consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.1.2.3.5 Steam Generators

Summary of Technical Information in the Application

In LRA Section 3.1.2.1.5, the applicant identified the following materials, environments, aging effects, and associated AMPs related to the SG components that are within the scope of the LRA. LRA Table 3.1.2-5 lists the SG components that require an AMR, which are discussed below.

Steam generator components are constructed of the following materials:

- low-alloy steel clad with stainless steel
- low-alloy steel clad with nickel-based alloy
- low-alloy steel
- carbon steel
- stainless steel
- nickel-based alloy

Steam generator components are exposed to the following environments:

- air
- treated, borated water on the primary side of the steam generators
- treated water on the secondary side of the steam generators, which includes steam

Steam generator components may experience the following aging effects:

- cracking
- loss of material
- fouling
- loss of preload/mechanical closure integrity

The above aging effects will be managed by the following AMPs:

- Water Chemistry Control Program
- Inservice Inspection Program
- Boric Acid Corrosion Prevention Program
- Alloy 600 Aging Management Program
- Bolting and Torquing Activities Program
- Steam Generator Integrity Program
- Flow-Accelerated Corrosion Program

In Table 3.1.2-5 of the LRA, the applicant provided a summary of AMRs for the SGs and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.1.2-5 of the LRA, which summarizes the results of AMR evaluations in the SRP-LR for the SG component groups.

Aging Effects

The staff finds that the materials, environments, and aging effects associated with the SG components detailed in LRA Section 3.1.2.1.5 are acceptable because they are consistent with the SRP-LR and the GALL Report. In addition, they are consistent with the operating experience of these components. Various sections of this SER discuss the staff's review of the above AMPs related to the SG components.

The applicant replaced the two original steam generators with Westinghouse Delta 109s steam generators in the fall of 2000. Several corrosion mechanisms have been identified in operating SGs in the industry that can result in unacceptable tube degradation. The ANO-2 replacement SG design addresses these degradation mechanisms and provides a design that is resistant to tube corrosion. Given that appropriate water chemistry is maintained, the SGs are designed for a cumulative operating service of 40 years.

The tube material, tubing fabrication methods, and installation techniques minimize corrosion in the tubes. The replacement SGs contain thermally treated nickel-chromium-iron Alloy 690 tubes that are 11/16 inch in diameter with a 0.040-in. wall thickness. The tubes undergo a laboratory-derived thermal treatment process following tube-forming operations. The thermal treatment subjects the tubes to elevated temperatures for a prescribed period of time to improve the grain structure of the material. Laboratory tests and operating experience in nuclear power plants have shown thermally treated Alloy 690 to be resistant to PWSCC and ODSCC.

Industry corrosion tests subjected the SG tubing material to simulated SG water chemistry. These tests indicated that the loss from general corrosion over the 40-year operating design objective is small compared to the tube wall thickness. Testing to investigate the susceptibility of heat exchanger construction materials to stress corrosion in caustic and chloride aqueous solutions (more aggressive than reactor water conditions) indicate that the Alloy 690 material provides as good or better corrosion resistance as either Alloy 600 or nickel-iron-chromium Alloy 800.

The replacement SG design features minimize the potential for concentration of chemical species in crevices or contact areas between tubes and tubesheet or other internals that can be detrimental to high nickel-alloy tubing material. All tubes are initially tack expanded on the tube end, welded to the tubesheet cladding, then expanded into the tubesheet for the full depth of the tubesheet bore by the hydraulic expansion process. This process has the advantages of expanding the tube into essentially metal-to-metal contact with the tubesheet bore, without excessively cold working the tube wall. In addition, the full-depth expansion joint minimizes crevices between the tube and tubesheet.

The tube support plates are constructed of stainless steel and are a broached trefoil-hole design. The tube support plates are sized to provide sufficient strength to ensure that the tubes maintain structural integrity during a seismic event. The clearance between the tube and tube support, and the spacing between the supports, is sized to minimize the potential for excessive vibration of the tubes. The tube support plates are made of corrosion resistant Type 405 ferritic stainless steel. Use of this material minimizes the potential for corrosion of the tube support plates, thus minimizing tube denting. The tube support design reduces the tube-to-tube support plate crevice area, while providing for maximum steam and water flow in the open areas adjacent to the tube.

The upper bundle supports consists of five sets of staggered stainless steel antivibration bars. Antivibration bars installed in the U-bend portion of the tube bundle minimize the potential for excessive tube vibration. The antivibration bars are fabricated from Type 405 stainless steel.

The SG shell is constructed of low-alloy steel. Manways and handhold openings in the shell provide access to the SG internal structures. Manways on the inlet and outlet side of the channel head permit access to the tubesheet for inspection and tube plugging, if required.

Reactor coolant enters the primary side of the SGs through the 42-in. inside diameter inlet nozzle, flows through tubes, and leaves through two, 30-in. inside diameter outlet nozzles. A divider plate in the channel head separates the inlet and outlet plenums. The channel head is a low-alloy steel forging with low-cobalt stainless steel cladding. The tubesheet is low-alloy steel with the reactor coolant side of the tubesheet clad with nickel-chromium-iron Alloy 690.

Feedwater enters the secondary side of the SGs through the feedwater nozzle where it is distributed via an elevated feedwater distribution ring which directs the flow into the downcomer. The downcomer is the annular passage formed by the inner surface of the SG shell and the cylindrical wrapper that encloses the tubes. The feedwater distribution ring is welded to the feedwater nozzle to minimize the potential for draining the ring. The connection between the nozzle and the feedwater ring is a thermal sleeve that minimizes the effect of cold feedwater addition transients on the feedwater nozzle. The feedwater ring is located above the elevation of the feedwater nozzle to minimize the time required to fill the feedwater nozzle during a cold water addition transient. The feedwater is discharged through inverted J-nozzles installed on the top of the ring. These features reduce the thermal fatigue loading on the feedwater nozzle, eliminate steady-state thermal stratification in the feedwater nozzle and feedwater piping elbow at the feedwater nozzle entrance, and minimize the potential for bubble collapse water hammer generated in the feedwater distribution ring.

<u>Steam Generator Components in LRA Table 3.1.1 Requiring Further Evaluation</u>

LRA Table 3.1.1 summarizes the AMPs for the RCS, including SG components. The staff reviewed SG-related items in LRA Table 3.1.1 to determine their acceptability in the AMR. The following items in LRA Table 3.1.1 need further evaluation or clarification.

For Item 3.1.1-2, the applicant identified the Inservice Inspection Program to manage loss of material from pitting and crevice corrosion in the SG shell assembly. IN 90-04 states that the ASME Code, Section XI, inservice inspection method may not be sufficient to detect general and pitting corrosion in the shell/transition cone welds. The applicant stated that the concerns of IN 90-04 are not applicable to SGs because they were replaced in 2000, and pitting corrosion of the SG shell is not currently known to exist. However, the staff believes that the current operating experience does not provide assurance that pitting will not occur at the shell assembly in the future. In the absence of corrosion tests to demonstrate that the shell and transition cone would not develop pitting corrosion at the end of the extended period of operation, the applicant should assume pitting and general corrosion and implement inspection methods to detect such corrosion. In RAI 3.1.1-1, the staff asked the applicant to clarify whether it will implement any procedures, in addition to the ASME Code, to inspect the shell assembly, including transition cone, in the ANO-2 SGs for pitting and general corrosion.

By letter dated July 1, 2004, the applicant responded that the rules of Section XI of the ASME Code require a volumetric examination of one upper shell-to-transition cone weld during each 10-year inspection interval. However, IN 90-04 states that if general corrosion pitting of the SG shell is known to exist, the requirements of Section XI of the ASME Code may not be sufficient to differentiate isolated cracks from inherent geometric conditions. IN 90-04 indicates that the degradation probably results from corrosion-assisted thermal fatigue caused by relatively cold water impinging upon the weld region during reactor trips from full-power and certain transient operations.

The applicant further stated that localized corrosion is heavily dependent on contaminants for initiation and propagation. The ANO-2 Water Chemistry Control Program limits these contaminants, which precludes localized corrosion. The program relies on monitoring and control of water chemistry based on the guidelines in TR-102134 for secondary water chemistry. In addition, the shell-to-transition cone welds in the replacement SGs have low cyclic stress (thermal fatigue) levels with a cumulative usage factor of 0.15. The applicant installed the replacement SGs in 2000, with a design life extending to 2040, which is beyond the period of extended operation ending in 2038. The applicant believes that the corrosion mechanisms described in IN 90-04 are not applicable to the replacement SGs because of the control of water chemistry. Therefore, the applicant believes that no additional inspections are required for the shell-to-transition cone weld for the period of extended operation.

The staff finds the applicant's response acceptable because the shell-to-transition cone welds in the replacement SGs have an acceptable cumulative usage factor (0.15), as compared to the ASME Code allowable cumulative usage factor of 1.0. This indicates that the cyclic stresses are low, which will minimize cracking, and the Water Chemistry Control Program is based on guidelines in TR-102134, which will minimize localized corrosion at the shell-to-transition cone welds.

For Items 3.1.1-19 and 3.1.1-20, the applicant stated that the SGs do not have carbon steel tube support plates and carbon steel tube support lattice bars, respectively. By letter dated July 1, 2004, in its response to RAI 3.1.1-2, the applicant clarified that the SG tubes are supported by tube support plates maintained in place with a system of stayrods and spacer pipes. The support plates are fabricated from stainless steel; the stayrods and spacer pipes are fabricated from carbon steel. The U-bend portions of the tubes are supported by a system of antivibration bars fabricated from stainless steel. These items are all subject to an AMR and are included in LRA Table 3.1.2-5. The staff finds the applicant's response acceptable because the applicant has clarified the tube support system.

For Item 3.1.1-21, the applicant stated that the feedwater ring discussed in the GALL Report (e.g., Section IV.D1.3-a) is applicable to CE System 80 steam generators and is not applicable to the Westinghouse steam generators at ANO-2. In RAI 3.1.1-3, the staff asked the applicant to justify the exclusion of the Westinghouse feedwater ring from the LRA. By letter dated July 22, 2004, the applicant responded that the internal feedwater distribution rings are within the scope of license renewal, but are not subject to an AMR because they do not support any intended function of the steam generators. There are no design-bases or regulated events at ANO-2 that rely on the SG feedwater ring to demonstrate successful mitigation and recovery from the event. However, the applicant stated that it performs a visual inspection of the feedwater distribution ring and J-nozzles at least once every 5 years as part of the Steam Generator Integrity Program.

Although the applicant has not performed an AMR of the feedwater distribution ring and J-nozzles, the staff finds the applicant's response acceptable because the applicant's periodic inspection will detect aging effects of the feedwater distribution ring and J-nozzles. In addition, the feedwater distribution ring in the replacement SGs is designed to minimize potential thermal fatigue which may cause cracking.

For Item 3.1.1-39, the applicant stated that loss of material from erosion affecting SG secondary manways and handholds is applicable to once-through SGs and is not applicable to the Westinghouse steam generators at ANO-2. However, the ANO-2 steam generators do have manways and handholds which may be degraded from erosion. In RAI 3.1.1-4, the staff asked the applicant to justify why loss of material from erosion is not an applicable aging mechanism for these components in the ANO-2 steam generators.

By letter dated July 1, 2004, the applicant responded that Item 3.1.1-39 of Table 3.1.1 represents GALL Report Item IV.D2.1.10 (i.e., erosion of carbon steel manway covers). Because Section IV.D2 of the GALL Report is specific to once-through SGs and ANO-2 has recirculating SGs, this GALL Report line item is not applicable to ANO-2. The GALL Report does not identify loss of material from erosion as an aging effect requiring management for recirculating steam generators. This is consistent with the results of the operating experience review which did not identify erosion as an applicable aging mechanism for manway and inspection port covers of recirculating steam generators. However, as identified in LRA Table 3.1.2-5, page 3.1-98, loss of material is an AERM for the secondary manway and inspection port covers (6 inch and 8 inch) exposed to internal treated water. Loss of mechanical closure integrity is an AERM for secondary bolted closures, as indicated on page 3.1-104 of LRA Table 3.1.2-5. Localized leakage at bolted closures may cause loss of material by erosion at ferritic seating surfaces, which is managed by bolting and torquing activities and the Inservice Inspection Program.

