3.3 AGING MANAGEMENT OF AUXILIARY SYSTEMS

Review Responsibilities

Primary - Branches assigned responsibility per SRP-LR section 3.0

3.3.1 Areas of Review

This review plan section addresses the aging management review (AMR) of the auxiliary systems for license renewal. For a recent vintage plant, the information related to the auxiliary systems are contained in Chapter 9, "Auxiliary Systems," of the plant's FSAR consistent with the "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (NUREG-0800) (Ref. 1). The auxiliary systems contained in this review plan section are generally consistent with those contained in NUREG-0800 except for refueling water, chilled water, heat removal, condenser circulating water, and condensate storage system. For older plants, the location of applicable information is plant-specific because their FSAR may have predated NUREG-0800. Typical auxiliary systems that are subject to an AMR for license renewal are new fuel storage, spent fuel storage, spent fuel pool cooling and cleanup (BWR/PWR), suppression pool cleanup (BWR), overhead heavy load and light load (related to refueling) handling, open-cycle cooling water, closed-cycle cooling water, ultimate heat sink, compressed air, chemical and volume control (PWR), standby liquid control (BWR), reactor water cleanup (BWR), shutdown cooling (older BWR), control room area ventilation, auxiliary and radwaste area ventilation, primary containment heating and ventilation, diesel generator building ventilation, fire protection, diesel fuel oil, and emergency diesel generator.

Aging management is reviewed, following the guidance in this SRP-LR Section 3.1, for portions of the chemical and volume control system for PWRs, and for standby liquid control, reactor water cleanup, and shutdown cooling systems extending up to the first isolation valve outside of containment for BWRs (the shutdown cooling systems for older BWRs). The following systems have portions that are classified as Group B quality standard: open-cycle cooling water (service water system), closed-cycle cooling water, compressed air, standby liquid control, shutdown cooling system (older BWR), control room area ventilation and auxiliary and radwaste area ventilation. Aging management for these portions is reviewed following the guidance in Section 3.3. The aging management program for the cooling towers is reviewed following the guidance in Section 3.5 for "Group 6" structures.

The responsible review organization is to review the following LRA, AMR, and AMP items, assigned to it, per SRP-LR section 3.0, for review:

AMRs

- AMRs consistent with the GALL report, for which further evaluation is not recommended
- AMRs consistent with the GALL report, for which further evaluation is recommended
- AMRs not consistent with the GALL report

AMPs

- AMPs consistent with GALL AMPs
- Plant-specific AMPs

FSAR Supplement

- In addition, the responsible review organization is to review the FSAR supplement associated with each assigned AMP.

3.3.2 Acceptance Criteria

The acceptance criteria for the areas of review describe methods for determining whether the applicant has met the requirements of the NRC's regulations in 10 CFR 54.21.

3.3.2.1 AMR Results Consistent with the GALL Report for Which No Further Evaluation is Recommended

The aging management review and acceptable aging management programs applicable to the auxiliary systems are described and evaluated in Chapter VII of the GALL report (Ref. 2).

The applicant's LRA should provide sufficient information so that the NRC reviewer is able to confirm that the specific AMR line-item and the associated AMP are consistent with the cited GALL AMR line-item. The staff reviewer should then confirm that the LRA AMR line-item is consistent with the GALL line-item to which it is compared.

If the applicant identifies an exception to the cited GALL AMP, the LRA should include a basis or reference how the criteria of 10 CFR 54.21(a)(3) would still be met. The NRC reviewer should then confirm that the AMP, with all exceptions, would satisfy the criteria of 10 CFR 54.21(a)(3). If, while reviewing the AMP, the reviewer identifies a difference from the GALL AMP, this difference should be reviewed and dispositioned as if it was an exception identified by the applicant in its LRA. The disposition of all LRA-defined exceptions and staff-identified differences should be documented.

The LRA should identify any enhancements that are needed to permit an existing aging management program to be declared consistent with the GALL AMP to which the LRA AMP is compared. The reviewer is to confirm both that the enhancement, if implemented, would allow the existing plant aging management program to be consistent with the GALL AMP and also that the applicant has a commitment to implement the enhancement prior to the period of extended operation. The reviewer should document the disposition of all enhancements.

3.3.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

The basic acceptance criteria, defined in 3.3.2.1, apply to all of the AMRs and AMPs reviewed as part of this section. In addition, if the GALL AMR line-item to which the LRA AMR line-item is compared identifies that "further evaluation is recommended," then additional criteria apply as identified by the GALL report for each of the following aging effect/aging mechanism combinations.

