified those aging effects for the Structures and Component Supports that are contained in the GALL report as applicable to its plant. In addition, the reviewer ensures that the applicant has stated that the plant programs covered by the applicant's reference contain the same program elements that the staff evaluated and relied upon in approving the corresponding generic program in the GALL report.

The applicant may state that certain of its aging management programs contain the same program elements as the corresponding generic program described in the GALL report and upon which the staff relied in its evaluation, as described in the GALL report in accepting the generic program. The applicant may then state that the GALL report is applicable to its plant with respect to these programs. The reviewer verifies that the applicant has identified the appropriate programs as described and evaluated in the GALL report. Programs evaluated in the GALL report regarding the Structures and Component Supports are tabulated in Table 3.5-1 of this review plan section. No further staff evaluation is necessary if so recommended in the GALL report.

3.5.3.2 Further Evaluation of Aging Management as Recommended by the GALL Report

3.5.3.2.1 PWR and BWR Containments

3.5.3.2.1.1 Aging of Inaccessible Concrete Areas

The GALL report recommends further evaluation of programs to manage of aging effects in inaccessible areas for increases in porosity and permeability, cracking, and spalling due to leaching of calcium hydroxide and aggressive chemical attack; and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel for PWR concrete and steel containments, BWR Mark II concrete containments, and Mark III concrete and steel containments. The current aging management programs consist of Section XI, Subsection IWL examinations of 1992 or later edition of ASME code as approved in 10 CFR 50.55a (Ref. 3) and in accordance with the requirements of 10 CFR 50.55a for inaccessible areas to detect the aging effects. However, the GALL report notes that IWL exempts from examination portions of the concrete containments that are inaccessible (e.g., basemat, exterior walls below grades, and concrete covered by liner). To cover the inaccessible areas, 10 CFR 50.55a(b)(2)(ix) requires that the licensee shall evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. The GALL report notes that IWL and the requirements of 10 CFR 50.55a(b)(2)(ix) are not covered for managing the aging effects for inaccessible areas when conditions do not exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. The GALL report recommends that an applicant should describe and justify its approach to manage the aging effects for inaccessible areas, when conditions do not exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. The reviewer reviews the applicant's proposed aging management program to verify that, where appropriate, an effective inspection program will be implemented to ensure that the aging effects in inaccessible areas are adequately managed during the period of extended operation.

3.5.3.2.1.2 Cracking, Distortion, and Increases in Component Stress Level Due to Settlement and Reduction of Foundation Strength Due to Erosion of Porous Concrete Subfoundations

The GALL report recommends further evaluation of programs to manage: (1) cracking, distortion, and increases in component stress level due to settlement for PWR concrete and steel containments and BWR Mark II concrete containments and Mark III concrete and steel containments and (2) reduction of foundation strength due to erosion of porous concrete subfoundations for all types of PWR and BWR containments. The GALL report recommends that: if de-watering system is relied upon for control of settlement and erosion, then proper functioning of the de-water system should be evaluated for the period of extended operation. The reviewer verifies that, if the applicant's plant credits a de-watering system in its CLB, the applicant should monitor the functionality of the de-watering system during the period of extended operation.

3.5.3.2.1.3 Loss of Strength and Modulus of Concrete Structures Due to Elevated Temperature

The GALL report recommends further evaluation of programs to manage loss of strength and modulus of concrete structures due to elevated temperature for PWR concrete and steel containments, BWR Mark II concrete containments, and Mark III concrete and steel containments. The GALL report notes that the implementation of IWL examinations and 10 CFR 50.55a would not be able to detect the loss of concrete strength and modulus due to elevated temperature. The GALL report also notes no mandated aging management exists for managing this aging effect. The GALL report recommends that a plant-specific evaluation should be performed, if any portion of the concrete containment components exceeds specified temperature limits, i.e., general temperature 66^0C (150^0 F) and local area temperature 93^0C (200^0 F). The reviewer verifies that the applicant's discussion in the renewal application indicates that the affected PWR and BWR containment components are not exposed to temperature that exceeds the temperature limits [operating temperature <66^0C (150^0F), and local area temperature <93^0C (200^0F)]. For containment concrete components that operate above the temperature limits [operating temperature <66^0C (150^0F), local area temperature <93^0C (200^0F)], the reviewer reviews the applicant proposed programs on a case-by-case basis to ensure that the effects of elevated temperature will be managed during the period of extended operation.

