3.2 AGING MANAGEMENT OF ENGINEERED SAFETY FEATURES

Review Responsibilities

Primary - Branch responsible for materials and chemical engineering
Secondary - Branch responsible for mechanical engineering

3.2.1 Areas of Review

This review plan section addresses the aging management review of the Engineered Safety Features. For a recent vintage plant, the information related to the Engineered Safety Features is contained in Chapter 6, "Engineered Safety Features," 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 Engineered Safety Features consist of containment spray, standby gas treatment (BWRs), containment isolation components, and emergency core cooling systems.

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:

3.2.1.1 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.

3.2.1.2 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.

3.2.1.3 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.

3.2.1.4 Components or Aging Effects that are not Addressed in the GALL Report

The GALL report provides a generic staff evaluation of programs for 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.

3.2.1.5 FSAR Supplement

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

3.2.2 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.

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

Acceptable methods for managing aging of the Engineered Safety Features are described and evaluated in Chapter V 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.

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

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

3.2.2.2.1 Cumulative Fatigue Damage

Fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. Time-limited aging analyses 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.

3.2.2.2.2 Crack Initiation and Growth Due to Stress Corrosion Cracking

The management of crack initiation and growth due to stress corrosion cracking (SCC) of the safety injection tank, refueling water tank, and associated components (PWR) should be further evaluated. The existing aging management program relies on inservice visual inspection and water chemistry monitoring and control to mitigate and detect degradation. However, visual inspection cannot detect cracks initiated on the inside surface. Therefore, verification of the effectiveness of the inservice inspection and chemistry control programs should be performed to ensure that corrosion is not occurring. The GALL report recommends further evaluation of programs to manage crack initiation and growth due to stress-corrosion cracking to verify the effectiveness of the inservice inspection and chemistry control programs. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and the component's intended function will be maintained during the period of extended operation.

3.2.2.2.3 Loss of Material Due to General Corrosion

The management of loss of material from general corrosion of pumps, valves, piping and fittings associated with some of the BWR emergency core cooling systems (high pressure coolant injection, reactor core isolation cooling, high pressure core spray, low pressure core spray, low-pressure coolant injection [residual heat removal]) and lines to the suppression chamber and to the drywell and suppression chamber spray system should be further evaluated. The existing aging management program relies on water chemistry to mitigate degradation. However, control of primary water chemistry does not preclude loss of material due to general corrosion at locations of stagnant flow conditions. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL report recommends further evaluation of programs to manage loss of material due to general corrosion to verify the effectiveness of the chemistry control program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and the component's intended function will be maintained during the period of extended operation.

Loss of material due to general corrosion could occur in the containment spray (PWR) and drywell and suppression chamber spray (BWR) system header and spray nozzle system components; standby gas treatment system components (BWR); containment isolation valves and associated piping; the outer buried surface of the refueling water tank (PWR); and the automatic depressurization system piping and fittings (BWR). The GALL report recommends further evaluation to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A-1, of the Standard Review Plan.

3.2.2.2.4 Local Loss of Material Due to Pitting and Crevice Corrosion

The management of local loss of material from pitting and crevice corrosion of pumps, valves, piping and fittings associated with some of the BWR emergency core cooling system piping and fittings (high pressure coolant injection, reactor core isolation cooling, high pressure core spray, low pressure core spray, low-pressure coolant injection [residual heat removal]) and lines to the suppression chamber and to the drywell and suppression chamber spray system should be further evaluated. The existing aging

management program relies on water chemistry to mitigate degradation. However, control of coolant water chemistry does not preclude loss of material due to crevice and pitting corrosion at locations of stagnant flow conditions. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL report recommends further evaluation of programs to manage the loss of material due to pitting and crevice corrosion to verify the effectiveness of the chemistry control program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and the component's intended function will be maintained during the period of extended operation.

Local loss of material from pitting and crevice corrosion could occur in the containment spray (PWR) and drywell and suppression chamber spray (BWR) system header and nozzle system components; standby gas treatment system components (BWRs); containment isolation valves and associated piping; the buried portion of the refueling water tank external surface (PWRs); and automatic depressurization system piping and fittings (BWR). The GALL report recommends further evaluation to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A-1, of the Standard Review Plan.

