3.3 AGING MANAGEMENT OF AUXILIARY SYSTEMS

Review Responsibilities

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

3.3.1 Areas of Review

This review plan section addresses the aging management review of the Auxiliary Systems for license renewal. For a recent vintage plant, the information related to the Auxiliary Systems is contained in Chapter 9, "Auxiliary 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). Typical Auxiliary Systems that are subject to an aging management review for license renewal are new fuel storage, spent fuel storage, spent fuel pool cooling and cleanup (BWR/PWR), suppression pool cleanup system (BWR), overhead heavy load and light load (related to refueling) handling systems, open-cycle cooling water system, closed-cycle cooling water system, ultimate heat sink, compressed air system, chemical and volume control system (PWR), standby liquid control system (BWR), reactor water cleanup system (BWR), shutdown cooling system (older BWR), control room area ventilation system, auxiliary and radwaste area ventilation system, primary containment heating and ventilation system, diesel generator building ventilation system, fire protection, diesel fuel oil system, and the emergency diesel generator system.

The aging management for portions of the chemical and volume control system for PWRs, and for BWRs, the standby liquid control, reactor water cleanup, and shutdown cooling (older BWR) systems, extending up to the first isolation valve outside of containment is reviewed following the guidance in Section 3.1 of this standard review plan. The aging management for portions of the spent fuel pool cooling and cleanup, chemical and volume control system (PWR), and suppression pool cleanup and shutdown cooling systems (BWR), that are classified as Group B quality standard, is reviewed following the guidance in Section 3.3 of this standard review plan. The aging management program for the cooling towers is reviewed following the guidance in Section 3.5 of this standard review plan for "Group 6" structures.

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:

3.3.1.1 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.

3.3.1.2 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 focus should be on augmented programs for license renewal.

3.3.1.3 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.

3.3.1.4 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.

3.3.1.5 FSAR Supplement

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

3.3.2 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.

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

Acceptable methods for managing aging of the Auxiliary Systems are described and evaluated in Chapter VII 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.

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

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

3.3.2.2.1 Loss of Material From General, Microbiologically Influenced, Galvanic, Pitting, and Crevice Corrosion

Loss of material from general, microbiologically influenced, pitting, and crevice corrosion could occur in carbon steel piping, valve bodies, pump casing, tanks, heat exchangers, and ion exchangers in the spent fuel pool cooling and cleanup system (BWR and PWR), and the shutdown cooling system (older BWR). The water chemistry program relies on monitoring and control of reactor water chemistry 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 to manage the effects of loss of material from crevice or pitting corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause crevice or pitting or microbiologically influenced corrosion. 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 from general, microbiologically influenced, pitting, and crevice corrosion to verify the effectiveness of the water chemistry 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.

3.3.2.2.2 Hardening, and Cracking From Material Degradation

Hardening and cracking from materials degradation could occur in valve linings in spent fuel pool cooling and cleanup system (BWR and PWR) and seals in control room area, auxiliary and radwaste area, and primary containment heating ventilation systems. The GALL report recommends further evaluation to ensure these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.3.2.2.3 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 evaluation of this TLAA is addressed separately in Section 4.3 of this standard review plan.

3.3.2.2.4 Crack Initiation and Growth from Stress Corrosion Cracking (SCC)

Crack initiation and growth from SCC could occur in stainless steel (SS) piping in contact with reactor coolant in standby liquid control system (BWR). The GALL report recommends further evaluation to ensure these aging effects are adequately managed.