The staff finds the applicant's response acceptable because LRA Table 3.1.2-5 does include the aging management of the 3-in. and 6-in. inspection ports and the 8-in. handholds. Further, the applicant has appropriate AMPs to manage the aging effect of these components.

<u>Steam Generator Components in LRA Table 3.1.2-5 Requiring Further Evaluation</u>

LRA Table 3.1.2-5 summarizes the AMR of SG components. Each SG component is identified with associated intended function, material, environment, aging effect, and AMP. The staff reviewed LRA Table 3.1.2-5 to determine whether the applicant has demonstrated that the effects of aging of the SG components will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3). The following SG components in

Table 3.1.2-5 need further evaluation or clarification.

In Table 3.1.2-5, the applicant identified the Steam Generator Integrity Program, described in LRA Section B.1.25, to manage cracking in the antivibration bar end caps, peripheral retaining rings, U-bend, and U-shaped retainer bars (see LRA, page 3.1-100), as well as stay rods, stay-rod hex nuts, spacer pipes, peripheral backup bars, wrapper, and wrapper jacking screws (see LRA page 3.1-106). In RAI 3.1.2.5-1, the staff asked the applicant to (1) discuss how it inspects these components and the frequency of inspection under the Steam Generator Integrity Program, and (2) clarify whether the U-bend referred to on LRA page 3.1-100 is applicable to the U-bend region of the tube or to the U-bend tube supports (e.g., peripheral retaining rings and retainer bars).

By letter dated July 1, 2004, the applicant responded that the Steam Generator Integrity Program includes visual inspection of the SG lower internals (tube support structures and tube bundle, including the U-bend). This inspection is completed at least once every 5 years. This inspection verifies loose parts and corrosion and other damage in this region. The SG upper internals (moisture separators) require a thorough visual inspection once every 5 years. This inspection looks for mechanical damage, corrosion, or other unusual conditions. The U-bend referred to in LRA Table 3.1.2-5 on page 3.1-100 has a typographical error because the reference is to the peripheral retaining rings and not to the tubes. The components on that page should include the U-bend peripheral retaining ring and the U-shaped retainer bars. The staff finds that the inspection of the secondary-side components is acceptable because the applicant performs periodic visual inspections of the above components for potential degradation.

The applicant identified LRA Section B.1.28, "System Walkdown Program," to manage loss of material in an air environment for many of the SG components listed in LRA Table 3.1.2-5. In RAI 3.1.2.5-3, the staff asked the applicant to (1) clarify how it documents the SG components in the System Walkdown Program because the staff could not determine whether the SG components are included in LRA Section B.1.28, and (2) discuss how it will inspect those SG components that are not accessible for the inspection during system walkdown.

By letter dated July 1, 2004, the applicant responded that the primary program to manage loss of material in an air environment in Table 3.1.2-5 is the Boric Acid Corrosion Prevention Program. This is consistent with the GALL Report, which does not indicate the need for a program to manage loss of material from general corrosion from external surfaces in an air environment for systems that operate at temperatures above 100 °C (212 °F). Because SG components operate at temperatures above 100 °C (212 °F), general corrosion in air is not an applicable aging mechanism. For these components, loss of material resulting from corrosion in air can be caused only by leakage. During system walkdowns, leakage can be detected from both accessible and inaccessible components. For RCS components, the System Walkdown Program is redundant with the Boric Acid Corrosion Prevention Program since both programs rely on visual inspections to detect evidence of leakage. The staff finds the applicant's response acceptable because the System Walkdown Program is a redundant and secondary program to monitor the loss of material in steam generators in an air environment. The primary program is the Boric Acid Corrosion Prevention Program, which also provides inspection of the outer surface of steam generators.

The applicant identified several aging mechanisms in the secondary side of the steam generators that contribute to tube degradation. In RAI 3.1.2.5-4, the staff asked the applicant to discuss the aging management of the loose parts in the steam generators. By letter dated July 1, 2004, the applicant responded that it performed the first inservice inspection for the replacement steam generators during the spring 2002 refueling outage. This inspection identified one loose part in the secondary side of the steam generators, which was retrieved during that outage. Measures are in place to monitor for loose parts within the steam generators and to prevent the introduction of foreign objects into the steam generators. The applicant removes loose parts whenever possible as part of the foreign object search and retrieval activity. In the unlikely event an object cannot be readily removed, it remains in the steam generator only if an evaluation is performed to determine that the object will not cause unacceptable tube degradation. The applicant performs sludge lancing of the steam generators at least once every 5 years. The applicant completes the secondary-side inspections in accordance with operating procedures for the Steam Generator Integrity Program.

The staff finds the applicant's response acceptable because the applicant has procedures to monitor and inspect the loose parts in the secondary side of the steam generators.

LRA Table 3.1.2-5, page 3.1-96, discusses the aging management of SG tube plugs. In RAI 3.1.2.5-5, the staff asked the applicant to discuss (1) the types and materials of tube plugs that it has installed in the SG tubes, and (2) whether NRC Bulletin 89-01, and associated supplements 1 and 2, IN 89-33, IN 89-65, and IN 94-87 are applicable to the tube plugs installed in the steam generators. By letter dated July 1, 2004, the applicant responded that there are two welded plugs (one at each end of the same tube) in steam generator B. These Alloy-690 plugs were welded in place at the factory before shipment of the steam generator. Steam generator A has no plugs. The NRC generic communications listed above describe failures of certain installed SG tube plugs fabricated of Alloy-600 material from PWSCC. Because the only plugs currently installed in the SG tubes are fabricated of Alloy-690 material (which is highly resistant to PWSCC), the generic communications described in the RAI above are not applicable to ANO-2. The staff agrees with the applicant that the previous NRC generic communications regarding tube plugs do not apply to tube plugs in the steam generators.

On LRA page 3.1-96, the applicant identified the Water Chemistry Control Program as an AMP to manage loss of material and cracking in the SG tubes. In RAI 3.1.2.5-6, the staff questioned the industry guidelines used in the Water Chemistry Control Program. By letter dated July 1, 2004, the applicant responded that it based the Water Chemistry Control Program on the EPRI guidelines in TR-105714, Revision 4, for primary water chemistry, and TR-102134, Revision 5, for secondary water chemistry. The staff is satisfied that the applicant is using the latest version of EPRI water chemistry reports. This demonstrates that the applicant has a procedure to adopt the latest revision of the EPRI guidelines that it will use during the period of extended operation.

Industry experience has shown that denting of tubes from corrosion of tube support plates is an aging effect. The applicant did not identify tube denting as an aging effect. In RAI 3.1.2.5-7, the staff asked the applicant to justify why it excluded denting as an aging effect for the SG tubes. By letter dated July 1, 2004, the applicant responded that the steam generators have stainless steel tube support plates which are inherently resistant to the type of corrosion (magnetite) leading to tube denting. Therefore, the SG tubes are not susceptible to denting. The staff finds that the applicant's response is acceptable because industry experience for the stainless steel tube support plates has not shown extensive tube denting that would cause a concern.

On LRA page 3.1-98, the applicant identified internal treated water as an environment for the 6-in. and 8-in. inspection port covers, but not for the 3-in. inspection port cover. Additionally, the applicant identified the diaphragms in the 3-in. inspection port as a component for aging management; however, it did not identify the diaphragm for the 6-in. or 8-in. inspection ports. In RAI 3.1.2.5-8, the staff asked the applicant to clarify this discrepancy. By letter dated July 1, 2004, the applicant responded that the steam generator 3-in. inspection ports have Alloy 690 diaphragms which prevent the treated water from contacting the underside of the low-alloy steel inspection port covers. The SG design does not include similar diaphragms for the 6-in. and 8-in. inspection ports. The staff finds that the applicant's clarification is acceptable and that it properly manages the inspection port covers.

On LRA page 3.1-99, the applicant identified the Inservice Inspection Program to manage cracking in the antivibration bars and tube support plates. In RAI 3.1.2.5-9, the staff questioned the applicability of the Inservice Inspection Program to manage the aging effects of these components. The staff asked the applicant to discuss the details of how these two components will be inspected under the Steam Generator Integrity Program, including inspection scope, frequency, and method.

By letter dated July 1, 2004, the applicant responded that it had inadvertently identified the Inservice Inspection Program to manage cracking for the antivibration bars and tube support plates. LRA Table 3.1.2-5, page 3.1-99, should identify only the Steam Generator Integrity and Water Chemistry Control Programs as applicable aging management programs for these items.

The Steam Generator Integrity Program requires visual inspection of the SG lower internals, including tube support structures and tube bundle. The applicant completes this inspection at least once every 5 years. This inspection checks for loose parts and corrosion and other damage in this region. The applicant performs an integrity assessment after each SG inspection which addresses all known degradation mechanisms in the steam generator being evaluated. The integrity assessment is performed in two parts, a condition monitoring assessment and an operational assessment. The condition monitoring assessment ensures that structural integrity was maintained during the previous operating cycle, while the operational assessment ensures that structural integrity will continue to be maintained during the upcoming operating interval. Each operational assessment addresses past operating experience, current degradation mechanisms and locations, and other insights from previous condition monitoring assessments. The staff finds that the applicant's clarification is acceptable and that the appropriate AMPs manage the antivibration bars and tube support plates.

On LRA page 3.1-102, the applicant discussed the aging management for the feedwater inlet nozzles. In RAI 3.1.2.5-11, the staff asked the applicant to discuss whether a flexitallic gasket is used in the feedwater system because there have been cases where the pieces of broken flexitallic gasket have fallen into the secondary side of the steam generators and caused tube degradation. By letter dated July 1, 2004, the applicant responded that the SG feedwater inlet nozzle is welded to the SG shell. As such, no flexitallic gasket is used at the feedwater inlet nozzle to the steam generator. The staff finds that potential loose parts resulting from a failure of the flexitallic gasket in the feedwater system is not of a concern at ANO-2.

On LRA pages 3.1-102 and 3.1-103, the applicant identified the Inservice Inspection Program to manage cracking in feedwater inlet nozzles, feedwater thermal sleeves, and flow-limiting insert (integral flow restrictors). In RAI 3.1.2.5-12, the staff asked the applicant to discuss the inspection method and frequency for these components. By letter dated July 1, 2004, the applicant responded that it inspects the feedwater inlet nozzles in accordance with ASME Code, Section XI, Examination Category C-B. However, the applicant inadvertently identified the Inservice Inspection Program as managing the aging effect of cracking for the feedwater thermal sleeves and flow-limiting inserts (integral flow restrictors) on the steam generators. Because these items are internal to the SG feedwater and steam nozzles, they are not accessible for performance of inservice inspection. For the nickel-based alloy feedwater thermal sleeves and flow-limiting inserts, the applicant uses the Water Chemistry Control Program alone to manage cracking and loss of material. The Water Chemistry Control Program maintains the environment in the steam generators by controlling contaminants that could lead to loss of material and cracking. A review of operating experience identified no failures caused by inadequate chemistry control. The feedwater thermal sleeves and flow-limiting inserts are internal to SG feedwater and steam nozzles and, as such, do not have a pressure boundary function. The Water Chemistry Control Program alone is sufficient to manage the aging effect of cracking for the SG feedwater nozzle thermal sleeves and flow-limiting inserts.

The staff finds that the applicant's response is acceptable because the applicant identified the appropriate AMPs for the feedwater inlet nozzle, thermal sleeve, and flow-limiting inserts. The applicant will inspect the feedwater inlet nozzle in accordance with ASME Code, Section XI. The thermal sleeve and flow limiting inserts are inaccessible for inspection; however, the Water Chemistry Control Program will manage the aging effects of these components.