3.3.2.2.1 Loss of Material due to General, Pitting, and Crevice Corrosion

1. Loss of material due to general, pitting, and crevice corrosion could occur in the steel channel head and access cover, tubes, and tubesheets of the heat exchanger in the BWR spent fuel pool cooling and cleanup system. These effects could also occur if the elastomer lining or stainless steel clad is degraded in the elastomer lined or stainless steel clad steel piping, piping components, and piping elements in the shutdown cooling

system of older BWRs and in the PWR spent fuel pool cooling and cleanup system. The water chemistry program relies on monitoring and control of reactor water chemistry based on EPRI guidelines of BWRVIP-29 (TR-103515) (Ref. 3) for water chemistry in BWRs and TR-105714 (Ref. 4) for primary water chemistry in PWRs to manage the effects of loss of material from general, pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause general, pitting, or crevice corrosion. Pitting and crevice corrosion could occur if cladding and liners are degraded. 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, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

2. Loss of material due to pitting and crevice corrosion could occur in the stainless steel filter housing, valve bodies, and nozzles of the ion exchanger in the spent fuel pool cooling and cleanup system (PWR), in the piping, filter housing, valve bodies, and shell and nozzles of the ion exchanger in the spent fuel pool cooling and cleanup system (BWR), and in the piping and pump casing in the shutdown cooling system (older BWR). The water chemistry program relies on monitoring and control of reactor water chemistry based on EPRI guidelines of BWRVIP-29 (TR-103515) (Ref. 3) for water chemistry in BWRs, TR-105714 (Ref. 4) for primary water chemistry in PWRs to manage the effects of loss of material from pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting, or crevice 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 pitting and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

3. Loss of material due to general, pitting, and crevice corrosion could occur in the steel piping, piping components, and piping elements of the diesel engine lubricating oil system. The GALL report recommends further evaluation to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1, of this standard review plan.)

3.3.2.2.2 Hardening and Cracking or Loss of Strength due to Elastomer Degradation or Loss of Material due to Wear

Hardening and cracking due to elastomer degradation could occur in elastomer linings of the filters, valves, and ion exchangers in spent fuel pool cooling and cleanup systems (BWR and PWR). Hardening and loss of strength due to elastomer degradation could occur in the collars and seals of the ducts and in the elastomer seals of the filters in the control room area, auxiliary and radwaste area, and primary containment heating ventilation systems and in the collars and seals of the ducts in the diesel generator building ventilation system. Loss of material due to wear could occur in the collars and seals of the ducts in the ventilation systems. The GALL

report recommends further evaluation to ensure that 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 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 Cracking due to Stress Corrosion Cracking

1. Cracking due to SCC could occur in the stainless steel piping, piping components, and piping elements of the BWR Standby Liquid Control system that are in contact with sodium pentaborate solution. The water chemistry program relies on monitoring and control of water chemistry based on the guidelines in TR-103515 (Ref. 3) to manage the effects of cracking due to SCC. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause SCC. Therefore, the GALL report recommends verification of the effectiveness of the chemistry control program should be performed to ensure that SCC is not occurring. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that stress corrosion cracking is not occurring and that the component's intended function will be maintained during the period of extended operation.

2. Cracking due to SCC could occur in stainless steel heat exchanger components exposed to treated water and closed cycle cooling water greater than 140 degrees Fahrenheit. The GALL report recommends further evaluation to ensure that 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 due to General, Microbiologically Influenced, Pitting, and Crevice Corrosion

Loss of material due to general, pitting, and crevice corrosion could occur for internal surfaces of steel components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems. Loss of material due to microbiologically influenced corrosion (MIC) could occur in the internal surfaces of a subset of these steel ventilation system components. Loss of material due to pitting and crevice corrosion could occur in the stainless steel and copper alloy components in ventilation and diesel exhaust systems, and loss of material due to pitting and/or general corrosion could occur on the external surfaces of all steel structures and components, including bolting, exposed to uncontrolled air or wetting due to condensation for operating temperatures less than 212°F in the auxiliary systems. The GALL report recommends further evaluation to ensure that 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 Material due to General, Galvanic, Pitting, and Crevice Corrosion

Loss of material due to general, galvanic, pitting, and crevice corrosion could occur in steel and copper alloy tanks, piping, valve bodies, and tubing in the reactor coolant pump oil collection system in fire protection. 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 due to 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 that the component's intended function will be maintained during the period of extended operation.

3.3.2.2.7 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion and Biofouling

Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling could occur in the internal surface of steel tanks in the diesel fuel oil system and the 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 D4057, D1796, D2709 and D2276 to manage loss of material due to corrosion or biofouling. Corrosion or biofouling may occur at locations where contaminants accumulate. 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 at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

3.3.2.2.8 Quality Assurance for Aging Management of Nonsafety-Related Components

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

3.3.2.2.9 Cracking due to Stress Corrosion Cracking and/or Cyclic Loading

1. Cracking due to SCC and cyclic loading could occur in the stainless steel heat exchangers in the chemical and volume control system (PWR). The water chemistry program relies on monitoring and control of water chemistry based on the guidelines of TR-105714 (Ref. 4) for primary water chemistry in PWRs to manage the effects of cracking due to SCC and cyclic loading. The GALL report recommends verification of the effectiveness of the chemistry control program be performed to ensure that cracking is not occurring. The absence of cracking due to stress corrosion cracking and cyclic loading is to be verified. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.
2. Cracking due to SCC and cyclic loading could occur for high-strength steel closure bolting in auxiliary systems exposed to air with steam or water leakage. Cracking due to cyclic loading could occur for the steel and stainless steel closure bolting and pump casing for the high-pressure pumps in the chemical and volume control system (PWR) . The GALL report recommends further evaluation to ensure that these aging effects are managed adequately. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1, of this standard review plan.)