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

Crack initiation and growth from SCC could occur in heat exchanger components in the BWR reactor water cleanup system and the PWR chemical and volume control system. The GALL report recommends further evaluation to ensure these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

Crack initiation and growth from SCC could occur in the external surfaces adhered with electrical heat tracing of low-pressure SS piping and valves in chemical and volume control system (PWR). The GALL report recommends further evaluation to ensure these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.3.2.2.5 Loss of Material from Microbiologically Influenced, Galvanic, Pitting, and Crevice Corrosion, Wear and Erosion/Corrosion

Loss of material from general, galvanic, microbiologically influenced, pitting, and crevice corrosion could occur in piping and filter housings in air handling, heating/cooling and ventilation system, and the diesel engine starting air and combustion air subsystems. The GALL report recommends further evaluation to ensure these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

Loss of material from wear could occur in the flexible collars and seals in heating and ventilation systems. The GALL report recommends further evaluation to ensure these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.3.2.2.6 Loss of Iodine Retention Capacity From Moisture Absorption

Loss of iodine retention capacity from absorption of moisture could occur in the BWR standby gas treatment system charcoal absorber filter. The GALL report recommends further evaluation to ensure these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.3.2.2.7 Loss of Material from General, Galvanic, Pitting, and Crevice Corrosion

Loss of material from general, galvanic, pitting, and crevice corrosion could occur in tanks, piping, valve bodies, and tubing in the reactor coolant pump oil collect system. The fire protection program relies on a combination of visual and volumetric examinations in accordance with the guidelines of 10 CFR Part 50 appendix R and Branch technical position 9.5-1 to manage loss of material from corrosion. However, corrosion may occur at locations where water from wash downs may accumulate. Therefore, verification of the effectiveness of the program should be performed to ensure that corrosion is not occurring. The GALL report recommends further evaluation of programs to manage loss of material from general, galvanic, pitting, and crevice corrosion to verify the effectiveness of the program. A one-time inspection of the bottom half of the interior surface of the tank of the reactor coolant pump oil collection system 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.

3.3.2.2.8 Induced cracking from vibration and Wall Thinning from Erosion/Corrosion

Wall thinning from erosion/corrosion and cracking from vibration-induced fatigue could occur in components in the diesel engine cooling water subsystem. The GALL report recommends further evaluation to ensure these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1, Appendix A.1 of this standard review plan.

3.3.2.2.9 Loss of Material from Corrosion or Buildup of Deposits from Biofouling

Loss of material from corrosion, or buildup of deposits from biofouling could occur in diesel fuel oil strainer and tanks in the diesel fuel oil system and emergency diesel generator system. The existing aging management program relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination in accordance with the guidelines of ASTM Standards D270, D1796, D2709 and D975 to manage Loss of material from corrosion or buildup of deposits from biofouling. However, corrosion or biofouling may occur at locations where contaminants may accumulate and could cause corrosion or buildup of deposits. 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 corrosion/biofouling to verify the effectiveness of the program. A one-time inspection of selected 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.

3.3.2.2.10 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.

3.3.2.3 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.

3.3.2.4 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.

3.3.2.5 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.

3.3.3 Review Procedures

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

3.3.3.1 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 Auxiliary System 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 Auxiliary System components are tabulated in Table 3.3-1 of this review plan section. No further staff evaluation is necessary if so recommended in the GALL report.

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

3.3.3.2.1 Loss of Material From General, Microbiologically Influenced, Galvanic, Pitting, and Crevice Corrosion

The GALL report recommends further evaluation of programs to manage loss of material from general, microbiologically influenced, pitting, and crevice corrosion of carbon steel piping, valve bodies, pump casing, tanks, heat exchangers, and ion exchangers in the spent fuel pool cooling and cleanup system (BWR and PWR) and the shutdown cooling system (older BWR) to verify the effectiveness of the water chemistry program. The water chemistry program relies on monitoring and control of reactor water chemistry 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 to manage the effects of loss of material from crevice or pitting corrosion (Ref. 3-

5). However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause crevice or pitting corrosion. Therefore, verification of the effectiveness of the water chemistry control program is should be performed to ensure that degradation is not occurring and the component's intended function would 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 reviewer also verifies that the proposed inspection would be performed using techniques similar to ASME Code and ASTM standards, including visual, ultrasonic, and surface techniques (Ref. 6-7).

3.3.3.2.2 Hardening, and Cracking From Material Degradation

The GALL report recommends further evaluation of programs to manage the hardening and cracking from materials degradation of valves in spent fuel pool cooling and cleanup system (BWR and PWR), and seals in control room area, auxiliary and radwaste area, and primary containment heating ventilation systems. The staff reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

3.3.3.2.3 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 evaluation of this TLAA is addressed separately in Section 4.3 of this standard review plan.