On LRA page 3.1-104, the applicant identified the Steam Generator Integrity Program to manage cracking in key bracket and snubber lugs. In RAI 3.1.2.5-13, the staff questioned the applicability of the Steam Generator Integrity Program to manage cracking in these components. By letter dated July 1, 2004, the applicant responded that it had inadvertently identified the Steam Generator Integrity Program to manage cracking in these two components. These components are located on the outer surface of the SG shell and interface with the SG lateral support system. The Inservice Inspection Program manages cracking of these components for the period of extended operation. The staff finds the applicant's clarification acceptable because the applicant typically uses the Inservice Inspection Program, rather than the Steam Generator Integrity Program, to monitor the key bracket and snubber lugs.

In RAI 3.1.2.5-14, the staff questioned why the applicant did not identify wall thinning or FAC as an aging effect for the steam outlet nozzle, as shown on LRA page 3.1-105, because this aging effect is specified for the steam outlet nozzle in GALL IV D1.1-d. By letter dated July 1, 2004, the applicant responded that the nozzle in GALL Item IV.D1.1-d is carbon steel, whereas the integral flow restrictors in the steam outlet nozzles at ANO-2 are fabricated with nickel-based alloy. LRA page 3.1-103 identifies these flow restrictors, The applicant stated that nickel-based alloy material (Alloy-690) is not susceptible to FAC. Because of the integral flow restrictors, the low-alloy steel of the steam outlet nozzles is not exposed to the high-velocity fluid that causes FAC. The staff finds that the applicant's response is acceptable because the steam outlet restrictor/nozzle is fabricated with Alloy 690 material which is not susceptible to wall thinning or FAC.

On the basis of industry operating experience with this material and use of a water chemistry control program consistent with the GALL Report, the staff finds the applicant's approach to managing the aging effects for the SG components to be acceptable.

Aging Management Programs

For loss of material from the nickel-alloy SG tube plugs, U-tubes, divider plate, and tube plate exposed to treated, borated water, the applicant credited the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3). Section 3.0.3.1 of this SER documents the staff's evaluation of this AMP. The staff concludes that the Primary and Secondary Water Chemistry Control Program credited by the applicant for this line item is adequate.

During its review of Table 3.1.2-5 of the LRA, the staff identified that the SG inspection port diaphragms had been associated with the wrong item from tables in the GALL Report. By letter dated March 24, 2004, the applicant revised the associated note for this component type.

The staff finds that management of cracking in nickel-based alloy exposed to treated water using the Water Chemistry Control Program, as determined by inservice inspection, is acceptable.

Conclusion

On the basis of its audit and review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the steam generator components so that the component intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.1.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the RV, internals, RCS, pressurizer, and SG components and component types that are within the scope of license renewal and subject to an AMR will be adequately managed so that the component intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging of the RV, internals, RCS, pressurizer, and steam generator systems, as required by 10 CFR 54.21(d).

3.2 Engineered Safety Features Systems

This section of the SER documents the staff's review of the applicant's AMR results for the engineered safety features system components and component groups associated with the following systems:

- emergency core cooling system (ECCS)
- containment spray system
- containment cooling system
- containment penetrations system
- hydrogen control system

3.2.1 Summary of Technical Information in the Application

In Section 3.2 of the LRA, the applicant provided the AMR results for the ESF system components and component types listed in LRA Tables 2.3.2-1 through 2.3.2-5. The applicant also listed the materials, environments, aging effects requiring management, and AMPs associated with each system.

In Table 3.2.1, "Summary of the Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801," of the LRA, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the engineered safety features system components and component types. In Section 3.2.2.2 of the LRA, the applicant provided information concerning Table 3.2.1 components for which further evaluation is recommended by the GALL Report.

3.2.2 Staff Evaluation

The staff reviewed LRA Section 3.2 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the ESF system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the component intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff performed an audit and review to confirm the applicant's claim that certain identified AMRs are consistent with the staff-approved AMRs in the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMRs. The ANO-2 ANO-2 Audit and Review Report documents the staff's onsite audit and review findings, which are summarized in Section 3.2.2.1 of this SER.

The staff also audited and reviewed those AMRs that are consistent with the GALL Report and for which further evaluation is recommended. The staff determined that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.2.3.2 of the SRP-LR. Section 3.2.2.2 of this SER summarizes the staff's audit and review findings.

The staff conducted a technical review of the remaining AMRs that were not consistent with the GALL Report. The review included evaluating whether the applicant had identified all plausible aging effects, and that the aging effects listed were appropriate for the combination of materials and environments specified. Section 3.2.2.3 of this SER documents the staff's review findings.

Finally, the staff reviewed the AMP summary descriptions in the FSAR Supplement to ensure that they provide an adequate description of the programs credited with managing or monitoring aging for the ESF systems components and component groups.

Table 3.2-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.2 that are addressed in the GALL Report.

Table 3.2-1 Staff Evaluation for Engineered Safety Features System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping, fittings, and valves in emergency cooling system (Item Number 3.2.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c))	TLAA - Metal Fatigue	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.1)
Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems (Item Number 3.2.1-3)	Loss of material due to general corrosion	Plant specific	Containment Leak Rate (B.1.6), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.2)
Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems (Item Number 3.2.1-5)	Loss of material due to pitting and crevice corrosion	Plant specific	Containment Leak Rate (B.1.6), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.3)
Containment isolation valves and associated piping (Item Number 3.2.1-6)	Loss of material due to microbiologically influenced corrosion (MIC)	Plant specific	Containment Leak Rate (B.1.6), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.4)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
High pressure safety injection (charging) pump miniflow orifice (Item Number 3.2.1-8)	Loss of material due to erosion	Plant specific	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.6)
External surface of carbon steel components (Item Number 3.2.1-10)	Loss of material due to general corrosion	Plant specific	Containment Leak Rate (B.1.6), Boric Acid Corrosion Prevention (B.1.3)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.2)
Piping and fittings of CASS in emergency core cooling system (Item Number 3.2.1-11)	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation (See Section 3.2.2.1)
Components serviced by open-cycle cooling system (Item Number 3.2.1-12)	Loss of material due to general, pitting and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	Service Water Integrity (B.1.24), Water Chemistry Control (B.1.30), Heat Exchanger Monitoring (B.1.12), Periodic Surveillance and Preventive Maintenance (B.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.2.2.1)
Components serviced by closed-cycle cooling system (Item Number 3.2.1-13)	Loss of material due to general, pitting and crevice corrosion	Closed-cycle cooling water system	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation (See Section 3.2.2.1)
Pumps, valves, piping, and fittings, and tanks in containment spray and emergency core cooling systems (Item Number 3.2.1-15)	Crack initiation and growth due to SCC	Water chemistry	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation (See Section 3.2.2.1)
Carbon steel components (Item Number 3.2.1-17)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric Acid Corrosion Prevention (B.1.3)	Consistent with GALL, which recommends no further evaluation (See Section 3.2.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Closure bolting in high pressure or high temperature systems (Item Number 3.2.1-18)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	Bolting/Torquing Activities (B.1.2), Boric Acid (B.1.3), System Walkdown (B.1.28)	Consistent with GALL, which recommends no further evaluation (See Section 3.2.2.1)

The staff's review of the ANO-2 ESF system and associated components followed one of several approaches. One approach, documented in Section 3.2.2.1 of this SER, involves the staff's review of the AMR results for components in the ESF system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.2.2.2 of this SER, involves the staff's review of the AMR results for components in the ESF system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.2.2.3 of this SER, involves the staff's technical review of the AMR results for components in the ESF system that the applicant indicated are not consistent with the GALL Report, or are not addressed in the GALL Report. Section 3.0.3 of this SER documents the staff's review of the AMPs that are credited to manage or monitor aging effects of the ESF system components.

3.2.2.1 AMR Results That Are Consistent with the GALL Report

In Sections 3.2.2.1.1 through 3.2.2.1.5 of the LRA, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the aging effects related to the ESF system components:

- Boric Acid Corrosion Prevention Program
- Periodic Surveillance and Preventive Maintenance Program
- Water Chemistry Control Program
- System Walkdown Program
- Service Water Integrity Program
- Heat Exchanger Monitoring Program
- Bolting and Torquing Activities Program
- Containment Leak Rate Program
- Flow-Accelerated Corrosion Program

In Tables 3.2.2-1 through 3.2.2-5 of the LRA, the applicant provided a summary of the AMRs for the ESF systems and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

In Tables 3.2.2-1 through 3.2.2-5 of the LRA, the applicant provided a summary of the AMRs for the ESF systems and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables align with the information in the GALL Report. The staff audited those AMRs with notes A through E, which indicate that the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report, and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR line item differs from, but is consistent with, the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review, and whether the AMR was valid for the site-specific conditions.

Note D indicates that the component for the AMR line item differs from, but is consistent with, the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined whether the AMR line item of the different component was applicable to the component under review. The staff determined whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report, and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but credits a different AMP. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report, and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA and program bases documents, which are available at the applicant's engineering office. On the basis of its audit and review, the staff finds that the AMR results which the applicant claimed to be consistent with the GALL Report are in fact consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant identified the applicable aging effects which are appropriate for the combination of materials and environments listed.

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the component intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion

The staff has evaluated the applicant's claim of consistency with the GALL Report. The staff reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the applicant has demonstrated that the effects of aging for these components can be adequately managed so that their intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application

In Section 3.2.2.2 of the LRA, the applicant provided further evaluation of aging management, as recommended by the GALL Report, for ESF systems. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general corrosion
- local loss of material due to pitting and crevice corrosion
- local loss of material due to microbiologically influenced corrosion (MIC)
- changes in material properties due to elastomer degradation
- local loss of material due to erosion
- buildup of deposits due to corrosion
- quality assurance for aging management of nonsafety-related components

Staff Evaluation

For those component groups evaluated in the GALL Report, for which the applicant has claimed consistency with GALL, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff audited the applicant's further evaluations against the criteria contained in Section 3.2.2.2 of the SRP-LR. The ANO-2 ANO-2 Audit and Review Report documents the details of the staff's onsite audit and review.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.2.2.2.1 Cumulative Fatigue Damage

As stated in the SRP-LR, 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)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.2.2.2.2 Loss of Material due to General Corrosion

In Section 3.2.2.2.2 of the LRA, the applicant addressed loss of material due to general corrosion that could occur in the containment spray, containment isolation valves and associated piping, and the external surfaces of carbon steel components.

Section 3.2.2.2.2 of the SRP-LR states that loss of material due to general corrosion could occur in the containment spray, containment isolation valves and associated piping, and the external surfaces of carbon steel components. The GALL Report recommends further evaluation on a plant-specific basis to ensure that this aging effect is adequately managed.

The applicant stated that the Containment Leak Rate Program (AMP B.1.6) and the Water Chemistry Control Program (AMP B.1.30.3) are credited with managing the aging effect of loss of material due to general corrosion on external surfaces of carbon steel components in the containment penetrations system. The applicant also stated that there are no carbon steel components in the containment spray system and the ECCS.

Sections 3.0.3.1 and 3.0.3.3.4 of this SER, respectively, document the staff's evaluation of the Primary and Secondary Water Chemistry Control Program and the Containment Leak Rate Program. The staff concludes that the Primary and Secondary Water Chemistry Control Program and the Containment Leak Rate Program credited by the applicant for this line item are adequate.

In Table 3.2.1, Item 3.2.1-10 of the LRA, the applicant also stated that the System Walkdown Program (AMP B.1.28), the Boric Acid Corrosion Prevention Program (AMP B.1.3), and the Containment Leak Rate Program (AMP B.1.6) manage loss of material due to general corrosion on external surfaces of carbon steel components.

The staff reviewed the System Walkdown Program, the Boric Acid Corrosion Prevention Program, and the Containment Leak Rate Program. Sections 3.0,3,3,9, 3.0.3.2.1, and 3.0.3.1 of this SER, respectively, document the staff's evaluation of these programs. The staff concludes that the System Walkdown Program, the Boric Acid Corrosion Prevention Program, and the Containment Leak Rate Program credited by the applicant for this line item are adequate.