3.5.3.2.1.4 Loss of Material Due to Corrosion in Inaccessible Areas of Liner Plate and Steel Structures

The GALL report recommends further evaluation of programs to manage loss of material due to corrosion of steel structures and liner plate for all types of PWR and BWR containments. The aging management program consists of ASME Section XI, Subsection IWE (Ref. 4) and IWF examinations (Ref. 5) (IWF for support components of BWR containments, such as downcomer bracing, column and saddle supports, seismic restraints, and vent system supports) and the requirements of 10 CFR 50.55a for inaccessible areas. However, the GALL report notes that IWE exempts from examination portions of the containments that are inaccessible, such as embedded or inaccessible portions of steel liners and steel containment shells, piping and valves penetrating or attaching to the containment. To cover the inaccessible areas, 10 CFR 50.55a(b)(2)(ix) requires that the licensee shall evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. The GALL report notes that IWE and the requirements of 10 CFR 50.55a(b)(2)(ix) are not covered for managing the aging effects for inaccessible areas when conditions do not exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. The GALL report recommends that an applicant should describe and justify its approach to manage the aging effects for inaccessible areas, when conditions do not exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. The reviewer reviews the applicant’s proposed aging management program to verify that, where appropriate, an effective inspection program has been developed and implemented to ensure that the aging effects in inaccessible areas are adequately managed.

3.5.3.2.1.5 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature

The GALL report recommends that loss of pretress is a TLAA to be performed for the period of license renewal. The reviewer reviews the evaluation of this TLAA separately, following the guidance in Section 4.5 of this standard review plan.

3.5.3.2.1.6 Cumulative Fatigue Damage

Fatigue of the containment liner plate and penetrations is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.6 of this standard review plan.

3.5.3.2.1.7 Cracking due to Cyclic Loading and SCC

The GALL report recommends further evaluation of programs to manage cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cyclic loading for all types of PWR and BWR containments. A similar recommendation for further evaluation of programs to manage cracking of vent header and downcomers due to SCC is also provided for BWR containments. The aging management program (for those not designed to a fatigue analysis) consists of inservice inspection (VT-1 inspection) to detect cracks that are produced from cyclic loading and SCC. However, the report notes that VT-1 inspection may not be sufficient to detect cracks. Supplemental inspection by UT or other techniques may be required. A combination of E-B, E-F (Ref. 4), and enhanced VT-1 is an acceptable method to manage these aging effects. The reviewer reviews the applicant's proposed programs to verify that an adequate program will be in place to ensure that cracks are detected.

3.5.3.2.2 Class I Structures

3.5.3.2.2.1 Aging of Supports Not Covered by Structures Monitoring Program

The GALL report recommends further evaluation of programs to manage scaling, cracking, and spalling due to repeated freeze–thaw; increase in porosity, permeability, scaling, cracking, and spalling due to leaching of calcium hydroxide and aggressive chemical attack; expansion and cracking due to reaction with aggregates; cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel; cracks, distortion, and increases in components stress level due to settlement; reduction of foundation strength due to erosion of porous concrete subfoundation for Group 1-3, 5-9 Class I structures; loss of material due to corrosion of structural steel components for Groups 1-5, 7-8 Class I structures; loss of strength and modulus of concrete structures due to elevated temperatures for Groups 2-5; and crack initiation and growth due to stress corrosion cracking and loss of material due to corrosion of steel liner for Groups 7-8 Class I structures. The aging management program consists of a structures monitoring program to verify that the current licensing basis (CLB) is maintained through periodic testing and inspection of critical plant structures, systems, and components. The GALL report recommends that no further evaluation is required if the structures monitoring program covers the structure/aging effect combinations for Class 1

structures. The reviewer verifies that the applicant has identified the structure/aging effect combinations not within the scope of the applicant's structures monitoring program developed in accordance with the guidance provided in NEI 93-01, Revision 2 and Regulatory Guide 1.160, Rev.2 (Ref. 6). The applicant may choose to expand the scope of its structures monitoring program to include these structure/aging effect combinations. Otherwise, the reviewer evaluates the applicant's proposed program in accordance with the guidance in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.5.3.2.2.2 Aging Management of Inaccessible Areas

The GALL report recommends further evaluation of aging management in inaccessible areas, such as foundation and exterior walls below grade exposed to ground water, the reviewer reviews the aging management program on a case-by-case basis for the management of increases in porosity and permeability, cracking, and spalling due to aggressive chemical attack; cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel for Groups 1-3, 5, 7-9 Class I structures; and loss of material due to corrosion of structural steel components for Groups 1-5, 7-8 Class I structures to assure that the intended functions will be maintained during the period of the extended operation.