3.3.2.2.10 Reduction of Neutron-Absorbing Capacity and Loss of Material due to General Corrosion

Reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of the spent fuel storage rack in the spent fuel storage. The GALL report recommends further evaluation to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1, of this standard review plan.)

3.3.2.2.11 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

Loss of material due to general, pitting, and crevice corrosion and MIC could occur for the external surfaces of underground piping, piping components, and piping elements in the open-cycle cooling water system (service water system) and in the diesel fuel oil system. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

3.3.2.3 AMR Results Not Consistent with or Not Addressed in GALL Report

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

3.3.2.4 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 be appropriate 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. The description should also contain any future aging management activities, including enhancements, to be completed before the period of extended operation. Examples of the type of information required are provided in Table 3.3-2 of this standard review plan.

3.3.3 Review Procedures

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

3.3.3.1 AMR Results Consistent with the GALL Report for Which No Further Evaluation is Recommended

The applicant may reference the GALL report in its license renewal application, as appropriate, to demonstrate that the aging management reviews and programs at its facility are consistent with those reviewed and approved in the GALL report. The reviewer should not conduct a re-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 acceptable the applicant's reference to GALL in its license renewal application. In making this determination, the reviewer confirms that the applicant has provided a brief description of the system, components, materials, and environment. The reviewer also confirms that the applicant has stated that the applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report.

Furthermore, the reviewer should confirm that the applicant has addressed operating experience identified after the issuance of the GALL report. Performance of this review requires the reviewer to confirm that the applicant has identified those aging effects for the auxiliary system components that are contained in GALL as applicable to its plant.

The reviewer confirms that the applicant has identified the appropriate AMPs as described and evaluated in the GALL report. If the applicant commits to an enhancement to make its aging management program consistent with a GALL AMP, then the reviewer is to confirm that this enhancement when implemented will indeed make the LRA AMP consistent with the GALL AMP. If an aging management program in the LRA identifies an exception to the GALL AMP to which it is claiming to be consistent, the reviewer is to confirm that the LRA AMP with the exception will satisfy the criteria of 10CFR54.21(a)(3). If the reviewer identifies a difference, not identified by the LRA, between the LRA AMP and the GALL AMP, to which the LRA claims to be consistent, the reviewer should confirm that the LRA AMP with this difference satisfies 10CFR54.21(a)(3). The reviewer should document the basis for accepting enhancements, exceptions or differences. The AMPs evaluated in GALL pertinent to the auxiliary system components are summarized in Table 3.2-1 of this standard review plan.

AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

The basic review procedures defined in 3.3.3.1 apply to all of the AMRs and AMPs provided in this section. In addition, if the GALL AMR line-item to which the LRA AMR line-item is compared identifies that "further evaluation is recommended," then additional criteria apply as

identified by the GALL report for each of the following aging effect/aging mechanism

3.3.3.2.1 Loss of Material due to General, Pitting, and Crevice Corrosion

1. The GALL report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion of the steel channel head and access cover, tubes, and tubesheets of the heat exchanger in the BWR spent fuel pool cooling and cleanup system. These effects could also occur if the elastomer lining or stainless steel clad is degraded in the elastomer lined or stainless steel clad steel piping, piping components, and piping elements in the shutdown cooling system of older BWRs and in the PWR spent fuel pool cooling and cleanup system. The GALL recommends further evaluations 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 BWRVIP-29 (TR-103515) for water chemistry in BWRs, and TR-105714 for primary water chemistry in PWRs, to manage the effects of loss of material from general, pitting or crevice corrosion (Ref. 3 and 4). However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause general, pitting or crevice corrosion. Therefore, verification of the effectiveness of the water chemistry control program should be performed to ensure that corrosion is not occurring and that 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 that the component's intended function will be maintained during the period of extended operation. If the applicant proposes a one-time inspection of select components at 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).

2. The GALL report recommends further evaluation of programs to manage loss of material due to pitting and crevice corrosion of the stainless steel filter housing, valve bodies, and nozzles of the ion exchanger in the spent fuel pool cooling and cleanup system (PWR), of the piping, filter housing, valve bodies, and shell and nozzles of the ion exchanger in the spent fuel pool cooling and cleanup system (BWR) and of the piping and pump casing in 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 BWRVIP-29 (TR-103515) for water chemistry in BWRs, TR-105714 for primary water chemistry in PWRs to manage the effects of loss of material from pitting or crevice corrosion (Ref. 3-5). However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting or crevice corrosion. Therefore, verification of the effectiveness of the water chemistry control program should be performed to ensure that corrosion is not occurring and that 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 that the component's intended function will be maintained during the period of extended operation. If the applicant proposes a one-time inspection of select components at 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. The GALL report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion of the steel piping, piping components, and piping elements of the diesel engine lubricating oil system. The GALL report recommends further evaluation to ensure that these aging effects are adequately managed. 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.