On the basis of its review of the Water Chemistry Control Program, the System Walkdown Program, the Boric Acid Corrosion Prevention Program, and the Containment Leak Rate Program, the staff finds that the applicant has appropriately evaluated the AMR results involving management of the loss of material due to general corrosion, as recommended in the GALL Report.

3.2.2.2.3 Local Loss of Material due to Pitting and Crevice Corrosion

In Section 3.2.2.2.3 of the LRA, the applicant addressed local loss of material due to pitting and crevice corrosion that could occur in the containment spray components, containment isolation valves and associated piping, and the buried portion of the refueling water tank external surface.

Section 3.2.2.2.3 of the SRP-LR states that local loss of material due to pitting and crevice corrosion could occur in the containment spray components, containment isolation valves and associated piping, and the buried portion of the refueling water tank external surface. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed.

The applicant stated that the refueling water storage tank is not buried, so it is not subject to this aging mechanism. The applicant credited the Containment Leak Rate Program (AMP B.1.13) and Water Chemistry Control Program (AMP B.1.30.3) with managing the aging effect of loss of material due to pitting and crevice corrosion for the other components. The staff evaluated and accepted the Primary and Secondary Water Chemistry Control Program and the Containment Leak Rate Program. Section 3.0.3.1 and 3.0.3.3.4 of this SER, respectively, document the staff's evaluation of these programs.

Subsection 3.2.2.2.3.2 of the SRP-LR recommends verification of the programs' effectiveness and identifies one-time inspections as an acceptable method. Both programs include periodic (rather than one-time) inspection of components, however, it does not appear that the parameters monitored or locations inspected will allow the applicant to determine the presence or extent of pitting and crevice corrosion.

By letter dated June 24, 2004, the staff asked the applicant, in RAI 3.2-11, to describe how the presence or extent of pitting and crevice corrosion will be detected for ESF systems components subject to this aging effect, and to provide the basis for assurance that periodic inspections will provide an adequate sampling. In further discussions with the applicant, the staff asked the applicant to confirm that planned activities will provide an appropriate sample for each material and environment combination, or to provide for a review to confirm that each material and environment combination subject to this aging effect has been adequately sampled before the period of extended operation.

In its response, the applicant provided details of ESF systems' material and environment groups that credit water chemistry control programs for local loss of material due to pitting and crevice corrosion. The applicant provided information on the following material and environment combinations:

- carbon steel exposed to treated water greater than 132 °C (270 °F)
- carbon steel exposed to treated water
- Inconel exposed to treated, borated water
- stainless steel exposed to treated, borated water greater than 132 °C (270 °F)
- stainless steel exposed to treated, borated water

Based on its review, the staff finds the applicant's response to RAI 3.2-11 acceptable because the applicant demonstrated that the AMR results involving management of the loss of material due to pitting and crevice corrosion have been appropriately evaluated, as recommended in the GALL Report. Therefore, the staff considers in RAI 3.2-11 resolved.

3.2.2.2.4 Local Loss of Material due to Microbiologically Influenced Corrosion

In Section 3.2.2.2.4 of the LRA, the applicant addressed local loss of material due to MIC.

Section 3.2.2.2.4 of the SRP-LR states that local loss of material due to MIC could occur in containment isolation valves and associated piping in systems that are not addressed in other chapters of the GALL Report. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed.

The applicant stated that the Containment Leak Rate Program (AMP B.1.6) and the water chemistry control programs are credited with managing the aging effect of loss of material due to MIC. Both programs include periodic (rather than one-time) inspection of components, however, it does not appear that the parameters monitored will detect the presence or extent of MIC.

By letter dated June 24, 2004, the staff asked the applicant, in RAI 3.2-12, to describe how it will detect the presence or extent of MIC for piping and valve component types in the containment penetrations system (see LRA Table 3.2.2-4).

In its response to RAI 3.2-12, the applicant stated that the majority of the containment penetrations system component types in listed in LRA Table 3.2.2-4 are exposed to a treated water environment, where sulfates are low (less than 150 parts per billion (ppb)). MIC is unlikely to occur in treated water systems with low sulfates. The applicant credits the Water Chemistry Control Program to minimize the potential for MIC by maintaining the system free of contaminants. The Containment Leak Rate Program provides additional assurance that loss of material due to MIC will be managed such that the containment penetrations system components will continue to perform their intended functions.

In its response to RAI 3.2-12, the applicant further identified some stainless steel containment penetrations system component types that are exposed to an untreated, borated water environment such as part of the quench tank, the reactor drain tank vent and drainlines, and the containment sump drainline. The applicant has confirmed the absence of MIC in the containment sump by means of containment sump close-out inspections, which it performs every refueling outage. Because these stainless steel component types in LRA Table 3.2.2-4 drain to the containment sump, the absence of MIC in the containment sump during inspections provides evidence that these stainless steel components in LRA Table 3.2.2-4 do not have MIC. Based on its review, the staff finds the applicant's response to RAI 3.2-12 acceptable because the applicant demonstrated that the AMR results involving management of the loss of material due to MIC have been appropriately evaluated, as recommended in the GALL Report. Therefore, the staff considers RAI 3.2-12 resolved.

3.2.2.2.5 Changes in Material Properties due to Elastomer Degradation

The applicant stated that this issue applies to boiling-water reactors (BWRs) only; therefore, it is not applicable to ANO-2. The staff concurs with the applicant's position.

3.2.2.2.6 Local Loss of Material due to Erosion

In Section 3.2.2.2.6 of the LRA, the applicant addressed local loss of material due to erosion that could occur in the HPSI miniflow orifice.

Section 3.2.2.2.6 of the SRP-LR states that local loss of material due to erosion could occur in the HPSI pump miniflow orifice. This aging mechanism and its effect will apply only to pumps that are normally used as charging pumps in the CVCS. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed.

The applicant stated that the chemical and volume control charging pumps are used for the RCS makeup at ANO-2, not the HPSI pumps. There are no orifices downstream of the chemical and volume control charging pumps.

The staff finds that ANO-2 components are not subject to this aging effect.

On the basis that there are no orifices downstream of the chemical and volume control charging pumps used for RCS makeup, the staff finds that this aging effect is not applicable to ANO-2.

3.2.2.2.7 Buildup of Deposits due to Corrosion

The applicant stated that this issue applies to BWRs only; therefore, it is not applicable to ANO-2. The staff concurs with the applicant's position.

3.2.2.2.8 Quality Assurance for Aging Management of Nonsafety-Related Components

Section 3.0.4 of this SER provides a separate evaluation of the applicant's Quality Assurance Program.

<u>Conclusion</u>

On the basis of its audit and review, the staff finds that the applicant's further evaluations conducted in accordance with the GALL Report are consistent with the acceptance criteria in Section 3.2.2.2 of the SRP-LR. Since the applicant's AMR results are otherwise consistent with the GALL report, the staff finds that the applicant has demonstrated that the effects of aging can be adequately managed so that the intended function(s) can be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3 AMR Results That Are NOT Consistent with the GALL Report

3.2.2.3.1 Emergency Core Cooling System

<u>Summary of Technical Information in the Application</u>

In Section 3.2.2.1.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the ECCS components:

- Boric Acid Corrosion Prevention Program
- Periodic Surveillance and Preventive Maintenance Program
- Water Chemistry Control Program
- System Walkdown Program
- Service Water Integrity Program

In Table 3.2.2-1 of the LRA, the applicant provided a summary of the AMRs for the ECCS components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The NRC staff reviewed the AMR of the ECCS component-material-environment-AERM combinations that are not addressed in the GALL Report. These combinations are identified by notes F through J in LRA Table 3.2.2-1, except for those which have past precedents. The staff also reviewed those combinations in Table 3.2.2-1, with notes A through E, for which issues were identified. The staff determined that the applicant identified all applicable AERMs and credited appropriate AMPs for managing the them. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.2-1 of the LRA lists individual system components within the scope of license renewal and subject to an AMR. The component types that do not rely on the GALL Report for AMR include bearing housing, bolting, heat exchanger (shell), heat exchanger (tubes), nozzle, orifice, piping, pump casing, tank, thermowell, tubing, and valve.

For these component types, the applicant identified the materials, environments, and AERMS, as specified below:

- Cast iron components exposed to a fresh raw water (internal) environment are subject to the aging effects of fouling and loss of material.

- Cast iron components in air (external) environments are subject to loss of material.

- Carbon steel components (bolting) in air (external) environments are subject to loss of material and loss of mechanical closure integrity.

- Stainless steel components in fresh raw water (internal) environments are subject to loss of material.

- Stainless steel components in fresh raw water (external), treated, borated water (internal), and treated, borated water greater than 132 °C (270 °F) (internal) environments are subject to fouling, cracking and loss of material, and for fresh raw water (internal), loss of material wear, as well.

- Inconel components in treated, borated water (internal) are subject to loss of material.

- Carbon steel with stainless steel cladding in air (external) and treated, borated water (internal) environments is subject to loss of material.

- Stainless steel components exposed to air (external) and nitrogen (internal) environments experience no aging effects.

- Inconel components exposed to air (external) environments experience no aging effects.

During its review, the staff determined that it needed additional information to complete its review.

In LRA Table 3.2.1, Item 3.2.2-18, the applicant stated that this AMR item was not considered to match the ANO-2 AMR results. The applicant stated that for closure bolting, the AERM is loss of mechanical closure integrity, which includes a broader range of aging mechanisms than those included in this line item (i.e., loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC). In RAI 3.2-1(1), (2), and (3), the staff requested the applicant to (1) explain the extent to which AMR Item 3.2.1-18 does not match the ANO-2 results, (2) clarify whether the aging effect of loss of mechanical closure integrity includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range," and (3) discuss how it will manage each of the identified aging effects and why the approach for managing these aging effects is adequate.

By letter dated April 6, 2004, the applicant stated that LRA Table 3.2-1, Item 3.2.1-18, addresses closure bolting in high-pressure or high-temperature systems. Within the ESF systems, the HPSI portion of the ECCS is a high-pressure system, but not a high-temperature system. The only bolting in a high-temperature system is the bolting on components in the SG blowdown and sampling penetrations in the containment penetrations system. In addition to loss of material, loss of mechanical closure integrity is considered an AERM. Cracking is not considered an AERM in the ESF systems because, at ANO-2, the potential for SCC of bolting in non-Class 1 systems is minimized by using lower yield strength carbon steel bolting material and limiting contaminants such as chlorides and sulfur in lubricants and sealant compounds. The staff found that the applicant adequately addressed the question of why AMR Item 3.2.1-18 does not match the ANO-2 results by clarifying that the ESF closure bolting, which is in a high-temperature environment, is susceptible to loss of mechanical closure integrity due to loss of preload, instead of crack initiation and growth due to cyclic loading and/or SCC. RAI 3.2.1(1) is, therefore, closed.

The applicant stated that the words "broad range" refer to the fact that loss of mechanical closure integrity is identified as an aging effect requiring management for bolting in two cases. First, bolting in high-temperature systems and in applications subject to significant vibration is subject to loss of mechanical closure integrity due to loss of preload, which is managed by the Bolting and Torquing Activities Program. The same bolted closures may be subject to loss of material, if they are carbon steel or wetted stainless steel. If so, the loss of material is managed by the System Walkdown Program or the Boric Acid Corrosion Prevention Program. Second, in the case of exposure to borated water leakage, loss of material may progress to such an extent that it will affect the mechanical closure integrity. Thus, both the loss of material and the loss of mechanical closure integrity are conservatively considered AERMs. In this case, both the loss of material and the loss of mechanical closure integrity are managed by the Boric Acid Corrosion Prevention and the System Walkdown Programs. Based on its review, the staff found that the applicant adequately delineated the aging effects included under loss of mechanical closure integrity, with a justifiable basis, and identified the associated AMPs to manage these aging effects. RAI 3.2-1(2) and (3), therefore, are closed.