3.2.2.2.5 Local Loss of Material Due to Microbiologically Influenced Corrosion

Local loss of material due to microbiologically influenced corrosion could occur in BWR and PWR containment isolation valves and associated piping in systems that are not addressed in other chapters of the GALL report. The GALL report recommends further evaluation to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A-1, of the Standard Review Plan.

3.2.2.2.6 Changes in Properties Due to Elastomer Degradation

Changes in properties due to elastomer degradation could occur in seals associated with the standby gas treatment system ductwork and filters. The GALL report recommends further evaluation to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A-1, of the Standard Review Plan.

3.2.2.2.7 Loss of Iodine Retention Capacity Due to Moisture Absorption

Loss of iodine retention capacity due to absorption of moisture could occur in the BWR standby gas treatment system charcoal absorber filter. The GALL report recommends further evaluation to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A-1, of the Standard Review Plan.

3.2.2.2.8 Buildup of Deposit from Biofouling

Deposit buildup from biofouling could occur in BWR and PWR containment isolation valves and associated piping in systems that are not addressed in other chapters of the GALL report. The GALL report recommends further evaluation to ensure that the aging

effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A-1, of the Standard Review Plan.

3.2.2.2.9 Local Loss of Material Due to Erosion

Local loss of material due to erosion could occur in the high-pressure safety injection pump miniflow orifice. This aging mechanism and effect will apply only to pumps that are normally used as charging pumps in the chemical and volume control systems (PWRs). The GALL report recommends further evaluation to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A-1, of the Standard Review Plan.

3.2.2.2.10 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.

3.2.2.3 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.

3.2.2.4 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.

3.2.2.5 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 will be managed during the period of extended operation.

3.2.3 Review Procedures

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

3.2.3.1 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 Engineered Safety Features components 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 Engineered Safety Features components are tabulated in Table 3.2-1 of this review plan section. No further staff evaluation is necessary if so recommended in the GALL report.

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

3.2.3.2.1 Cumulative Fatigue Damage

Fatigue 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 staff reviews the evaluation of this TLAA separately, following the guidance in Section 4.3 of this standard review plan.

3.2.3.2.2 Crack Initiation and Growth Due to Stress Corrosion Cracking

The GALL report recommends further evaluation of programs to manage crack initiation and growth due to stress-corrosion cracking SCC of the safety injection tank, refueling water tank penetrations, and associated components (PWR) to verify the effectiveness of the inservice inspection and chemistry control programs. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and the component's intended function will be maintained during the period of extended operation.

The reviewer reviews the applicant's proposed program to ensure that corrosion is not occurring and the component's intended function will be maintained during the period of extended operation. If an applicant proposes a one-time inspection of select components and susceptible locations to ensure that corrosion is not occurring, the reviewer verifies that the applicant's selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. The inspection techniques may include visual, ultrasonic and surface examination techniques, and follow-up actions are to be based on the inspection results.

3.2.3.2.3 Loss of Material Due to General Corrosion

The GALL report recommends further evaluation of programs to manage the loss of material due to general corrosion of piping and fittings associated with some of the BWR emergency core cooling systems (high pressure coolant injection, reactor core isolation cooling, high pressure core spray, low pressure core spray, low-pressure coolant injection [residual heat removal]) and lines to the suppression chamber and to the drywell and suppression chamber spray system to verify the effectiveness of the chemistry control program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and the component's intended function will be maintained during the period of extended operation.

The reviewer reviews the applicant's proposed program to ensure that corrosion is not occurring and the component's intended function will be maintained during the period of extended operation. If an applicant proposes a one-time inspection of select components and susceptible locations to ensure that corrosion is not occurring, the reviewer verifies that the applicant's selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. The inspection techniques may include visual, ultrasonic and surface techniques, and follow-up actions are to be based on the inspection results.