3.5.3.2.3 Component Supports

3.5.3.2.3.1 Aging of Supports Not Covered by Structures Monitoring Program

The GALL report recommends further evaluation of programs to manage loss of material due to environmental corrosion for Groups B2, B3, B4, and B5 component supports; reduction in concrete capacity due to vibration loads or other effects on concrete surrounding anchor bolts, and grout pads for all groups of component supports; loosening and slipping of bolted friction connections due to thermal cycling/vibration for Group 2 component supports; reduction/loss of isolation function due to sustained vibration loading of vibration isolation elements for Group 4 component supports. The aging management consists of a structures monitoring program to verify that the current licensing basis (CLB) is maintained through periodic testing and inspection of critical plant structures, systems, and components. The GALL report recommends that no further evaluation is required if a structures monitoring program covers the component supports/aging effect combinations for component supports. The reviewer verifies that the applicant has identified the component support/aging effect combinations not within the scope of the applicant's structures monitoring program developed in accordance with the guidance provided in NEI 93-01, Revision 2 and Regulatory Guide 1.160, Rev.2 (Ref. 6). The applicant may choose to expand the scope of its structures monitoring program to include these component support/aging effect combinations. Otherwise, the reviewer evaluates the applicant's proposed program in accordance with the guidance in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.5.3.2.3.2 Cumulative Fatigue Damage

Fatigue of support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.3 of this standard review plan.

3.5.3.2.4 Quality Assurance for Aging Management of Non-Safety-Related Components

An applicant's aging management programs for license renewal should contain the elements of corrective actions, confirmation process, and administrative controls. Safety-related components are covered by 10 CFR Part 50, Appendix B, which is adequate to address these program elements. However, Appendix B does not apply to non-safety-related components that are subject to an aging management review for license renewal. Nevertheless, an applicant has the option to expand the scope of its 10 CFR Part 50, Appendix B, program to include these components and address these program elements. If an applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR supplement. If an applicant chooses other alternative means, the branch responsible for quality assurance should be requested to review the applicant's proposal on a case-by-case basis.

3.5.3.3 Aging Management Programs or Evaluations that Are Different from those Described in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.5.3.4 Components or Aging Effects that Are Not Addressed in the GALL Report

Review procedures are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.5.3.5 FSAR Supplement

The reviewer verifies that the applicant has provided information to be included in the FSAR supplement for aging management of the Structures and Component Supports for license renewal with information equivalent to that in Table 3.5-2 of this review plan section. The reviewer also verifies that the applicant has provided information to be included in the FSAR supplement for Subsection 3.5.3.3, "Aging Management Programs or Evaluations that are Different from those Described in the GALL Report," and Subsection 3.5.3.4, "Components or Aging Effects that are Not Addressed in the GALL Report," of this review plan section with information equivalent to that in Table 3.5-2. The staff expects to impose a license condition in the renewed license, if granted, to require the applicant to update its FSAR to include this FSAR supplement at the next update required pursuant to 10 CFR 50.71(e)(4). As part of the license condition, until the FSAR update is complete, the applicant may make changes to the programs described in its FSAR supplement without prior Commission approval, provided that the applicant evaluates each such change pursuant to the criteria set forth in 10 CFR 50.59.

As noted in Table 3.5-2, an applicant need not incorporate the implementation schedule into its FSAR. However, an applicant should identify and commit to any future aging management activities to be completed before the period of extended operation. The staff expects to impose a license condition in the renewed license, if granted, to ensure that the applicant will complete these activities no later than the committed date.

3.5.4 Evaluation Findings

The reviewer verifies that the applicant has provided information sufficient to satisfy the provisions of this review plan section and the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

> The staff concludes that the applicant has demonstrated that the aging effects associated with the Structures and Component Supports will be adequately managed so that there is reasonable assurance that these structures and component supports will perform their intended functions in accordance with the current licensing basis during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the programs and activities for managing the effects of aging for the Structures and Component Supports.