In Tables 3.2.2-1 and 3.2.2-2 of the LRA, for ECCS and containment spray systems, the applicant identified loss of mechanical closure integrity as one of the aging effects (in addition to loss of material) requiring management for carbon steel bolting in air (external) environments. The Boric Acid Corrosion Prevention and the System Walkdown Programs are credited for managing the aging effect. In RAI 3.2-2, the staff requested that the applicant explain why it did not identify the Bolting and Torquing Activities Program as a required AMP. By letter dated April 6, 2004, the applicant stated that both the ECCS and containment spray system are exposed to air indoors with the potential for leaking borated water. Because of the highly corrosive nature of boric acid on carbon steel, borated water leakage could cause significant loss of material from components of bolted closures. In this case, loss of mechanical closure integrity is an aging effect from excessive loss of material resulting from borated water leakage, instead of from loss of preload. As a result, the Boric Acid Corrosion Prevention Program and the System Walkdown Program, instead of the Bolting and Torquing Activities Program, manage loss of material, and hence, loss of mechanical closure integrity. Based on the above information and the fact that the bolted closures in the ECCS and the containment spray system are not exposed to high-temperature environments, the staff determined that the applicant adequately explained why it did not identify the Bolted and Torquing Activities Program as a required AMP. RAI 3.2-2 is, therefore, closed.

In Table 3.2.2-1 of the LRA, the applicant stated that the Water Chemistry Control Program is used to manage cracking and loss of material for stainless steel components in a treated, borated water greater than 132 °C (270 °F) (internal) environment. This AMP is also used to manage loss of material for stainless steel components in a treated, borated water (internal) environment. In RAI 3.2-5, the staff requested that the applicant explain why a supplemental inspection program is not needed to assess the effectiveness of the Water Chemistry Control Program, as recommended by the GALL Report. By letter dated April 6, 2004, the applicant stated that for the ESF systems, the GALL Report does not identify stainless steel components among those certain cases requiring augmentation of the water chemistry program. The applicant further stated the following:

> NUREG-1801 does not include loss of material for stainless steel in any PWR borated water environment, consistent with the minor significance of the aging effect on this material. Operating history has demonstrated that the effect is minor, even in stagnant water conditions. The response to a question from the ANO-1 LRA review documents the results of inspections of the ANO-1 control rod drive mechanisms (CRDMs) which are also exposed to treated borated water. The response (ANO correspondence 1CAN090002, item 3.3.2.8.2.2-2) states, in part: "Loss of material by corrosion and pitting, and SCC of CRDM pressure boundary items have not been observed at ANO-1 in visual inspections of drives during routine and corrective maintenance activities. In addition, inspections at other B&W operating plants have found no indications in the motor tube extensions." Thus, loss of material is not a significant aging effect for stainless steel components in a typical PWR treated borated water (primary) environment. This is not an unexpected result since the materials chosen for primary systems were selected for their ability to withstand the borated water environment. Although the loss of material is minor, the effect is possible. ANO-2 has conservatively identified loss of material as an aging effect requiring management for stainless steel in treated borated water. Since industry experience has shown that primary water chemistry programs are effective in

preventing (managing) loss of material, this program alone is sufficient to manage the effect.

Based on the above, the staff finds the use of the chemistry program alone to be acceptable for managing loss of material in stainless steel components, and the GALL recommendations of augmenting the water chemistry program with a verification inspection are satisfied for the ESF components. RAI 3.2-5 is, therefore, closed.

In Tables 3.2.2-1, 3.2.2-2, 3.2.2-3, and 3.2.2-5 of the LRA, the applicant stated that for stainless steel bolting in air (external) environments, there is no applicable AERM. This presents a different AMR result from the stainless steel bolting in Table 3.2.2-4 of the LRA for the containment penetrations system, where loss of mechanical closure integrity is identified as an aging effect under a similar environment. In RAI 3.2-9, the staff requested that the applicant explain the apparent inconsistency in the above AMR results. By letter dated April 6, 2004, the applicant stated that some of the bolting in the containment penetrations system (blowdown and SG sampling) is exposed to high temperatures that could result in loss of preload and a loss of mechanical closure integrity. The portions of the ECCS, containment spray, containment cooling, and hydrogen control systems that are subject to AMR, on the other hand, are at low temperatures and would not experience a loss of mechanical closure integrity. The staff considered that the applicant has adequately explained why the stainless steel bolting is susceptible to loss of mechanical closure integrity in the containment penetrations system, but not in the other ESF systems. RAI 3.2-9 is, therefore, closed.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the ECCS component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the ECCS.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.2.2-1 identifies the following AMPs for managing the aging effects described above for the ECCS.

- Boric Acid Corrosion Prevention Program (B.1.3)
- Periodic Surveillance and Preventive Maintenance Program (B.1.18)
- Service Water Integrity Program (B.1.24)
- System Walkdown Program (B.1.28)
- Water Chemistry Control Program (B.1.30)

Sections 3.0.3.2.1, 3.0.3.3.7, 3.0.3.2.7, 3.0.3.3.9, and 3.0.3.1 of this SER, respectively, present the staff's detailed review of these AMPs.

During its review, the staff determined that it needed additional information to complete its review.

In LRA Table 3.2-1, Item 3.2.1-18, the applicant stated that the Bolting and Torquing Activities, Boric Acid Corrosion Prevention, and System Walkdown Programs will manage loss of mechanical closure integrity. In RAI 3.2-1(4), the staff requested the applicant to demonstrate that, with the combination of these AMPs, the aging effects associated with closure bolting will be adequately managed, or managed in a manner equivalent to that described in GALL AMP XI.M18, "Bolting Integrity." By letter dated April 6, 2004, the applicant stated that, while the Containment Leak Rate, Boric Corrosion Prevention, and System Walkdown Programs will be used to manage loss of material, the Bolting and Torquing Activities, Boric Acid Corrosion Prevention, and System Walkdown Programs will be used to manage loss of mechanical closure integrity. The applicant stated that visual inspections of bolting for loss of material and loss of mechanical closure integrity, embodied in the Boric Acid Corrosion Prevention and System Walkdown Programs, are adequate to assure that the closure bolting can perform its intended function. Loss of material (and ultimately loss of mechanical closure integrity) for external surfaces, such as a bolted closure, is a long-term aging effect that would be observed well before aging progressed to the point of loss of intended function. In addition, the Containment Leak Rate Program verifies that leak rates of the penetrations are acceptable, which proves that the closure bolting remains capable of performing its intended function. The Bolting and Torquing Activities Program assures that proper torque values are applied to bolted closures such that loss of mechanical closure integrity, as a result of loss of preload from high temperatures, does not occur. The Bolting and Torquing Activities and the System Walkdown Programs are plant-specific programs and are not intended to be comparable to GALL AMP XI.M18, which stipulates the ISI requirements of the ASME Code, Section XI. The ANO-2 Inservice Inspection Program for Class 1, 2, and 3 bolted closures includes these ISI requirements. However, these inspection requirements are focused on identifying the aging effect of cracking. Because cracking is not an AERM for non-Class 1 bolted closures, the applicant stated that it did not include the Inservice Inspection Program as an AMP for ESF systems. Because the bolted closures under these systems include only ASME Code Class 2 and 3 closure bolting, the staff found that the applicant's response adequately addresses the staff's concern regarding the adequacy and sufficiency of the Bolting and Torquing Activities and the System Walkdown Programs for the ANO-2 bolted closures. The applicant's response also clarified, for closure bolting, the difference between these AMPs and the ANO-2 Inservice Inspection Program, which primarily focuses on identifying the aging effect of cracking. Based on the above, RAI 3.2-1(4) is closed.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAI, the staff finds that the applicant identified appropriate AMPs for managing the aging effects of the ECCS component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the ECCS components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by

10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.2.2.3.2 Containment Spray System

Summary of Technical Information in the Application

In Section 3.2.2.1.2 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the AERMs for the containment spray system components:

- Boric Acid Corrosion Prevention Program
- Heat Exchanger Monitoring Program
- Periodic Surveillance and Preventive Maintenance Program
- Service Water Integrity Program
- System Walkdown Program
- Water Chemistry Control Program

In Table 3.2.2-2 of the LRA, the applicant provided a summary of AMRs for the containment spray system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The technical staff reviewed the AMR of the containment spray system component-material-environment-AERM combinations that are not addressed in the GALL Report. These combinations are identified by notes F through J in LRA Table 3.2.2-2, except for those with past precedents. The staff also reviewed those combinations in Table 3.2.2-2 identified by notes A through E for which there were issues identified. The staff determined that the applicant identified all applicable AERMs and has credited appropriate AMPs for managing them. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.2-2 of the LRA lists individual system components within the scope of license renewal and subject to an AMR. The component types that do not rely on the GALL Report for AMR include bolting, filter housing, heat exchanger (shell), heat exchanger (tubes), heat exchanger (tubesheet), heater housing, nozzle, orifice, piping, pump casing, tank, thermowell, tubing, valve, and vortex breaker.

For these component types, the applicant identified the materials, environments, and AERMS, as specified below:

- Carbon steel components (bolting) in air (external) and outdoor air (external) environments are subject to loss of material and loss of mechanical closure integrity.

- Carbon steel components in air (external) and fresh raw water (internal) are subject to loss of material.

- Stainless steel components in fresh raw water (external) and treated, borated water (internal) environments are subject to fouling and loss of material.

- Stainless steel components in fresh raw water (external) are subject to loss of material-wear.

- Stainless steel components in treated, borated water greater than 132 °C (270 °F) (internal) environments are subject to cracking and loss of material.

- Stainless steel components in untreated borated water (internal and external) are subject to loss of material.

- Ferritic stainless steel in fresh raw water (external) and treated borated water greater than 132 °C (270 °F) (internal) environments are subject to fouling and loss of material-wear in fresh raw water (external).

- Carbon steel components with stainless cladding in fresh raw water (external) are subject to cracking, loss of material, and loss of material-wear.

- Cast stainless steel components in treated, borated water (internal) are subject to loss of material.

- Stainless steel components exposed to air (external) and outdoor air (external) environments, as well as cast stainless steel components exposed to air (external) environments, experience no aging effects.

During its review, the staff determined that it needed additional information to complete its review. RAI 3.2-1(1), (2), and (3) requested the applicant to (1) explain the extent to which AMR Item 3.2.1-18 does not match the ANO-2 results, (2) clarify whether the aging effect of loss of mechanical closure integrity includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range," and (3) discuss how it will manage each of the identified aging effects and why the approach for managing the aging effects is adequate. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

RAI 3.2-2 requested that the applicant explain why it did not credit the Bolting and Torquing Activities Program as a required AMP for the aging effect of loss of mechanical closure integrity. The staff also requested the applicant to provide a detailed description of the potential aging effects included under loss of mechanical closure integrity, and to discuss how they will be managed by the stated AMPs. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

In Table 3.2.2-2 of the LRA, the applicant stated it credits the Water Chemistry Control Program to manage cracking and loss of material for stainless steel components in a treated, borated water greater than 132 °C (270 °F) (internal) environments, and to manage loss of material for stainless steel and cast stainless steel components in a treated, borated water (internal) environment. In RAI 3.2-6, the staff requested that the applicant explain why it does not need a supplemental inspection program to assess the effectiveness of the Water Chemistry Control Program. The staff's discussion of this RAI and its resolution by the applicant are similar to those for RAI 3.2-5, which are provided in Section 3.2.2.4.1 of this SER.

RAI 3.2-9 requested that the applicant explain the differences in the AMR results for the stainless steel bolting in air (external) environments, as provided in LRA Table 3.2.2-2 and Table 3.2.2-4. Table 3.2.2-2 does not identify an AERM for stainless steel bolting in air (external) environments, whereas Table 3.2.2-4 identifies, for containment penetrations system, loss of mechanical closure integrity as an aging effect for the same bolting under a similar environment. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the containment spray system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the containment spray system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.2.2-2 identifies the following AMPs for managing the aging effects described above for the containment spray system:

- Boric Acid Corrosion Prevention Program (B.1.3)
- Heat Exchanger Monitoring Program (B.1.12)
- Periodic Surveillance and Preventive Maintenance Program (B.1.18)
- Service Water Integrity Program(B.1.24)
- System Walkdown Program (B.1.28)
- Water Chemistry Control Program (B.1.30)

Sections 3.0.3.2.1, 3.0.3.3.3, 3.0.3.3.7, 3.0.3.2.7, 3.0.3.3.9, and 3.0.3.1 of this SER, respectively, provide the staff's detailed review of these AMPs.