The GALL report recommends further evaluation of programs to manage the loss of material due to general corrosion of containment spray (PWR) and drywell and supression chamber spray (BWR) system header and spray nozzle system components; standby gas treatment system components (BWR); containment isolation valves and associated piping; the outer buried surface of the refueling water tank (PWR); the automatic depressurization system piping and fittings (BWR); and emergency core cooling system header piping and fittings and spray nozzles (BWR). The reviewer reviews the applicant's proposed programs on a case-by-case basis to ensure that an adequate program will be in place for the management of general corrosion of these components.

3.2.3.2.4 Local Loss of Material Due to Pitting and Crevice Corrosion

The GALL report recommends further evaluation of programs to manage the loss of material due to pitting and crevice corrosion of piping and fittings associated with some of the BWR emergency core cooling system piping and fittings (high pressure coolant injection, reactor core isolation cooling, high pressure core spray, low pressure core spray, low-pressure coolant injection [residual heat removal]) and lines to the suppression chamber and to the drywell and suppression chamber spray system to verify the effectiveness of the chemistry control program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and the component's intended function will be maintained during the period of extended operation.

The reviewer reviews the applicant's proposed program to ensure that corrosion is not occurring and the component's intended function will be maintained during the period of extended operation. If an applicant proposes a one-time inspection of select components and susceptible locations to ensure that corrosion is not occurring, the reviewer verifies that the applicant's selection of susceptible locations is based on

severity of conditions, time of service, and lowest design margin. The inspection techniques may include visual, ultrasonic and surface techniques, and follow-up actions are to be based on the inspection results.

The GALL report recommends further evaluation of progams to manage the local loss of material due to pitting and crevice corrosion of containment spray (PWR) and drywell and supression chamber spray (BWR) system header and spray nozzle system components; standby gas treatment system components (BWR); containment isolation valves and associated piping; the outer buried surface of the refueling water tank (PWR); and the automatic depressurization system piping and fittings (BWR). The reviewer reviews the applicant's proposed programs on a case-by-case basis to ensure that an adequate program will be in place for the management of local loss of material due to pitting and crevice corrosion of these components.

3.2.3.2.5 Local Loss of Material Due to Microbiologically Influenced Corrosion

The GALL report recommends further evaluation of programs to manage the local loss of material due to microbiologically influenced corrosion of the BWR and PWR containment isolation valves and associated piping. The reviewer reviews the applicant's proposed programs on a case-by-case basis to ensure that an adequate program will be in place for the management of local loss of material due to microbiologically influenced corrosion of the BWR and PWR containment isolation barriers.

3.2.3.2.6 Changes in Properties Due to Elastomer Degradation

The GALL report recommends further evaluation of programs to manage changes in properties due to degradation of elastomer seals associated with BWR standby gas treatment system ductwork and filters. The reviewer reviews the applicant's proposed programs on a case-by-case basis to ensure that an adequate program will be in place for the management of changes in properties due to degradation of elastomer seals in the standby gas treatment system.

3.2.3.2.7 Loss of Iodine Retention Capacity Due to Moisture Absorption

The GALL report recommends further evaluation of programs to manage loss of iodine retention capacity due to absorption of moisture in the BWR standby gas treatment system charcoal absorber filter. The reviewer reviews the applicant's proposed programs on a case-by-case basis to ensure that an adequate program will be in place for the management of loss of iodine retention capacity from absorption of moisture in the BWR standby gas treatment system charcoal absorber filter.

3.2.3.2.8 Buildup of Deposit from Biofouling

The GALL report recommends further evaluation of programs to manage deposit buildup from biofouling in the containment isolation components associated with systems that are not addressed in other chapters of the GALL report. The reviewer reviews the applicant's proposed programs on a case-by-case basis to ensure that an adequate program will be in place for the management of deposit buildup from biofouling in the containment isolation components associated with systems that are not addressed in other chapters of the GALL report.

3.2.3.2.9 Local loss of Material Due to Erosion

The GALL report recommends further evaluation of programs to manage local loss of material due to erosion of the high-pressure safety injection pump miniflow orifice. The reviewer reviews the applicant's proposed programs on a case-by-case basis to ensure that an adequate program will be in place for the management of local loss of material due to erosion of the high-pressure safety injection pump miniflow orifice.