3.5.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

3.5.6 References

1. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, July 1981.

2. NUREG-xxxx, "Generic Aging Lessons Learned (GALL) Report," U.S. Nuclear Regulatory Commission, XXXX.

3. American Society of Mechanical Engineers, ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, Subsection IWL, Requirements for Class CC Concrete Components of Light-Water Cooled Power Plants, 1992 Edition with 1992 Addenda or later edition as approved in 10 CFR 50.55a. The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY.

4. American Society of Mechanical Engineers, ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, Subsection IWE, Requirements for Class MC and Metallic Liners of Class CC Components of Light-Water Cooled Power Plants, 1992 Edition with 1992 Addenda or later edition as approved in 10 CFR 50.55a. The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY.

5. American Society of Mechanical Engineers, ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, Subsection IWF, Requirements for Class 1, 2, 3, and MC Component supports of Light-Water Cooled Power Plants, 1989 Edition or later edition as approved in 10 CFR 50.55a. The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY.

6. NRC Regulatory Guide 1.160, Revision 2, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” March 1997.

7. NRC Regulatory Guide 1.35.1, “Determining Prestressing Forces for Inspection of Prestressed Concrete Containments,” July 1990.

8. NRC Regulatory Guide 1.127, Revision 1, “Inspection of Water–Control Structures Associated with Nuclear Power Plants,” March 1978.

9. NRC IE Bulletin 80-11, “Masonry Wall Design,” May 8, 1980.

10. NRC IE Information Notice 87-67, “Lessons Learned from Regional Inspections of Licensee Actions in Response to IE Bulletin 80-11,” December 31, 1987.

11. NRC Generic Letter 88-05, Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants, March 17, 1988.

12. EPRI NP-5769, “Degradation and Failure of Bolting in Nuclear Power Plants,“ Volumes 1 and 2, Electric Power Research Institute, Palo Alto, CA, April 1988.

13. EPRI NP-5067, “Good Bolting Practices, A Reference Manual for Nuclear Power Plant Maintenance Personnel,” Volumes 1: Large Bolt Manual, 1987, and Volume 2: Small Bolts and Threaded Fasteners, 1990, Electric Power Research Institute, Palo Alto, CA.

Table 3.5-1. Aging Management Programs for Structures and Components Supports Evaluated in Chapters II and III of the GALL Report

Type	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
Common Components of All Types of PWR and BWR Containment				
BWR/ PWR	Penetration sleeves, penetration bellows, and dissimilar metal welds	Cumulative fatigue damage	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA (see Subsection 3.5.2.2.1.6).
BWR/ PWR	Penetration sleeves, bellows, and dissimilar metal welds. For BWR only steel element: downcomers and vent header	Cracking from cyclic loading & crack initiation and growth from SCC	Containment inservice inspection and containment leak rate test	Yes, detection of aging effects should be further evaluated (see Subsection 3.5.2.2.1.7).
BWR/ PWR	Penetration sleeves, penetration bellows, and dissimilar metal welds	Loss of material from corrosion	Containment inservice inspection and containment leak rate test	No
BWR/ PWR	Personnel airlock and equipment hatch	Loss of material from corrosion	Containment inservice inspection and containment leak rate test	No
BWR/ PWR	Personnel airlock and equipment hatch	Fretting/lock-up from wear of locks, hinges, and closures mechanisms	Containment inservice inspection	No
BWR/ PWR	Seals, gaskets, and moisture barriers	Loss of sealant and leakage through containment from deterioration of joint seals, gaskets, and moisture barriers	Containment inservice inspection and containment leak rate test	No