3.3.3.2.4 Crack Initiation and Growth from Stress Corrosion Cracking (SCC)

The GALL report recommends further evaluation of programs to manage the crack initiation and growth from SCC of stainless steel (SS) piping in contact with reactor coolant in standby liquid control system (BWR). The staff reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

The GALL report recommends further evaluation of programs to manage the crack initiation and growth from SCC of heat exchanger components in the BWR reactor water cleanup system, and the PWR chemical and volume control system. The staff reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

The GALL report recommends further evaluation of programs to manage the crack initiation and growth from SCC of the external surfaces adhered with electrical heat tracing of low-pressure SS piping and valves in the PWR chemical and volume control system. The staff reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

3.3.3.2.5 Loss of Material from Microbiologically Influenced, Galvanic, Pitting, and Crevice Corrosion, Wear and Erosion/Corrosion

The GALL report recommends further evaluation of programs to manage the loss of material from general, galvanic, microbiologically influenced, pitting, and crevice corrosion of piping and filter housings in heating/cooling and ventilation system, and the diesel engine starting air and combustion air subsystems. The staff reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

The GALL report recommends further evaluation of programs to manage the loss of material from wear of the flexible collars and seals in heating and ventilation systems. The staff reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

3.3.2.2.6 Loss of Iodine Retention Capacity From Moisture Absorption

The GALL report recommends further evaluation of programs to manage the loss of iodine retention capacity from absorption of moisture in the charcoal absorber filter for the control room, auxiliary and radwaste and primary containment area ventilation systems. The staff reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

3.3.3.2.7 Loss of Material from General, Pitting, and Crevice Corrosion

The GALL report recommends further evaluation of programs to manage the loss of material from general, galvanic, pitting, and crevice corrosion of tanks, piping, valve bodies, and tubing in the reactor coolant pump oil collection system. The fire protection program relies on combination of visual and volumetric examinations in accordance with the guidelines of 10 CFR Part 50 appendix R, and branch technical position 9.5-1 to manage loss of material from corrosion. However, corrosion may occur at locations where water from wash downs may accumulate, and verification of the effectiveness of the program, should be performed to ensure that corrosion is not occurring. Therefore, verification of the effectiveness of the program should be performed to ensure that degradation is not occurring and the component's intended function would 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 visual inspection of the bottom half of the interior of the tank, it would be performed to ensure that corrosion is not occurring. If corrosion is identified a volumetric examination will then be conducted on any problematic areas. The results of examinations will be used as a leading indicator of other susceptible components. The reviewer also verifies that the proposed inspection would be performed using techniques similar to ASME Code and ASTM standards, including visual, ultrasonic, and surface examination techniques (Ref. 6-7).

3.3.3.2.8 Induced cracking from vibration and Wall Thinning from Erosion/Corrosion

The GALL report recommends further evaluation of programs to manage wall thinning from erosion/corrosion and cracking from vibration-induced fatigue of components in the emergency diesel generator system. The staff reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

3.3.3.2.9 Loss of Material from Corrosion or Buildup of Deposits from Biofouling

The Gall report recommends further evaluation of programs to manage of loss of material from corrosion, or buildup of deposits from biofouling of Diesel fuel oil strainer and tanks in the diesel fuel oil system and emergency diesel generator system. The fuel oil chemistry program relies on monitoring and control of fuel oil contamination in accordance with the guidelines of ASTM Standards D270, D1796, D2709 and D975 to manage Loss of material from corrosion or buildup of deposits from biofouling. However, corrosion or biofouling may occur at locations where contaminants may accumulate. Therefore, verification of the effectiveness of the fuel oil program is should be performed to ensure that corrosion/biofouling is not occurring and the component's intended function would be maintained during the period of extended operation.