During its review, the staff determined that it needed additional information to complete its review.

RAI 3.2-1(4) requested that the applicant explain why it did not identify the Bolting and Torquing Activities Program as a required AMP for the containment spray system, and demonstrate that the Boric Acid Corrosion Prevention, Bolting and Torquing Activities, and System Walkdown Programs will adequately manage the aging effects associated with closure bolting, or will manage these effects in a manner equivalent to that described in GALL AMP XI.M18. Section

3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAI, the staff finds that the applicant has identified the appropriate AMPs for managing the aging effects of the containment spray system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the containment spray system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.2.2.3.3 Containment Cooling System

Summary of Technical Information in the Application

In Section 3.2.2.1.3 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the AERMs for the containment cooling system components:

- System Walkdown Program
- Periodic Surveillance and Preventive Maintenance Program
- Service Water Integrity Program

In Table 3.2.2-3 of the LRA, the applicant provided a summary of AMRs for the containment cooling system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The NRC staff reviewed the AMR of the containment cooling system component-material-environment-AERM combinations that are not addressed in the GALL Report. These combinations are identified by notes F through J in LRA Table 3.2.2-3, except for those with past precedents. The staff also reviewed those combinations in Table 3.2.2-3, identified by notes A through E, for which there were issues identified. The staff determined that the applicant identified all applicable AERMs and credited appropriate AMPs for managing them. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.2-3 of the LRA lists individual system components within the scope of license renewal and subject to an AMR. The component types that do not rely on the GALL Report for AMR include blower housing, bolting, cooling coil assembly, cooling coil housing, damper housing, ductwork, piping and valve.

For these component types, the applicant identified the materials, environments, and AERMS, as specified below:

- Carbon steel components in air (external and internal), condensation (external and internal), and fresh raw water (internal) environments are subject to loss of material.
- Stainless steel components in condensation (external and internal) and fresh raw water (internal) environments are subject to loss of material.
- Copper alloy components in condensation (external) and fresh raw water (internal) environments are subject to fouling and loss of material, and for condensation (external) environments, loss of material-wear, as well.
- Stainless steel components in air (external and internal) environments experience no aging effects.

During its review, the staff determined that it needed additional information to complete its review.

RAI 3.2-1(1), (2), and (3) requested the applicant to (1) explain the extent to which AMR Item 3.2.1-18 does not match the ANO-2 results, (2) clarify whether the aging effect of loss of mechanical closure integrity includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range," and (3) discuss how it will manage each of the identified aging effects and why the approach for managing the aging effects is adequate. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

In Table 3.2.2-3 of the LRA, the applicant stated that loss of material is identified as the AERM for carbon steel bolting in air (external) and condensation (external) environments, and stainless steel bolting in condensation (external) environments. In RAI 3.2-3, the staff requested that the applicant explain why it did not identify loss of mechanical closure integrity as an AERM for the bolting, and how it would be managed if identified. By letter dated April 6, 2004, the applicant stated that it did identify loss of mechanical closure integrity as an AERM for bolting in two cases. First, bolting in high-temperature systems and in applications subject to significant vibration is also subject to loss of mechanical closure integrity caused by loss of preload, which is managed by the Bolting and Torquing Activities Program. The same bolted closures may be subject to loss of material if they are carbon steel or wetted stainless steel, and are managed by the System Walkdown or the Boric Acid Corrosion Prevention Programs. Second, in case of exposure to borated water leakage, loss of material may progress to such an extent that it will affect the mechanical closure integrity. In this case, the applicant conservatively considers both the loss of material and the loss of mechanical closure integrity as AERMs, which are managed by the Boric Acid Corrosion Prevention and the System

Walkdown Programs.

Based on the above, the applicant did not identify the loss of mechanical closure integrity as an AERM for bolting in the containment cooling system because the containment cooling system is not a high-temperature system, it is not subject to significant vibration, and it does not contain borated water. The staff found that the applicant adequately delineated the aging effects covered under loss of mechanical closure integrity, and explained why it did not identify them as AERMs for the bolting in the containment cooling system. RAI 3.2-3 is, therefore, closed.

RAI 3.2-9 requested that the applicant explain the differences in the AMR results for the stainless steel bolting in air (external) environments, as provided in LRA Table 3.2.2-3 and Table 3.2.2-4. Table 3.2.2-3 does not identify an AERM for stainless steel bolting in air (external) environments, whereas Table 3.2.2-4 identifies, for containment penetrations system, loss of mechanical closure integrity as an aging effect for the same bolting under a similar environment. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the containment cooling system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the containment cooling system.

<u>Aging Management Programs</u>

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also confirmed that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.2.2-3 identifies the following AMPs for managing the aging effects described above for the containment cooling system:

- Periodic Surveillance and Preventive Maintenance Program (B.1.18)
- Service Water Integrity Program (B.1.24)
- System Walkdown Program (B.1.28)

Sections 3.0.3.3.7, 3.0.3.2.7, and 3.0.3.3.9 of this SER, respectively, present the staff's detailed review of these AMPs.

On the basis of its review of the information provided in the LRA, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the containment cooling system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the containment cooling system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.2.2.3.4 Containment Penetration System

Summary of Technical Information in the Application

In Section 3.2.2.1.4 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the AERMs for the containment penetrations system components:

- Boric Acid Corrosion Prevention Program
- Bolting and Torquing Activities Program
- Containment Leak Rate Program
- Flow-Accelerated Corrosion Program
- Periodic Surveillance and Preventive Maintenance Program
- Water Chemistry Control Program

In Table 3.2.2-4 of the LRA, the applicant provided a summary of AMRs for the containment penetrations system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The NRC staff reviewed the AMR of the containment penetrations system component-material-environment-AERM combinations that are not addressed in the GALL Report. These combinations are identified by notes F through J in LRA Table 3.2.2-4, except for those with past precedents. The staff also reviewed those combinations in Table 3.2.2-4, identified by notes A through E, for which issues were identified. The staff determined that the applicant identified all applicable AERMs and credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

Table 2.3.2-4 of the LRA lists individual system components within the scope of license renewal and subject to an AMR. The component types that do not rely on the GALL Report for AMR include bolting, flex hose, piping, tubing, and valve.

For these component types, the applicant identifies the materials, environments, and AERMS, as specified below:

- Carbon steel bolting in air (external), condensation (external), and untreated borated water (external) environments is subject to loss of material, and for air (external) environments, loss of mechanical closure integrity, as well.

- Carbon steel components are subject to loss of material when exposed to air (external and internal), condensation (external), treated water (internal), and treated water greater than 132 °C> (270 °F) (internal) environments.

- Stainless steel bolting in air (external) environment is subject to loss of mechanical closure integrity.

- Stainless steel components in untreated, borated water (internal) and treated water greater than 132 °C (270 °F) (internal) environments are subject to cracking and loss of material.

- Elastomer components in air (external) and nitrogen (internal) environments are subject to cracking and change in material properties.

- Carbon steel components in nitrogen environments experience no aging effects.

- Stainless steel components in air (external and internal), concrete, and nitrogen environments experience no aging effects.

- Copper alloy components in air (external) and nitrogen (internal) environments experience no aging effects.

During its review, the staff determined that it needed additional information.

RAI 3.2-1(1), (2), and (3) requested the applicant to (1) explain the extent to which AMR Item 3.2.1-18 does not match the ANO-2 results, (2) clarify whether the aging effect of loss of mechanical closure integrity includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range," and (3) discuss how it will manage each of the identified aging effects and why the approach for managing the aging effects is adequate. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

In Table 3.2.2-4 of the LRA, the applicant stated that it identified loss of mechanical closure integrity as the AERM for carbon steel and stainless steel bolting, all in air (external) environments. The applicant credits the Bolting and Torquing Activities Program as an AMP. In view of the discussion provided in AMR Item 3.2.1-18, the staff requested, in RAI 3.2-4, that the applicant explain why it did not also credit the System Walkdown Program as an AMP. By letter dated April 6, 2004, the applicant stated that loss of mechanical closure integrity is an AERM for bolting that can experience a loss of preload caused by exposure to high temperatures, significant vibration, or significant loss of material from borated water leakage. For the containment penetrations system, the Bolting and Torquing Activities Program manages loss of mechanical closure integrity because the bolting in question is exposed to high temperatures. This program manages aging through the application of proper torque values to the bolting. The applicant uses the Containment Leak Rate Program, on the other hand, to manage the aging effect of loss of material for carbon steel bolting without reliance upon system walkdowns. The staff found the applicant's response to be adequate in providing the basis of how it will manage the aging effects of loss of material and/or loss of mechanical closure integrity. RAI 3.2-4 is, therefore, closed.

In Table 3.2.2-4 of the LRA, the applicant stated that it credits the Water Chemistry Control Program to manage cracking and loss of material for the stainless steel valve in a treated, borated water greater than 132 °C (270 °F) (internal) environments. In RAI 3.2-7, the staff requested that the applicant explain why it does not need a supplemental inspection program to assess the effectiveness of the Water Chemistry Control Program. The staff's discussion of this RAI and its resolution by the applicant is similar to that for RAI 3.2-5, which is provided in Section 3.2.2.4.1 of this SER.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the containment penetrations system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the containment penetrations system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also confirmed that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.2.2-4 identifies the following AMPs for managing the aging effects described above for the containment penetrations system.

- Bolting and Torquing Activities Program (B.1.2)
- Boric Acid Corrosion Prevention Program (B.1.3)
- Containment Leak Rate Program (B.1.6)
- Flow-Accelerated Corrosion Program (B.1.11)
- Periodic Surveillance and Preventive Maintenance Program (B.1.18)
- Water Chemistry Control Program (B.1.30)

Sections 3.0.3.3.2, 3.0.3.2.1, 3.0.3.1,3.0.3.1, 3.0.3.3.7, and 3.0.3.1 of this SER, respectively, provide the staff's detailed review of these AMPs.

During its review, the staff determined that it needed additional information to complete its review.

RAI 3.2-1(4) requested the applicant to demonstrate that the Boric Acid Corrosion Prevention, Bolting and Torquing Activities, and System Walkdown Programs will adequately manage the aging effects associated with closure bolting, or will manage them in a manner equivalent to that described in GALL AMP XI.M18. Section 3.2.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAI, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the containment penetrations system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the containment penetration system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.2.2.3.5 Hydrogen Control System

Summary of Technical Information in the Application

In Section 3.2.2.1.5 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the AERMs for the hydrogen control system components:

- System Walkdown Program
- Service Water Integrity Program

In Table 3.2.2-5 of the LRA, the applicant provided a summary of AMRs for the hydrogen control system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The NRC staff reviewed the AMR of the hydrogen control system component-material-environment-AERM combinations that are not addressed in the GALL Report. These combinations are identified by notes F through J in LRA Table 3.2.2-5, except for those with past precedents. The staff also reviewed those combinations in Table 3.2.2-5, identified by notes A through E, for which issues were identified. The staff confirmed that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.2-5 of the LRA lists individual system components within the scope of license renewal and subject to an AMR. The component types that do not rely on the GALL Report for AMR include bolting, filter housing, heat exchanger (shell and tubes), orifice, piping, pump casing, tubing, and valve.

For these component types, the applicant identified the materials, environments, and AERMs, as specified below:

- Carbon steel components in air (external) environments are subject to loss of material.
- Stainless steel components in condensation (external) and fresh raw water (internal) are subject to loss of material.
- Stainless steel components in fresh raw water (external) are subject to fouling, loss of material, and loss of material-wear.
- Stainless steel components in air (external and internal) and condensation (internal) environments experience no aging effects.

During its review, the staff determined that it needed additional information.