3.3.3.2.2 Hardening and Cracking or Loss of Strength due to Elastomer Degradation or Loss of Material due to Wear

The GALL report recommends further evaluation of programs to manage the hardening and cracking due to elastomer degradation of valves in spent fuel pool cooling and cleanup system (BWR and PWR). The GALL report also recommends further evaluation of programs to manage the hardening and loss of strength due to elastomer degradation of the collars and seals of the duct and of the elastomer seals of the filters in the control room area, auxiliary and radwaste area, and primary containment heating and ventilation systems and of the collars and seals of the duct in the diesel generator building ventilation system. The GALL report also recommends further evaluation of programs to manage the loss of material due to wear of the collars and seals of the duct in the 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 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 Cracking due to Stress Corrosion Cracking

1. The GALL report recommends further evaluation of programs to manage cracking due to SCC of the stainless steel piping, piping components, and piping elements of the BWR Standby Liquid Control system that are in contact with sodium pentaborate solution. The water chemistry program relies on monitoring and control of reactor water chemistry based on TR-103515 (Ref. 3) to manage the effects of cracking from SCC and cyclic loading. The effectiveness of the water chemistry control program should be reviewed to verify that cracking is not occurring and that 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 that the component's intended function will be maintained during the period of extended operation. If the applicant proposes a one-time inspection of select components at 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).

2. The GALL report recommends further evaluation of programs to manage the cracking due to SCC of stainless steel heat exchanger components exposed to treated water and closed cycle cooling water greater than 140 degrees Fahrenheit. 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 due to General, Microbiologically Influenced, Pitting, and Crevice Corrosion

The GALL report recommends further evaluation of programs to manage the loss of material due to general, pitting, and crevice corrosion of the internal surfaces of steel components in ventilation systems, diesel fuel oil system, and emergency diesel generator system and to manage loss of material due to microbiologically influenced corrosion of the internal surfaces for a subset of the steel ventilation components. The GALL report also recommends further evaluation of programs to manage the loss of material due to pitting and crevice corrosion of the stainless steel and copper alloy heating/cooling coils of the air handler heating/cooling components of ventilation systems and the stainless steel diesel exhaust components. In addition, the GALL report recommends further evaluation of programs to manage loss of material due to general corrosion of the external surfaces of all steel structures and components, including bolting, exposed to uncontrolled air or wetting due to condensation for operating temperatures less than 212ºF in the auxiliary 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.

3.3.3.2.6 Loss of Material due to General, Galvanic, Pitting, and Crevice Corrosion

The GALL report recommends further evaluation of programs to manage the loss of material due to general, galvanic, pitting, and crevice corrosion of steel and copper alloy tanks, piping, valve bodies, and tubing in the reactor coolant pump oil collection system in fire protection. 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 degradation is not occurring and that 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 that the component's intended function will be maintained during the period of extended operation. If the applicant proposes a one-time visual inspection of the bottom half of the interior of the tank, the inspection would be performed to ensure that corrosion is not occurring. If corrosion is identified, a volumetric examination would 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).

3.3.3.2.7 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion and Biofouling

The Gall report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion and MIC and to biofouling of the internal surface of steel tanks in the diesel fuel oil system and the 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 D4057, D1796, D2709 and D2276 to manage loss of material due to corrosion or biofouling. Corrosion or biofouling may occur at locations where contaminants accumulate. Verification of the effectiveness of the fuel oil program should be performed to ensure that corrosion/biofouling is not occurring and that 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/biofouling is not occurring and that 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/biofouling 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).

3.3.3.2.8 Quality Assurance for Aging Management of Nonsafety-Related Components

The applicant's aging management programs for license renewal should contain the elements of corrective actions, the 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 nonsafety-related components that are subject to an AMR for license renewal. Nevertheless, the 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 the applicant chooses this option, the reviewer verifies that the applicant has documented such a commitment in the FSAR supplement. If the applicant chooses alternative means, the branch responsible for quality assurance should be requested to review the applicant's proposal on a case-by-case basis.

3.3.3.2.9 Cracking due to Stress Corrosion Cracking and/or Cyclic Loading

1. The GALL report recommends further evaluation of programs to manage cracking due to SCC and cyclic loading in the stainless steel heat exchangers in the chemical and volume control system (PWR). The water chemistry program relies on monitoring and control of water chemistry based on the guidelines of TR-105714 (Ref. 4) for primary water chemistry in PWRs to manage the effects of cracking due to SCC and cyclic loading. The GALL report recommends verification of the effectiveness of the chemistry control program be performed to ensure that cracking is not occurring. The absence of cracking due to stress corrosion cracking and cyclic loading is to be verified. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes. 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.
2. The GALL report recommends further evaluation of programs to manage cracking due to SCC and cyclic loading for high-strength steel closure bolting in auxiliary systems that is exposed to air with steam or water leakage and to manage cracking due cyclic loading for the pump casing and closure bolting of high-pressure pumps in the PWR charging and

volume control system. The GALL report recommends further evaluation to ensure that these aging effects are adequately managed. 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.