The reviewer reviews the applicant's proposed program to ensure that corrosion/buildup 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/buildup 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 reviewer also verifies that the proposed inspection would be performed using techniques similar to ASME Code and ASTM standards, including visual, ultrasonic, and surface techniques (Ref. 6-7).

3.3.3.2.10 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.

3.3.3.3 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.

3.3.3.4 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.

3.3.3.5 FSAR Supplement

The reviewer verifies that the applicant has provided information to be included in the FSAR supplement for aging management of the Auxiliary Systems for license renewal with information equivalent to that in Table 3.3-2 of this review plan section. The reviewer also verifies that the applicant has provided information to be included in the FSAR supplement for Subsection 3.3.3.3, "Aging Management Programs or Evaluations that are Different from those Described in the GALL Report," and Subsection 3.3.3.4, "Components or Aging Effects that are Not Addressed in the GALL Report," of this review plan section with information equivalent to that in Table 3.3-2. 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 conditions, 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 3.3-2, 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.

3.3.4 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 Auxiliary Systems 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 Auxiliary Systems.

3.3.5 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.

3.3.6 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.

3. EPRI TR-103515, BWR Water Chemistry Guidelines-Revision 3, Normal and Hydrogen Water Chemistry, Electric Power Research Institute, Palo Alto, CA, February 1994.

4. EPRI TR-105714, PWR Primary Water Chemistry Guidelines-Revision *3*, Electric Power Research Institute, Palo Alto, CA, Nov. 1995.

5. EPRI TR-102134, PWR Secondary Water Chemistry Guideline-Revision *3*, Electric Power Research Institute, Palo Alto, CA, May 1993.

6. ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, The ASME Boiler and Pressure Vessel Code, 1989 or later edition as approved in 10 CFR 50.55a, The American Society of Mechanical Engineers, New York, NY.

7. ASTM D95-83, Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation, American Society for Testing and Materials, West Conshohocken, PA, 1983.

Table 3.3-1. Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of the GALL Report

Type	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
BWR/ PWR	Components in spent fuel pool cooling and cleanup	Loss of material from general and pitting and crevice corrosion	Water chemistry	Yes, detection of aging effects should be further evaluated (see subsection 3.3.2.2.1)
BWR/ PWR	Valve lining in spent fuel pool cooling and cleanup system, and seals in ventilation systems	Materials degradation from cracking, wear, or hardening from loss of strength	Plant-specific	Yes, plant-specific (see subsection 3.3.2.2.2)
BWR/ PWR	Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21 (c)	Yes, TLAA (see subsection 3.3.2.2.3)
BWR/ PWR	Heat exchangers in reactor water cleanup system (BWR) and chemical and volume control system (PWR)	Crack initiation and growth from SCC or unanticipated cyclic loading	Plant-specific	Yes, plant-specific (see subsection 3.3.2.2.4)
BWR/ PWR	Ducts, piping in air handling, and filters in heating /cooling ventilation systems, and components in emergency diesel generator systems	Loss of material from MIC, corrosion, wear or erosion/corrosion	Plant-specific	Yes, plant-specific (see subsection 3.3.2.2.5)
BWR/ PWR	Charcoal absorber filler in ventilation systems	Loss of iodine retention capacity from absorption of moisture	Plant-specific	Yes, plant-specific (see subsection 3.3.2.2.6)