RAI 3.2-1(1), (2), and (3) requested the applicant to (1) explain the extent to which AMR Item 3.2.1-18 does not match the ANO-2 results (2) clarify whether the aging effect of loss of mechanical closure integrity includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range," and (3) discuss how it will manage each of the identified aging effects and why the approach for managing the aging effects is adequate. Section 3.2.2.4.1 presents the staff's discussion of this RAI and its resolution by the applicant.

In Table 3.2.2-5 of the LRA, the applicant stated that it identified loss of material as an AERM for the carbon steel bolting in air (external) environments. In RAI 3.2-8, the staff requested that the applicant explain why it did not specify loss of mechanical closure integrity and its associated AMPs for the bolting. By letter dated April 6, 2004, the applicant stated that the hydrogen control system internal environment is air, and not borated water, as in the other systems. As a result, there is very little potential for any carbon steel bolting in the system to be exposed to borated water leakage that would result in loss of mechanical closure integrity. In addition, the system is not subject to elevated temperatures or significant vibration. The staff considered the applicant's response to be adequate in explaining why it did not identify loss of mechanical closure integrity as an AERM for the bolting in this system. RAI 3.2-8 is, therefore, closed.

RAI 3.2-9 requested that the applicant explain the differences in the AMR results for the stainless steel bolting in air (external) environments, as provided in LRA Tables 3.2.2-5 and 3.2.2-4. Table 3.2.2-5 does not identify an AERM for stainless steel bolting in air (external) environments, whereas Table 3.2.2-4 identifies, for containment penetrations system, loss of mechanical closure integrity as an aging effect for the same bolting under a similar environment. Section 3.2.2.4.1 of this SER presents the staff's discussion of this RAI and its resolution by the applicant.

In Table 3.2.2-5 of the LRA, the applicant stated it did not identify any aging effects for the stainless steel heat exchanger (tubes) in a condensation (internal) environment. Because industry experience indicates that stainless steel may be susceptible to the aging effect of loss of material when exposed to condensation with alternating wetting and drying, the staff requested, in RAI 3.2-10, that the applicant explain why it did not identify an aging effect for the component. By letter dated April 6, 2004, the applicant stated that for ANO-2, it identified loss of material as an aging effect for stainless steel, with condensation as an environment, when there is a potential for concentrating chemical species through repeated alternating wet and dry conditions. Conservatively, the applicant identified condensation as an internal environment in the hydrogen control system sample coolers, even though the coolers are only operated intermittently for short periods of time. The hydrogen control system normally has no flow through it, and, as a result, would not contain significant amounts of aggressive chemicals. Thus, there is minimal possibility of concentrating chemicals, and loss of material is not an aging effect requiring management. The staff considered the applicant's response to be adequate in explaining why it did not identify any aging effects for the stainless steel components in the specific condensation (internal) environment. RAI 3.2-10 is, therefore, closed.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the hydrogen control system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the hydrogen control system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also confirmed that the UFSAR Supplement contains an adequate description of the program.

LRA Table 3.2.2-5 identifies the following AMPs for managing the aging effects described above for the hydrogen control system.

- Service Water Integrity Program (B.1.24)
- System Walkdown Program (B.1.28)

Sections 3.0.3.2.7 and 3.0.3.3.9 of this SER, respectively, present the staff's detailed review of these AMPs.

On the basis of its review of the information provided in the LRA, the staff finds that the applicant has identified the appropriate AMPs for managing the aging effects of the hydrogen control system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the hydrogen control system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.2.3 Conclusion

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the aging effects associated with the engineered safety feature systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging of the engineered safety feature systems, as required by 10 CFR 54.21(d).

3.3 Auxiliary Systems

This section of the SER documents the staff's review of the applicant's AMR results for the auxiliary system components and component groups associated with the following systems:

- spent fuel pool system
- water suppression fire protection system
- emergency diesel generator system
- alternate ac diesel generator system
- chemical and volume control system
- Halon fire protection and reactor coolant pump motor oil leakage collection system
- fuel oil system
- service water system
- auxiliary building ventilation system
- control room ventilation system
- miscellaneous systems in scope of 10 CFR 54.4(a)(2)

3.3.1 Summary of Technical Information in the Application

In Section 3.3 of the LRA, the applicant provided the results of the AMR of the auxiliary systems components and component types listed in Tables 2.3.3-1 through 2.3.3-11 of the LRA. The applicant also listed the materials, environments, aging effects requiring management, and aging management programs associated with each system.

In Table 3.3.1, "Summary of the Aging Management Programs for the Auxiliary Systems Evaluated in Chapter VII of NUREG-1801," of the LRA, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the auxiliary systems components and component types. In Section 3.3.2.2 of the LRA, the applicant provided information concerning Table 3.3.1 components for which the GALL Report recommends further evaluation.

3.3.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the reactor system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff performed an audit to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. Section 3.0.3 of this SER documents the staff's evaluations of the AMPs. The audit report issued on August 19, 2004, and summarized in Section 3.3.2.1 of this SER, documents the staff's audit findings.

The staff also performed an audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. During the audit, the staff determined that the applicant's additional evaluations were consistent with the acceptance criteria in Section 3.3.2.2 of the SRP-LR. The staff's audit findings are documented in the audit report and summarized in Section 3.3.2.2 of this SER.

The staff conducted a technical review of the remaining AMRs that were not consistent with the GALL Report. The review included evaluating whether the applicant had identified all plausible aging effects and whether the aging effects listed were appropriate for the combination of materials and environments specified. Section 3.3.2.3 of this SER documents the staff's review findings.

Finally, the staff reviewed the AMP summary descriptions in the UFSAR Supplement to ensure that they adequately describe the programs credited with managing or monitoring aging for the reactor system components.

Table 3.3-1 below summarizes the staff's evaluation of the components, aging effects/mechanisms, and AMPs listed in LRA Section 3.3 that are addressed in the GALL Report.

Table 3.3-1 Staff Evaluation for Auxiliary System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components in spent fuel pool cooling and cleanup (Item Number 3.3.1-1)	Loss of material due to general, pitting, and crevice corrosion	Water chemistry and one-time inspection	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.1)
Linings in spent fuel pool cooling and cleanup system; seals and collars in ventilation systems (Item Number 3.3.1-2)	Hardening, cracking and loss of strength due to elastomer degradation; loss of material due to wear	Plant specific	Periodic Surveillance and Preventive Maintenance (B.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.2)
Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR) (Item Number 3.3.1-3)	Cumulative fatigue damage	TLAA, evaluated in accordances with 10 CFR 54.21(c)		Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.3)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR) (Item Number 3.3.1-4)	Crack initiation and growth due to SCC or cracking	Plant specific	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.4)
Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of carbon steel components (Item Number 3.3.1-5)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Plant specific	Fire Protection (B.1.10), System Walkdown (B.1.28), Wall Thinning Monitoring (B.1.29), and Periodic Surveillance and Preventive Maintenance (B.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.5)
Components in reactor coolant pump oil collect system of fire protection (Item Number 3.3.1-6)	Loss of material due to galvanic, general, pitting, and crevice corrosion	One-time inspection	Periodic Surveillance and Preventive Maintenance (B.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.6)
Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system (Item Number 3.3.1-7)	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Fuel oil chemistry and one-time inspection	Diesel Fuel Monitoring (B.1.7), Periodic Surveillance and Preventive Maintenance (B.1.18), and Service Water Integrity (B.1.24)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.7)
Heat exchangers in chemical and volume control system (Item Number 3.3.1-9)	Crack initiation and growth due to SCC and cyclic loading	Water chemistry and a plant-specific verification program	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.9)
Neutron absorbing sheets in spent fuel storage racks (Item Number 3.3.1-10)	Reduction of neutron absorbing capacity and loss of material due to general corrosion (Boral, boron steel)	Plant specific	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.10)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
New fuel rack assembly (Item Number 3.3.1-11)	Loss of material due to general, pitting, and crevice corrosion	Structures monitoring	Structures Monitoring - Structures (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Neutron absorbing sheets in spent fuel storage racks (Item Number 3.3.1-12)	Reduction of neutron absorbing capacity due to Boraflex degradation	Boraflex monitoring	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Spent fuel storage racks and valves in spent fuel pool cooling and cleanup (Item Number 3.3.1-13)	Crack initiation and growth due to stress corrosion cracking	Water chemistry	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Closure bolting and external surfaces of carbon steel and low-alloy steel components (Item Number 3.3.1-14)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boron Acid Corrosion Prevention (B.1.3)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Components in or serviced by closed-cycle cooling water system (Item Number 3.3.1-15)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Closed-cycle cooling water system	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Cranes including bridge and trolleys and rail system in load handling system (Item Number 3.3.1-16)	Loss of material due to general corrosion and wear	Overhead heavy load and light load handling system	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Components in or serviced by open-cycles cooling water systems (Item Number 3.3.1-17)	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Buried piping and fittings (Item Number 3.3.1-18)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	Buried Piping Inspection (B.1.4)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1) Consistent with GALL, which recommends further evaluation (3.3.2.2.11)
Components in compressed air system (Item Number 3.3.1-19)	Loss of material due to general and pitting corrosion	Compressed air monitoring		Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Components (doors and barrier penetration seals) and concrete structures in fire protection (Item Number 3.3.1-20)	Loss of material due to wear; hardening and shrinkage due to weathering	Fire protection	Fire Protection (B.1.10)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Components in water-based fire protection (Item Number 3.3.1-21)	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling	Fire water system	Fire Protection (B.1.10)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Components in diesel fire system (Item Number 3.3.1-22)	Loss of material due to galvanic, general, pitting, and crevice corrosion	Fire protection and fuel oil chemistry	Diesel Fuel Monitoring (B.1.7) and Fire Protection (B.1.10)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Tanks in diesel fuel oil system (Item Number 3.3.1-23)	Loss of material due to general, pitting, and crevice corrosion	Aboveground carbon steel tanks	System Walkdown (B.1.28)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Closure bolting (Item Number 3.3.1-24)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and SCC	Bolting integrity	Bolting and Torquing Activities (B.1.2)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components (aluminum bronze, crass, cast iron, cast steel) in open-cycle and closed-cycle cooling water systems, and ultimate heat sink (Item Number 3.3.1-29)	Loss of material due to selective leaching	Selective leaching of materials	Service Water Integrity (B.1.24), Periodic and Preventive Surveillance (B.1.18), Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)
Fire barriers, walls, ceilings, and floors in fire protection (Item Number 3.3.1-30)	Concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates; loss of material due to corrosion embedded steel	Fire protection and structures monitoring	Fire Protection (B.1.10)	Consistent with GALL, which recommends no further evaluation (See Section 3.3.2.1)

The staff's review of the ANO-2 auxiliary system and associated components followed one of several approaches. One approach, documented in Section 3.3.2.1 of this SER, involves the staff's audit and review of the AMR results for components in the auxiliary system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.3.2.2 of this SER, involves the staff's audit and review of the AMR results for components in the auxiliary system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.2.2.3 of this SER, involves the staff's technical review of the AMR results for components in the auxiliary system that the applicant indicated are not consistent with the GALL Report, or are not addressed in the GALL Report. Section 3.0.3 of this SER documents the staff's review of the AMPs that are credited to manage or monitor aging effects of the auxiliary system components.

3.3.2.1 AMR Results That Are Consistent with the GALL Report

Summary of Technical Information in the Application

In Sections 3.3.2.1.1 through 3.3.2.1.11 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the auxiliary system components:

- Boric Acid Corrosion Prevention Program
- System Walkdown Program
- Water Chemistry Control Program
- Bolting and Torquing Activities Program
- Buried Piping Inspection Program
- Fire Protection Program
- Oil Analysis Program

- Wall Thinning Monitoring Program
- Heat Exchanger Monitoring Program
- Periodic Surveillance and Preventive Maintenance Program
- Diesel Fuel Monitoring Program
- Service Water Integrity Program
- Flow-Accelerated Corrosion Program

Staff Evaluation

In Tables 3.3.2-1 through 3.3.2-11 of the LRA, the applicant summarized the AMRs for the auxiliary systems and identified which AMRs it considered to be consistent with the GALL Report.