3.3.3.2.10 Reduction of Neutron-Absorbing Capacity and Loss of Material due to General Corrosion

The GALL report recommends further evaluation of programs to manage reduction of neutron-absorbing capacity and loss of material due to general corrosion of the neutron-absorbing sheets of the spent fuel storage rack in the spent fuel storage. 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.

3.3.3.2.11 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

The GALL report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion and MIC of the external surfaces of underground piping, piping components, and piping elements in the open-cycle cooling water system (service water system) and in the diesel fuel oil system to verify the effectiveness of the buried piping and tanks inspection program. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

3.3.3.3 AMR Results Not Consistent with or Not Addressed in GALL Report

The reviewer should confirm that the applicant, in the license renewal application, has identified applicable aging effects, listed the appropriate combination of materials and environments, and aging management programs that will adequately manage the aging effects. The aging management program credited could be an AMP that is described and evaluated in the GALL report or a plant-specific program. Review procedures are described in Branch Technical Position RLSB-1 (Appendix A.1 of this standard review plan).

3.3.3.4 FSAR Supplement

The reviewer confirms that the applicant has provided information, equivalent to that in Table 3.3-2, in the FSAR supplement for aging management of the auxiliary systems for license renewal. The reviewer also confirms that the applicant has provided information, equivalent to that in Table 3.3-2, in the FSAR supplement for Subsection 3.3.3.3, "Aging Management Evaluations that Are Different from or Not Addressed in the GALL Report."

The staff expects to impose a license condition on any renewed license 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 NRC 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, the reviewer should confirm that the applicant has identified and committed in the license renewal application to any future aging management activities to be completed before the period of extended operation. The staff expects to impose a license condition on any renewed license 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 that the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

> On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing these aging effects for the auxiliary systems, such that there is reasonable assurance that the component intended functions will be maintained consistent with the CLB during the period of extended operation. The staff also reviewed the applicable FSAR supplement program descriptions and concludes that the FSAR supplement provides an adequate program description of the AMPs credited for managing aging effects, as required by 10 CFR 54.21(d).

3.3.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the NRC's regulations, the method described herein will be used by the staff in its evaluation of conformance with NRC 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-1801, "Generic Aging Lessons Learned (GALL)," U.S. Nuclear Regulatory Commission, July 2001.

3. BWRVIP-29 (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.

[Original Table Replaced In Its Entirety Below.]

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	SRP Ref	Item Number in GALL
BWR/ PWR	Components in spent fuel pool cooling and cleanup systems and in the shutdown cooling system of older BWRs	Loss of material due to General, pitting and crevice corrosion (for unlined/unclad) and loss of material due to pitting and crevice corrosion (after liner/cladding degradation in elastomer lined and stainless steel clad steel components)	Water chemistry and one-time inspection	Yes, detection of aging effects is to be further evaluated (See subsection 3.3.2.2.1.1)	3.3.2.2.1.1	A-35 A-39 A-40
BWR	Piping, piping components, and piping elements; heat exchangers	Loss of material due to Pitting and crevice corrosion	Water chemistry and one-time inspection	Yes, detection of aging effects is to be further evaluated (See subsection 3.3.2.2.1.2)	3.3.2.2.1.2	A-58 A-70
BWR/ PWR	Components in diesel engine lubricating oil subsystem	Loss of material due to general, pitting and crevice corrosion	Plant specific	Yes, plant specific (See subsection 3.3.2.2.1.3)	3.3.2.2.1.3	AP-30
BWR/ PWR	Linings in spent fuel pool cooling and cleanup system; seals and collars in ventilation systems	Loss of material due to wear and Hardening and loss of strength due to Elastomer degradation	Plant specific	Yes, plant specific (See subsection 3.3.2.2.2)	3.3.2.2.2	A-15 A-16 A-17 A-18 A-36 A-73

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	SRP Ref	Item Number in GALL
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)	3.3.2.2.3	A-06 A-100 A-34 A-37 A-42 A-57 A-62
BWR	Components in contact with sodium penta-borate solution in standby liquid control system (BWR)	Cracking due to Stress corrosion cracking	Water Chemistry and One Time Inspection	Yes, detection of aging effects is to be further evaluated (See subsection 3.3.2.2.4.1)	3.3.2.2.4.1	A-59
BWR/ PWR	Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR)	Cracking due to Stress corrosion cracking	Plant specific	Yes, plant specific (See subsection 3.3.2.2.4.2)	3.3.2.2.4.2	A-68 A-71 A-85
BWR/ PWR	Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of all auxiliary system steel components	Loss of material due to General, pitting, crevice, and microbiologicall y influenced corrosion	Plant specific	Yes, plant specific (See subsection 3.3.2.2.5)	3.3.2.2.5	A-08 A-09 A-10 A-105 A-11 A-12 A-13 A-14 A-23 A-24 A-27 A-46 A-77 A-78 A-80 A-81