PWR Concrete (Reinforced and Prestressed) and Steel Containment **BWR Concrete (Mark II and III) and Steel (Mark I, II and III) Containment**				
BWR/ PWR	Concrete elements: Basemat, exterior walls below grade.	Aging of inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Containment inservice inspection	Yes, for inaccessible areas (see Subsection 3.5.2.2.1.1).
BWR/ PWR	Concrete elements: Basemat	Cracks, distortion, and increases in components stress level from settlement	Containment structure settlement monitoring	Yes, if applicable, proper functioning of de-watering system should be evaluated (see Subsection 3.5.2.2.1.2).
BWR/ PWR	Concrete elements: Foundation	Reduction in foundation strength from erosion of porous concrete subfoundation	Containment structure settlement monitoring	Yes, if applicable, proper functioning of de-watering system should be evaluated (see Subsection 3.5.2.2.1.2).
BWR/ PWR	Concrete elements: Basemat, dome, and wall	Loss of strength and modulus from elevated temperature	Plant-specific	Yes, for any portions of concrete containment that exceed specified temperature limits (see Subsection 3.5.2.2.1.3).
BWR/ PWR	Prestressed containment: Tendons and anchorage components	Loss of prestress from relaxation, shrinkage, creep, and elevated temperature	TLAA evaluated in accordance with 10 CFR 54.21(c).	Yes, TLAA (see Subsection 3.5.2.2.1.5).
BWR/ PWR	Steel elements: Liner plates and steel structures	Aging of inaccessible steel areas: Loss of material from corrosion	Containment inservice inspection and containment leak rate test	Yes, for inaccessible areas (see Subsection 3.5.2.2.1.4).

BWR	Steel elements: Vent header, drywell head, torus, downcomers, s. pool shell (designed to a fatigue analysis)	Cumulative fatigue damage	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA (see Subsection 3.5.2.2.1.6).
BWR/ PWR	Steel elements: protected by coating	Loss of material from corrosion	Protective coating monitoring and maintenance	No
BWR/ PWR	Prestressed containment: Tendons and anchorage components	Loss of material from corrosion of prestressing tendons anchorage components	Containment inservice inspection	No
BWR/ PWR	Concrete elements: Basemat, dome, and wall	Scaling, cracking, and spalling from freeze-thaw; expansion and cracking from reaction with aggregate	Containment inservice inspection	No
BWR	Steel elements: Vent line bellows	Crack initiation and growth from stress corrosion cracking	Containment inservice inspection	No
BWR	Steel elements: Suppression chamber liner	Crack initiation and growth from stress corrosion cracking	Containment inservice inspection and containment leak rate test	No
BWR	Steel elements: Drywell head and downcomer pipes	Fretting and lock up from wear of locks, hinges and closures mechanisms	Containment inservice inspection	No
Class I Structures				
BWR/ PWR	All Groups except Group 6 : Accessible interior/exterior concrete & steel	All types of aging effects	Structures monitoring	No, if within the scope of the applicant's structures monitoring

	components.			program (see Subsection 3.5.2.2.2.1).
BWR/ PWR	All Groups except group 6: Inaccessible concrete & steel components such as exterior walls below grade and foundation	Aging of Inaccessible concrete and steel areas due to corrosion, leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Plant-specific	Yes, for inaccessible areas (see Subsection 3.5.2.2.2.2).
BWR/ PWR	Group 6: All accessible/inacce -ssible concrete & steel components	All types of aging effects including loss of material from abrasion, cavitation, and corrosion	Inspection of water-controlled structures	No
BWR/ PWR	Group 5: Liners	Crack initiation and growth from stress corrosion cracking and loss of material from crevice corrosion	Monitoring of leak in fuel storage facility	No
BWR/ PWR	Groups 1-3, 5-6: All masonry block walls	Cracking from restraint, shrinkage, creep, and aggressive environment	Masonry wall	No
Component Supports				
BWR/ PWR	All Groups: Support members, anchor bolts, and welds, concrete surrounding anchor bolts, grout pad, bolted friction connections etc.	Aging of component supports	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see Subsection 3.5.2.2.3.1).

BWR/ PWR	Groups B1.1, B1.2, and B1.3: Support members, anchor bolts, and welds	Cumulative fatigue damage	TLAA evaluated in accordance with 10 CFR 54.21(c).	Yes, TLAA (see Subsection 3.5.2.2.3.2).
BWR/ PWR	All Groups: Support members, anchor bolts, and welds	Loss of material from boric acid corrosion	Boric acid corrosion	No
BWR/ PWR	Groups B1.1, B1.2, and B1.3: Support members, anchor bolts, welds, spring hangers, guides, stops, and vibration isolators	Loss of material from environmen-tal corrosion; Loss of mechanical function from corrosion, distortion, dirt, overload; cracking initiation and growth from stress corrosion cracking	Inservice inspection	No
BWR/ PWR	Group B1.1: High strength low-alloy bolts	Crack initiation and growth from SCC	Bolting integrity	No

Table 3.5-2. FSAR Supplement for Aging Management of Structures and Component Supports