3.2.3.2.10 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 the associated 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.

3.2.3.3 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.

3.2.3.4 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.

3.2.3.5 FSAR Supplement

The reviewer verifies that the applicant has provided information to be included in the FSAR supplement for aging management of the Engineered Safety Features for license renewal with information equivalent to that in Table 3.2-2 of this review plan section. The reviewer also verifies that the applicant has provided information to be included in the FSAR supplement for Subsection 3.2.3.3, "Aging Management Programs or Evaluations that are Different from those Described in the GALL Report," and Subsection 3.2.3.4, "Components or Aging Effects that are Not Addressed in the GALL Report," of this review plan section with information equivalent to that in Table 3.2-2. 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 3.2-2, 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.

3.2.4 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 Engineered Safety Features will be adequately managed so that there is reasonable assurance that these systems 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 Engineered Safety Features.

3.2.5 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.

3.2.6 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)," U.S. Nuclear Regulatory Commission, XXXX.

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL Report

Type	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
BWR/ PWR	Piping, fittings and valves in emergency core cooling system	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA (see subsection 3.2.2.2.1)
PWR	Tanks in emergency core cooling system	Crack initiation and growth from SCC	Water chemistry and inservice inspection	Yes, detection of aging effects should be further evaluated (see subsection 3.2.2.2.2)
BWR	Piping, fittings, pumps and valves in emergency core cooling system	Loss of material from general corrosion	Water chemistry	Yes, detection of aging effects should be further evaluated (see subsection 3.2.2.2.3)
BWR/ PWR	Components in containment spray (PWR only), standby gas treatment system (BWR only), containment isolation, and emergency core cooling systems	Loss of material from general corrosion	Plant-specific	Yes, plant-specific (see subsection 3.2.2.2.3)
BWR	Piping, fittings, pumps and valves in emergency core cooling system	Loss of material from crevice and pitting corrosion	Water chemistry	Yes, detection of aging effects should be further evaluated (see subsection 3.2.2.2.4)
BWR/ PWR	Components in containment spray (PWR only), standby gas treatment system (BWR only), containment isolation, and emergency core cooling systems	Loss of material from pitting and crevice corrosion	Plant-specific	Yes, plant-specific (see subsection 3.2.2.2.4)

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL Report

Type	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
BWR/ PWR	Containment isolation valves and associated piping	Loss of material from microbiologal corrosion	Plant-specific	Yes, plant-specific (see subsection 3.2.2.2.5)
BWR	Seals in standby gas treatment system	Changes in properties from elastomer degradation	Plant-specific	Yes, plant-specific (see subsection 3.2.2.2.6)
BWR	Filter in standby gas treatment system	Loss of filter capacity from absorption of moisture	Plant-specific	Yes, plant-specific (see subsection 3.2.2.2.7)
BWR/ PWR	Containment isolation valves and associated piping	Buildup of deposit from biofouling	Plant-specific	Yes, plant-specific (see subsection 3.2.2.2.8)
PWR	High-pressure safety injection (charging) pump miniflow orifice	Loss of material from erosion	Plant-specific	Yes, plant-specific (see subsection 3.2.2.2.9)
BWR/ PWR	Containment isolation valve disc seal	Changes in properties from elastomer degradation	Inservice inspection and containment leak rate tests	No
BWR/ PWR	Piping and fittings of cast austenitic stainless steel (CASS) in emergency core cooling systems	Loss of fracture toughness from thermal aging embrittlement	Thermal aging embrittlement of CASS	No
BWR/ PWR	Components serviced by open-cycle cooling system	Local loss of material from corrosion and/or buildup of deposit from biofouling	Open-cycle cooling water system	No
BWR/ PWR	Components serviced by closed-cycle cooling system	Loss of material from general, pitting and crevice corrosion	Closed-cycle cooling water system	No

Table 3.2-1. Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of the GALL Report