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	SRP Ref	Item Number in GALL
BWR/ PWR	Components in reactor coolant pump oil collect system of fire protection	Loss of material due to General, pitting and crevice corrosion	One-time inspection	Yes, detection of aging effects is to be further evaluated (See subsection 3.3.2.2.6)	3.3.2.2.6	A-82
		Loss of material due to General, pitting, crevice, and galvanic corrosion	One-time inspection	Yes, detection of aging effects is to be further evaluated (See subsection 3.3.2.2.6)	3.3.2.2.6	A-83
BWR/ PWR	Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system	Loss of material due to General, pitting, crevice, MIC and macrofouling due to Biofouling	Fuel oil chemistry and one-time inspection	Yes, detection of aging effects is to be further evaluated (See subsection 3.3.2.2.7)	3.3.2.2.7	A-30
PWR	Heat exchanger components in PWR chemical and volume control system	Cracking due to stress corrosion cracking and/or Cyclic loading	Water chemistry and a plant-specific verification program	Yes, plant specific. (See subsection 3.3.2.2.9.1)	3.3.2.2.9.1	A-69 A-84
BWR/ PWR	High-strength steel closure bolting exposed to air with steam or water leakage; High-pressure pump casing and closure bolting in PWR chemical and volume control system	Cracking due to stress corrosion cracking and/or Cyclic loading	Plant specific	Yes, plant specific. (See subsection 3.3.2.2.9.2)	3.3.2.2.9.2	A-104 A-76
BWR/ PWR	Neutron absorbing sheets in spent fuel storage racks	Reduction of neutron-absorbing capacity and loss of material due to General corrosion	Plant specific	Yes, plant specific (See subsection 3.3.2.2.10)	3.3.2.2.10	A-88 A-89

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	SRP Ref	Item Number in GALL
BWR/ PWR	Buried Piping, piping components, and piping elements	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	No Yes, detection of aging effects and operating experience are to be further evaluated (See subsection 3.3.2.2.11)	3.3.2.2.11	A-01
BWR	Components in shutdown cooling system (older BWR)	Cracking due to Stress corrosion cracking	BWR stress corrosion cracking and Water Chemistry	No	NA	A-101 A-61
	Piping, piping components, and piping elements in reactor water cleanup system	Cracking due to Stress corrosion cracking, intergranular stress corrosion cracking	Reactor water cleanup system inspection	No	NA	A-41 A-60
BWR/ PWR	Closure bolting	Loss of material due to General, pitting, and crevice corrosion; cracking due to stress corrosion cracking and cyclic loading; loss of preload due to stress relaxation	Bolting Integrity	No	NA	A-03 A-04 AP-26 AP-27 AP-28
	Components in or serviced by closed-cycle cooling water system	Loss of material due to General, pitting, crevice, galvanic, and microbiologicall y influenced corrosion	Closed-cycle cooling water system	No	NA	A-25 A-52 A-63 A-67 AP-12 AP-24

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	SRP Ref	Item Number in GALL
	Components in or serviced by open-cycle cooling water systems	Loss of material due to General, pitting, crevice, and MIC; Reduction of heat transfer due to biofouling	Open-cycle cooling water system	No	NA	A-31 A-32 A-38 A-43 A-44 A-53 A-54 A-64 A-65 A-72 A-74 AP-25
		Macrofouling due to biofouling and loss of material due to Pitting, crevice, microbiologically influenced, and selective leaching	Open-cycle cooling water system and Selective Leaching	No	NA	A-48 A-49 A-51 A-66
	Components in water-based fire protection system	Loss of material due to General, pitting, crevice, and microbiologically influenced corrosion and macrofouling due to Biofouling	Fire water system	No	NA	A-33 A-45 A-47 A-55
	Concrete structural fire barriers - walls, ceilings and floors in fire protection	Concrete cracking and spalling due to Freeze thaw, aggressive chemical attack, and reaction with aggregates; Loss of material due to corrosion of embedded steel	Fire protection and structures monitoring	No	NA	A-90 A-91 A-92 A-93

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	SRP Ref	Item Number in GALL
	Crane structural girders and rail system in load handling system	Loss of material due to General corrosion and due to Wear (rails only)	Overhead heavy load and light load handling systems	No	NA	A-05 A-07
	Fire-rated doors and fire barrier penetration seals	Increased elastomer hardness, shrinkage and loss of strength due to Weathering; Loss of material due to wear of steel	Fire protection	No	NA	A-19 A-20 A-21 A-22
	Gray cast iron components buried in soil	Loss of material due to selective leaching and general corrosion	Selective leaching of materials	No	NA	A-02
	Gray cast iron components in or serviced by closed-cycle cooling water systems	Loss of material due to pitting and crevice corrosion, and selective leaching	Closed-Cycle Cooling Water System and Selective Leaching of Materials	No	NA	A-50
	Internal surfaces of steel piping, piping components, and piping elements and closure bolting in compressed air system	Loss of material due to General, pitting and crevice corrosion	Compressed air monitoring	No	NA	A-103 A-26
	Neutron absorbing sheets in spent fuel storage racks	Reduction of neutron-absorbing capacity due to Boraflex degradation	Boraflex monitoring	No	NA	A-86 A-87