BWR/ PWR	Components in reactor coolant pump oil collect system	Loss of material from galvanic, general, pitting, and crevice corrosion	Fire Protection	Yes, detection and aging effects should be further evaluated (see subsection 3.3.2.2.7)
BWR/ PWR	Diesel engine cooling water subsystem	Cracking from cycle loading	Plant-specific	Yes, plant-specific (see subsection 3.3.2.2.8)
BWR/ PWR	Diesel fuel oil strainer and tanks	Loss of material from corrosion, buildup of deposit from biofouling	Fuel oil chemistry	Yes, detection of aging effects should be further evaluated (see subsection 3.3.2.2.9)
BWR	Piping, pump casing, and valve body and bonnets in shutdown cooling system (older BWR)	Loss of material from general and pitting and crevice corrosion	Water chemistry	Yes, detection of aging effects should be further evaluated (see subsection 3.3.2.2.1)
BWR	Piping in contact with reactor coolant in standby liquid control system	Crack initiation and growth from SCC	Plant-specific	Yes, plant-specific (see subsection 3.3.2.2.4)
PWR	External surfaces of low-pressure stainless steel piping and valves in chemical and volume control system (PWR)	Crack initiation and growth from SCC from electrical heat tracing tape adhesive	Plant-specific	Yes, plant-specific (see subsection 3.3.2.2.4)
BWR/ PWR	New fuel rack assembly	Loss of material from corrosion or coating degradation	Structural monitoring	No
BWR/ PWR	Neutron absorbing sheets in spent fuel storage racks	Reduction in neutron absorbing capacity from aging degradation	Boraflex monitoring	No
BWR/ PWR	Closure bolting and external surfaces of carbon steel components	Loss of material from boric acid corrosion	Boric acid corrosion	No

BWR/ PWR	Components in or serviced by closed-cycle cooling water	Loss of material from corrosion	Closed-cycle cooling water system	No
BWR/ PWR	Bridge and trolleys in load handling system and rail system	Loss of material from corrosion and wear	Overhead and gantry cranes inspection and maintenance	No
BWR/ PWR	Components in or serviced by open-cycle cooling water systems	Loss of material from corrosion, or cavitation, or buildup of deposit from biofouling	Open-cycle cooling water system	No
BWR/ PWR	Buried piping	Loss of material from corrosion	Outer surface of buried piping and components	No
BWR/ PWR	Components in compressed air system	Loss of material from corrosion	Compressed air inspection and maintenance	No
BWR/ PWR	Components (doors, barrier penetration seals) and concrete structures in fire protection	Loss of material from wear; hardness and shrinkage from weathering; or concrete cracking and spalling	Fire protection	No
BWR/ PWR	Components in water based fire protection	Loss of material and buildup of deposit from corrosion	Fire water system	No
BWR/ PWR	Components in diesel fire system	Loss of material from galvanic, general, pitting, and crevice corrosion	Fire protection	No
BWR/ PWR	Tanks in diesel fuel oil system	Loss of material from corrosion	Outer surface of above ground carbon steel tanks	No
BWR/ PWR	External surfaces of carbon steel components	Loss of material from atmospheric corrosion	Protective coating monitoring and maintenance	No
BWR/ PWR	Closure bolting	Loss of material from atmospheric corrosion, or loss of preload from stress relaxation or crack initiation	Bolting integrity	No

		and growth from cyclic loading, or stress corrosion cracking		
BWR	Components in contact with sodium pentaborate solution in standby liquid control systems (BWR)	Crack initiation and growth from SCC	Inservice inspection	No
BWR	Components in reactor water cleanup system and shutdown cooling system (older BWR)	Crack initiation and growth from SCC	BWRVIP water chemistry inservice inspection	No

Table 3.3-2. FSAR Supplement for Aging Management of Auxiliary Systems

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
Boraflex monitoring (BWR/PWR)	The program consists of; (1) periodic visual inspection for discoloration and thickness, and hardness testing of sample coupons, (2) performing neutron attenuation testing ("blackness testing") to determine gap formation, (3) Sampling for the presence of silica in the spent fuel pool along with boron loss and (4) monitoring and analysis of criticality to assure that the required 5% subcriticality margin is maintained. This program is implemented in response to GL 96-04.	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 implemented in response to GL 88-05 and in accordance with ASME Section XI inservice inspection for reactor coolant leak tests.	Existing program
BWRVIP (BWR)	The BWR vessel internal program (VIP) consists of inspection, evaluation, maintenance, repair and water chemistry. The program addresses BWR reactor vessel, internals, and pressure boundary components. The BWRVIP is described in staff approved topical reports.	Existing program