Type	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
BWR	Emergency core cooling system valves and lines to and from HPCI and RCIC pump turbines	Wall thinning from flow-accelerated corrosion	Flow-accelerated corrosion	No
BWR/ PWR	Pumps, valves, piping and fittings in containment spray (PWR only) and emergency core cooling systems	Crack initiation and growth from SCC	Water chemistry and inservice inspection	No
PWR	Carbon steel components	Loss of material from boric acid corrosion	Boric acid corrosion	No
BWR/ PWR	External surface of carbon steel components	Loss of material from atmospheric corrosion	Protective coating monitoring and maintenance program	No
BWR/ PWR	Closure bolting in high-pressure or high-temperature systems	Loss of material from atmospheric corrosion, loss of preload from stress relaxation, and crack initiation and growth from cyclic loading, stress-corrosion cracking	Bolting integrity	No

Table 3.2-2. FSAR Supplement for Aging Management of Engineered Safety Features

Program	Description of Program	Implementation Schedule*
Bolting integrity (BWR/PWR)	This program consists of guidelines on materials selection, strength and hardness properties, installation procedures, lubricants and sealants, corrosion considerations in the selection and 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, with the exceptions noted in NUREG 1339, for safety related bolting, and EPRI NP-5067 for other bolting.	Existing program
Boric acid corrosion (PWR)	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 in accordance with GL 88-05, and in accordance with ASME Section XI inservice inspection for reactor coolant leak tests.	Existing program
Closed-cycle cooling water system (BWR/PWR)	The program relies on preventive measures to minimize corrosion by maintaining corrosion inhibitors by surveillance testing and inspection in conformance with the ASME OM Standards and Guides, Part 2. Corrosion inhibitor concentrations are maintained within the limits specified in the guidelines of EPRI-TR-107396 for closed-cycle cooling water systems.	Existing program
Flow accelerated corrosion (FAC) program (BWR/PWR)	The program consists of the following; (1) conduct appropriate analysis and baseline inspection, (2) determine extent of thinning and replace/repair components, and (3) perform follow up inspections to confirm or quantify and take longer-term corrective actions. The program relies on implementation of EPRI guidelines of NSAC–202L–R2.	Existing program

Inservice inspection (BWR/PWR)	The 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
One-time inspection	To verify the effectiveness of the chemistry control program, a one-time inspection of pumps, valves, piping and fittings associated with certain BWR emergency core cooling systems (high pressure coolant injection, reactor core isolation cooling, high pressure core spray, low pressure core spray, low-pressure coolant injection [residual heat removal]) and lines to the suppression chamber and to the drywell and suppression chamber spray system is performed to ensure that corrosion is not occurring.	The inspection should be completed before the period of extended operation.
Open-cycle cooling water system (BWR/PWR)	The program includes (a) surveillance and control of biofouling, (b) tests to verify heat transfer, (c) routine inspection and maintenance program, (d) system walk down inspection, and (e) review of maintenance, operating, and training practices and procedures. The program provides assurance that open-cycle cooling water system is in compliance with General Design Criteria and Quality Assurance to ensure open-cycle cooling water (or service water) system can be managed for an extended period of operation. This program is in response to NRC Generic Letter 89–13.	Existing program
Plant-specific AMP	The description should contain information associated with the basis for determining that aging effects will be managed during the period of extended operation.	Program should be implemented before the period of extended operation.
Protective Coating monitoring and maintenance program	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

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.
Thermal aging embrittlement of CASS AMP (BWR/PWR)	The program consists of: determination of the susceptibility of CASS piping to thermal aging embrittlement based on casting method, Mo content, and percent ferrite. For potentially susceptible piping, aging management is accomplished either through enhanced volumetric examination or component–specific flaw tolerance evaluation.	Existing program
Water Chemistry (BWR/PWR)	To mitigate aging effects on component surfaces that are exposed to water as process fluid, chemistry programs are used to control water chemistry for impurities (e.g., chloride, fluoride, and sulfate) that accelerate corrosion. The water chemistry program relies on monitoring and control of water chemistry maintaining maximum levels of various contaminants below the system specific limits based on EPRI guidelines of TR-103515 for water chemistry in BWRs, TR-105714 for primary water chemistry in PWRs, and TR-102134 for secondary water chemistry in PWRs.	Existing program

*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.