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	SRP Ref	Item Number in GALL
	Piping, piping components, and piping elements	Loss of material due to General, pitting, crevice, and microbiologically influenced corrosion and macrofouling due to Biofouling	Fire water system	No	NA	A-56
	Piping, piping components, and piping elements in diesel fire pump fuel oil system	Loss of material due to General, pitting and crevice corrosion	Fire protection and fuel oil chemistry	No	NA	A-28
	Spent fuel storage racks and piping, piping components, and piping elements in spent fuel pool cooling and cleanup	Cracking due to Stress corrosion cracking	Water Chemistry	No	NA	A-96 A-97
	Steel new fuel storage rack assembly	Loss of material due to General, pitting and crevice corrosion	Structures monitoring	No	NA	A-94
	Tanks in diesel fuel oil system	Loss of material due to General, pitting and crevice corrosion	Aboveground steel tanks	No	NA	A-95
PWR	Bolting and Closure bolting	Loss of material due to Boric acid corrosion	Boric acid corrosion	No	NA	A-102

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	SRP Ref	Item Number in GALL
	External surfaces of steel and and aluminum piping, piping components, and piping elements	Loss of material due to Boric acid corrosion	Boric acid corrosion	No	NA	A-79 AP-1
BWR/ PWR	Piping, piping components, and piping elements	None	None	NA - No AEM or AMP	NA - No AEM or AMP	AP-10 AP-13 AP-14 AP-15 AP-16 AP-17 AP-19 AP-2 AP-20 AP-21 AP-22 AP-3 AP-4 AP-5 AP-6 AP-7 AP-8 AP-9
PWR	Piping, piping components, and piping elements	None	None	NA - No AEM or AMP	NA - No AEM or AMP	AP-11 AP-18
	Stainless steel piping, piping components, and piping elements containing treated borated water	None	None	NA - No AEM or AMP	NA - No AEM or AMP	AP-23

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 in EPRI TR-104213 for pressure retaining bolting and structural bolting.	Existing program
Boraflex monitoring (BWR/PWR)	The program consists of (1) neutron attenuation testing ("blackness testing") to determine gap formation, (2) sampling for the presence of silica in the spent fuel pool along with boron loss, and (3) 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 leakage, (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.	Existing program
BWR vessel internals (BWR)	The program includes (1) inspection and flaw evaluation in conformance with the guidelines of applicable and staff-approved boiling water reactor vessel and internals project (BWRVIP) documents and (2) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-29 (EPRI TR-103515) to ensure the long-term integrity and safe operation of boiling water reactor (BWR) vessel internal components.	Existing program
Closed-cycle cooling water system (BWR/PWR)	The program relies on preventive measures to minimize corrosion by maintaining inhibitors and by performing non-chemistry monitoring consisting of inspection and nondestructive evaluations based on the guidelines of EPRI-TR-107396 for closed-cycle cooling water systems.	Existing program

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

Program	Description of Program	Implementation Schedule*
Compressed air monitoring (BWR/PWR)	The program consists of inspection, monitoring, and testing of the entire system, including (1) frequent leak testing valves, piping, and other system components, especially those made of steel; and (2) preventive monitoring that checks air quality at various locations in the system to ensure that oil, water, rust, dirt, and other contaminants are kept within the specified limits. This program is in response to NRC GL 88-14 and INPO's Significant Operating Experience Report (SOER) 88-01. It also relies on the ASME OM Guide Part 17, and ISA-S7.0.1-1996 as guidance for testing and monitoring air quality and moisture.	Existing program
Fire protection (BWR/PWR)	The program includes a fire barrier inspection program and a diesel-driven fire pump inspection program. The fire barrier inspection program requires periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors, and periodic visual inspection and functional tests of fire rated doors to ensure that their operability is maintained. The diesel-driven fire pump inspection program requires that the pump be periodically tested to ensure that the fuel supply line can perform the intended function. The AMP also includes periodic inspection and test of halon/carbon dioxide fire suppression system.	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 corrosion from biofouling of 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, this program will be modified to included (1) portions of the fire protection sprinkler system that are subjected to full flow tests prior to the period of extended operation and (2) portions of the fire protection system exposed to water are internally visually inspected.	Program should be modified before the period of extended operation
Fuel oil chemistry (BWR/PWR)	The AMP relies on a combination of surveillance and maintenance procedures. Monitoring and controlling fuel oil contamination in accordance with the guidelines of ASTM Standards D1796, D2276, D2709, and D4057, maintains the fuel oil quality. Exposure to fuel oil contaminants such as water and microbiological organisms is minimized by periodic cleaning/draining of tanks and by verifying the quality of new oil before its introduction into the storage tanks.	Existing program