Program	Description of Program	Implementation Schedule*
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
Compressed air inspection and maintenance (BWR/PWR)	The program consists of improved system inspections, maintenance, and testing and includes frequent leak testing of carbon steel components, and preventive maintenance to check air quality. This program is in response to NRC Generic Letter 88-14and INPO's Significant Operating Experience Report (SOER) 88-01. It also relies on the ASME Operation and Maintenance (OM) Guide Part 17, and ISA-S7.0.1-1996 as guidance for testing and monitoring of air quality and moisture.	Existing program
Fire protection (BWR/PWR)	The program consists of maintenance and testing of fire detection and suppression systems and surveillance procedures to ensure fire barriers are in place and fire suppression system and components are operable. [Choose what is appropriate: If plant was built prior to 1979, as part of the plant fire protection program specified in10 CFR Part 50, Appendix R and Branch Technical Position 9.5-1, the fire barrier inspection program consists of periodic visual inspection of fire protection barrier. If plant was built after 1979, the AMP follows the guidance of NUREG-0800, Section 9.5.1.]	Existing program
Fire water system (BWR/PWR)	To ensure no fouling has occurred in the fire protection system, periodic full flow flush test and system performance test are conducted to prevent buildup of deposits in components. Also, the system is normally maintained at required operating pressure and is monitored such that loss of system pressure is immediately detected and corrective actions initiated. The AMP relies on testing of water based fire protection system piping and components in accordance with applicable NFPA commitments. In addition, portions of the fire protection sprinkler system	Existing program

Program	Description of Program	Implementation Schedule*
	needs to be subjected to full flow tests prior to the period of extended operation. Fire protection system exposed to water also needs to be internally visually inspected.	
Fuel oil chemistry (BWR/PWR)	The AMP relies on a combination of surveillance and maintenance procedures. Monitoring and controlling of fuel oil contamination in accordance with the guidelines of ASTM Standards D975, D270, D1796, and D2709 maintains the fuel oil quality. Exposure to fuel oil contaminants such as water and microbiological organisms is minimized by periodic cleaning/draining tanks and by verifying the quality of new oil before its introduction into the storage tanks.	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 fuel oil program, a one-time thickness measurement of the tank bottom is performed. To verify the effectiveness of the reactor water chemistry program consists of a one-time inspection of internal surfaces of carbon steel piping, valve bodies, pump casing, and tanks, is performed using suitable techniques at the most susceptible locations is performed to ensure that corrosion is not occurring. To verify the effectiveness of fire protection program, a one-time visual inspection for the bottom half of the inside of the tank is an acceptable option 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	Existing program

Program	Description of Program	Implementation Schedule*
	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.	
Outer surface of above ground carbon steel tanks (BWR/PWR)	The program includes preventive measures to mitigate corrosion by protecting the external surface of carbon steel tanks, per standard industry practice with sealant or caulking at the interface of concrete and component. Paint or coatings are maintained according to the "Protective Coating Monitoring and Maintenance Program". Visual inspection during periodic system walk downs should be sufficient to monitor degradation of the protective paint, coating, calking or sealant. Verification of the effectiveness of the program by measuring the thickness of the tank bottoms ensures that degradation is not occurring and the component intended function would be maintained during the extended period of operation.	Existing program
Outer surface of buried piping and components (BWR/PWR)	The program includes preventive measures to mitigate corrosion by protecting the external surface of buried piping and components, with preventive measures external such as coating, wrapping, a cathodic protection system, and surveillance and monitoring of the coating conductance versus time or current. This program is based on standard industry practices as described in NACE-RP-01-69.	Existing program
Overhead and gantry cranes inspection and maintenance (BWR/PWR)	The AMP is based on ASME B30.2 specifications for overhead and gantry cranes. Walk downs should provide an estimate of thickness of material providing information on structural and functional requirements at the end of license renewal. Walk downs are performed using the visual inspection (VT-3) technique described in the ASME section XI code. Other methods such as ultrasonic inspection should be used to monitor for the loss of material from the internal surfaces of the girder.	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.

Program	Description of Program	Implementation Schedule*
Protective coating monitoring and maintenance (BWR/PWR)	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.
Structural monitoring (BWR/PWR)	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
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 license condition in the renewed license, if granted, to ensure that the applicant will complete these activities no later than the committed date.