Program	Description of Program	Implementation Schedule*
PWR and BWR Containment		
Containment inservice inspection	The ASME Section XI, Subsection IWL program consists of periodic visual inspection of external surfaces of concrete and unbonded post-tensioning systems for signs of degradation and assessment of the damage and corrective actions. The ASME Section XI, Subsection IWE program consists of periodic visual, surface, and volumetric inspection for pressure retaining components. Tendons are also managed in accordance with the guidance provided in Regulatory Guide 1.35.1 (Ref. 7). ASME Section XI program implemented in accordance with 10 CFR 50.55a.	Existing program
Containment leak rate test (LRT)	This program consists of monitoring of leakage rates through containment liner/welds, penetrations, fittings, and other access openings for detecting degradation of containment pressure boundary. Corrective actions are Taken if leakage rates exceed acceptance criteria. This program is implemented in accordance with 10 CFR 50, Appendix J and Regulatory Guide 1.163.	Existing program
Protective coating monitoring and maintenance	This program consists of guidance for selection, application, inspection, and maintenance of protective coating. This program is implemented in accordance with Regulatory Guide 1.54, Rev. 1, except that coating outside containment need not be qualified for a design basis accident.	Existing program
Containment structure settlement monitoring	A settlement monitoring program consists of measuring the differences in elevations of structures to ensure that the differential settlement does not exceed the design criteria for the containment structures during the period of extended operation.	Existing program

Class I Structures		
Inspection of water-control structures	The program consists of inspection and surveillance program for dams, slopes, canals, and other water-control structures associated with emergency cooling water systems or flood protection based on Regulatory Guide 1.127 (Ref. 8).	Existing program
Monitoring of leak in fuel storage facility	This program consists of periodic monitoring of leak chase system drain lines and leak detection sump of fuel storage facility and refueling channel for managing aging effects of SCC and crevice cracks of liners.	Existing program
Masonry wall	This program consists of inspection requirements in accordance with IE Bulletin 80-11 (Ref. 9) and plant-specific monitoring proposed by Information Notice 87-67 (Ref. 10) for managing aging effects due to cracking of masonry walls.	Existing program
Component Supports		
Inservice inspection	This program consists of periodic volumetric, surface, and/or visual examination of components and their supports for signs of degradation, assessment, and corrective actions. This program is in accordance with ASME Section XI, 1989 or later edition as approved in 10 CFR 50.55a.	Existing program
Boric acid corrosion	The program consists of (1) visual inspection of external surfaces that are potentially exposed to borated water for leaks, (2) timely discovery of leak path and removal of the boric acid residues, (3) assessment of the damage, and (4) follow up inspection for adequacy. This program is implemented in response to GL 88-05 (Ref. 11) and in accordance with ASME Section XI inservice inspection for reactor coolant leak tests.	Existing program
Bolting integrity	This program consists of guidelines on materials selection, strength and hardness properties, installation procedures, lubricants and sealants, corrosion considerations in the selection and	Existing program

	installation of pressure-retaining bolting for nuclear applications, and enhanced inspection techniques. This program relies on the bolting integrity program delineated in NUREG-1339 and industry's recommendations delineated in EPRI NP-5769 (Ref. 12), with the exceptions noted in NUREG 1339, for safety related bolting, and EPRI NP-5067 (Ref. 13) for other bolting.	
Class I Structures and Component Supports		
Structures monitoring	The program consists of periodic inspection and monitoring the condition of structures and structure component supports to ensure that aging degradation leading to loss of intended functions will be detected and the extent of degradation can be determined. This program is implemented in accordance with NEI 93-01, Rev. 2 and Regulatory Guide 1.160, Rev. 2.	Existing program
PWR and BWR Containment, Class I Structures, and Component Supports		
Quality assurance	The 10 CFR Part 50, Appendix B program provides for corrective actions, confirmation process, and administrative controls for aging management programs for license renewal. The scope of this existing program will be expanded to include non-safety-related structures and components that are subject to an aging management review for license renewal.	Program should be implemented before the period of extended operation.

*An applicant need not incorporate the implementation schedule into its FSAR. However, an applicant should identify and commit to any future aging management activities to be completed before the period of extended operation. The staff expects to impose a license condition in the renewed license, if granted, to ensure that the applicant will complete these activities no later than the committed date.