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

Program	Description of Program	Implementation Schedule*
ASME Section XI Inservice inspection (ISI) (BWR/PWR)	The program consists of periodic volumetric, surface, and/or visual examination of components and their supports for assessment, signs of degradation, and corrective actions. This program is in accordance with ASME Section XI, 1995 edition through the 1996 addenda.	Existing program
One-time inspection	To verify the effectiveness of the water chemistry control program by determining if the aging effect is not occurring or the aging effect is progressing slowly so that the that the intended function will be maintained during the period of extended operation, a one-time inspection of internal surfaces of steel piping, valve bodies, pump casings, and tanks is performed using suitable techniques at the most susceptible locations to ensure that corrosion is not occurring. To verify the effectiveness of the fuel oil program by determining if the aging effect is not occurring or the aging effect is progressing slowly so that the intended function will be maintained during the period of extended operation, a one-time thickness measurement of the tank bottom is performed. To verify the effectiveness of the fire protection program by determining if the aging effect is not occurring or the aging effect is progressing slowly so that the intended function will be maintained during the period of extended operation, a one-time visual inspection of the bottom half of the inside of the tank is an acceptable option 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 (1) surveillance and control of biofouling, (2) tests to verify heat transfer, (3) routine inspection and maintenance program, (4) system walk down inspection, and (5) review of maintenance, operating, and training practices and procedures. The program provides assurance that the open-cycle cooling water system is in compliance with General Design Criteria and Quality Assurance to ensure that the open-cycle cooling water (or service water) system can be managed for an extended period of operation. This program is in response to NRC GL 89-13.	Existing program

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

Program	Description of Program	Implementation Schedule*
Aboveground steel tanks (BWR/PWR)	The program includes preventive measures to mitigate corrosion by protecting the external surface of steel components, per standard industry practice, with sealant or caulking at the interface of concrete and component. 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 that the component intended function will be maintained during the extended period of operation.	Existing program
Buried piping and tanks surveillance (BWR/PWR)	The program includes preventive measures to mitigate corrosion by protecting the external surface of buried piping and components, e.g., coating, wrapping, and a cathodic protection system. The program also includes surveillance and monitoring of the coating conductance versus time or current. This program is based on standard industry practices as described in NACE-RP-0285-95 and RP-0169-96.	Existing program
Buried piping and tanks inspection	The program includes (1) preventive measures to mitigate corrosion, and (2) periodic inspection to manage the effects of corrosion on the pressure-retaining capacity of buried steel piping and tanks. Preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings and cathodic protection. As an alternative, buried piping and tanks are inspected visually for any evidence of damage when they are excavated during maintenance and when a pipe is dug up and inspected for any reason with a frequency that is based on operating experience.	Program should be implemented before the period of extended operation
Inspection of overhead heavy load and light load handling system (BWR/PWR)	The program evaluates the effectiveness of the maintenance monitoring program and the effects of past and future usage on the structural reliability of cranes and hoists. The number and magnitude of lifts made by the hoist or crane are also reviewed. Rails and girders are visually inspected on a routine basis for degradation. Functional tests are also performed to assure their integrity. These cranes must also comply with the maintenance rule requirements provided in 10 CFR Part 50.65.	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

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

Program	Description of Program	Implementation Schedule*
Quality assurance	The 10 CFR Part 50, Appendix B program provides for corrective actions, the confirmation process, and administrative controls for aging management programs for license renewal. The scope of this existing program will be expanded to include nonsafety-related structures and components that are subject to an AMR for license renewal.	Program should be implemented before the period of extended operation
Reactor water cleanup system (BWR)	The program includes inservice inspection (ISI) and monitoring and control of reactor coolant water chemistry. Related to the inspection guidelines for RWCU piping welds outboard of the second isolation valve, the program includes measures delineated in NUREG-0313, Rev. 2, and NRC Generic Letter (GL) 88-01 and ISI in conformance with the American Society of Mechanical Engineers (ASME) Section XI.	Existing program
Selective leaching of materials	The program includes a hardness measurement of selected components that may be susceptible to selective leaching to determine whether loss of materials is occurring and whether the process will affect the ability of the components to perform their intended function for the period of extended operation. For systems subjected to environments where water is not treated (i.e., the open-cycle cooling water system and the ultimate heat sinks), the program also follows the guidance in NRC GL 89-13.	Program should be implement before the period of extended operation
Structures 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 that 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

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

Program	Description of Program	Implementation Schedule*
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 impurities (e.g., chloride, fluoride, and sulfate) that accelerate corrosion. The water chemistry program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below the system-specific limits based on EPRI guidelines of BWRVIP-29 (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, the reviewer should verify that the applicant has identified and committed in the license renewal application to any future aging management activities to be completed before the period of extended operation. The staff expects to impose a license condition on any renewed license to ensure that the applicant will complete these activities no later than the committed date.