The staff conducted an audit of the information provided in the LRA and program bases documents, which are available at the applicant's engineering office. On the basis of its audit, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant identified the applicable aging effects and they are appropriate for the combination of materials and environments listed.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the GALL Report evaluation bounded the plant-specific components contained in these GALL Report component groups.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicate the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined that it had reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item is different but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the AMR line item of the different component applies to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item is different but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined that the AMR line item of the different component applies to the component under review. The staff determined that it had reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review to confirm the applicant's claim that certain identified AMRs are consistent with the staff-approved AMRs in the GALL Report. The staff reviewed the information provided in the LRA and program bases documents, which were available at the applicant's engineering office. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMRs. The staff evaluation is discussed below.

3.3.2.1.1 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

The staff reviewed Table 3.3.1, Item Number 3.3.1-15, and associated AMRs consistent with the GALL Report.

The applicant stated that it uses the plant-specific periodic surveillance and preventive maintenance (PSPM) program (AMP B.1.18) to manage loss of material for heat exchanger (bonnet and shell) components exposed to treated water of the emergency diesel generator system. The staff's evaluation of the PSPM program is documented in Section 3.0.3.3.7 of this SER. The staff found that the use of the PSPM program in lieu of the auxiliary systems water chemistry control program (AMP B.1.30.1) is not adequate for the carbon steel components of the emergency diesel generator and alternate AC diesel generator systems that are exposed internally to treated water. The PSPM program's emergency diesel generator maintenance inspections detect aging effects but do not sample or control water chemistry to manage aging effects. The auxiliary systems water chemistry control program, evaluated in Section 3.0.3.3.11 of this SER, controls and monitors water chemistry in addition to performing sampling and analyses on the emergency diesel generator cooling water system.

By letter dated March 24, 2004, the applicant stated that the auxiliary systems water chemistry control program applies to the emergency diesel generator heat exchanger bonnet and shell in treated water (page 3.3-51 of the LRA) rather than the PSPM program. Subsequently, by letter dated May 19, 2004, the applicant committed, in response to Question B.1.30.1-6, to update the UFSAR supplement LRA Section A.2.1.31 to reflect industry guidance used for auxiliary systems water chemistry control program (AMP B.1.30.1). This is now consistent with the GALL Report, and on that basis the staff finds it acceptable.

3.3.2.1.2 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion and Biofouling; Buildup of Deposit Due to Biofouling

The staff reviewed Table 3.3.1, Item Number 3.3.1-17, the AMP descriptions in the LRA, and the associated AMRs consistent with the GALL Report.

The applicant stated that it uses the plant-specific, periodic surveillance and preventive maintenance program (AMP B.1.18) to manage this aging effect. The staff's evaluation of the PSPM program is documented in Section 3.0.3.3.7 of this SER. The staff found that the use of the PSPM program in lieu of the service water integrity program (AMP B.1.24) is not acceptable for managing the loss of material aging effect for emergency diesel generator heat exchanger bonnets in a fresh, raw water environment.

By letter dated March 24, 2004, the applicant stated that the PSPM program manages loss of material for the emergency diesel generator heat exchanger bonnet in fresh raw water (page 3.3-51 of the LRA) in Table 3.3.2-3 through periodic internal inspections during emergency diesel generator overhauls. The applicant further stated that, in addition to the periodic surveillance and preventive maintenance program, the service water integrity program is conservatively included as an AMP since it provides additional aging management of this component. The evaluation of this program is discussed in Section 3.0.3.2.7 of this SER. On the basis of the review of the service water integrity program and the applicant's response, the staff finds this acceptable.

On the basis of its audit and review, the staff determined that for all other AMRs not requiring further evaluation, as identified in the Table 3.3.1 (Table 1), the applicant's references to the GALL Report are acceptable and no further staff review is required.

<u>Conclusion</u>

The staff has evaluated the applicant's claim of consistency with GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components can be adequately managed so that their intended function(s) can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the effects of aging can be adequately managed so that the intended function(s) can be maintained consistent with the CLB for the period of extended operation, as required by

10 CFR 54.21(a)(3).

3.3.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application

In Section 3.3.2.2 of the LRA, the applicant provided further evaluation of aging management as recommended by the GALL Report for auxiliary systems. The applicant provided information concerning how it will manage the following aging effects:

- loss of material due to general, pitting, and crevice corrosion
- hardening and cracking or loss of strength due to elastomer degradation or loss of material due to wear
- cumulative fatigue damage
- crack initiation and growth due to cracking or stress-corrosion cracking
- loss of material due to general, microbiologically influenced, pitting, and crevice corrosion
- loss of material due to general, galvanic, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion and biofouling
- quality assurance for aging management of nonsafety-related components
- crack initiation and growth due to stress-corrosion cracking and cyclic loading
- reduction of neutron-absorbing capacity and loss of material due to general corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion

Staff Evaluation

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues in need of further evaluation. In addition, the staff audited the applicant's additional evaluations against the criteria contained in Section 3.3.2.2 of the Standard Review Plan for License Renewal. The audit report issued August 19, 2004, documents the details of the staff's audit.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

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

In Section 3.3.2.2.1 of the LRA, the applicant addressed loss of material in components of the spent fuel pool system.

Section 3.3.2.2.1 of the SRP-LR states that loss of material due to general, pitting, and crevice corrosion could occur in the channel head and access cover, tubes, and tubesheets of the heat exchanger in the spent fuel pool cooling and cleanup. The Water Chemistry Program relies on monitoring and control of reactor water chemistry based on the EPRI guidelines of TR-105714 for primary water chemistry and TR-102134 for secondary water chemistry to manage the effects of loss of material due to 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. Therefore, the applicant should assess the effectiveness of the Chemistry Control Program to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion to assess the effectiveness of the Water Chemistry Program. A one-time inspection of selected components at susceptible locations is an acceptable method for ensuring that corrosion is not occurring and that the components' intended function will be maintained during the period of extended operation. No loss of material aging effects are observed for stainless steel components exposed to air.

Further, Section 3.3.2.2.1 of the SRP-LR states that loss of material due to pitting and crevice corrosion could occur in the filter housing, valve bodies, and nozzles of the ion exchanger in the spent fuel pool cooling and cleanup system. The Water Chemistry Program relies on monitoring and control of reactor water chemistry based on the EPRI guidelines of TR-105714 for primary water chemistry and TR-102134 for secondary water chemistry to manage the effects of loss of material due to pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting or crevice corrosion. Therefore, the applicant should evaluate the effectiveness of the Chemistry Control Program to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to pitting and crevice corrosion to evaluate the effectiveness of the Water Chemistry 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.

The applicant stated that the portion of the spent fuel pool system that supplies emergency makeup is subject to an AMR, and the applicant credited the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3) with managing loss of material. The staff reviewed the Primary and Secondary Water Chemistry Control Program and documented its evaluation in Section 3.0.3.1 of this SER. The Water Chemistry Control Program, in conjunction with anticipated future maintenance activities, provides for the inspection of systems when they are opened for maintenance, which addresses the verification program recommendation in the GALL Report. The Water Chemistry Control Program is credited with managing loss of material for stainless steel components in this portion of the spent fuel pool system that are exposed to borated treated water. This is consistent with the GALL Report and acceptable to the staff.

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

In Section 3.3.2.2.2 of the LRA, the applicant addressed the potential for degradation of elastomers in collars and seals in spent fuel cooling systems and ventilation systems.

Section 3.3.2.2.2 of the SRP-LR states that hardening and cracking due to elastomer degradation could occur in elastomer linings of the filter, valve, and ion exchangers in spent fuel pool cooling and cleanup systems. Hardening and loss of strength due to elastomer degradation could occur in the collars and seals of the duct 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 duct in the diesel generator building ventilation system. Loss of material due to wear could occur in the collars and seals of the duct in the ventilation systems. The GALL Report recommends further evaluation to ensure adequate management of these aging effects.

The applicant stated that the portion of the spent fuel pool system that is subject to an AMR contains no elastomers. The applicant stated that for the ventilation systems, it uses the plant-specific Periodic Surveillance and Preventive Maintenance Program (AMP B.1.18) to manage degradation of elastomers. The staff reviewed this program and concludes that it is acceptable. Section 3.0.3.3.7 of this SER documents this evaluation.

The applicant further stated that for other systems, the PSPM Program, supplemented by the Fire Protection Program (AMP B1.10), manages elastomer degradation. The staff reviewed the Fire Protection Program, as documented in Section 3.0.3.2.5 of this SER.

The staff finds that the PSPM Program is an acceptable program for managing cracking and change in material properties for elastomer expansion joints and flex hose in the alternate ac diesel generator system and the fuel oil system exposed to outdoor air and air expansion joints associated with control room and auxiliary building heating, ventilation, and air conditioning (HVAC) systems. However, Section 3.3.2.2.2 of the LRA states, "Elastomers are used in other [other than spent fuel pool and ventilation systems] systems. For these systems, management of elastomer degradation is provided by the PSPM program supplemented by the fire protection program." Based on this statement, the staff finds that the PSPM Program should be supplemented by the Fire Protection Program for elastomers in the alternate ac diesel generator and water suppression fire protection systems.

By letter dated March 24, 2004, the applicant stated that for these systems, the PSPM Program, supplemented by the Fire Protection Program, manages elastomer degradation. The words "supplemented by" mean that for fire protection elastomers, the Fire Protection Program is used instead of the PSPM Program. The staff finds assignment of these AMRs to the Fire Protection Program to be acceptable.

3.3.2.2.3 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA as defined in 10 CFR 54.3. The TLAAs must be evaluated in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.3.2.2.4 Crack Initiation and Growth due to Cracking or Stress-Corrosion Cracking

In Section 3.3.2.2.4 of the LRA, the applicant addressed the potential for cracking in the high-pressure pumps of the CVCS.

Section 3.3.2.2.4 of the SRP-LR addresses crack initiation and growth due to cracking in the high-pressure pump in the CVCS. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

In the ESF section of the GALL Report, Volume 2, Item V.D.1.1-a, the management of stainless steel components performing a pressure boundary function is addressed by using the Water Chemistry Program. The applicant stated that it uses the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3) to manage cracking and SCC of these stainless steel components. Section 3.0.3.1 of this SER documents the staff's review of the Primary and Secondary Water Chemistry Control Program. The program is consistent with the GALL Report and therefore acceptable to the staff.

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

In Section 3.3.2.2.5 of the LRA, the applicant addressed the loss of material due to corrosion that could occur on internal and external surfaces of components exposed to air and the associated range of atmospheric conditions.

Section 3.3.2.2.5 of the SRP-LR states that loss of material due to general, pitting, and crevice corrosion could occur in the piping and filter housing and supports in the control room area, in the auxiliary and radwaste area, in the primary containment heating and ventilation systems, in the piping of the diesel generator building ventilation system, in the aboveground piping and fittings, valves, and pumps in the diesel fuel oil system, and in the diesel engine starting air, combustion air intake, and combustion air exhaust subsystems in the emergency diesel generator system. Loss of material due to general, pitting, crevice, and MIC could occur in the duct fittings, access doors, and closure bolts, equipment frames and housing of the duct. Loss of material due to pitting and crevice corrosion could occur in the heating/cooling coils of the air handler heating/cooling, and loss of material due to general corrosion could occur on the external surfaces of all carbon steel SCs, including bolting exposed to operating temperatures less than 212 °F in the ventilation systems. The GALL Report recommends further evaluation to ensure adequate management of these aging effects.

The applicant credited the System Walkdown Program (AMP B.1.28) for managing loss of material of carbon steel components in the spent fuel pool, emergency diesel generator, alternate ac diesel generator, fuel oil, water suppression fire protection, service water, and the control room and auxiliary building HVAC systems for external and internal surfaces exposed to air and outdoor air. The staff reviewed the System Walkdown Program and concludes that it is acceptable. Section 3.0.3.3.9 of this SER documents its evaluation.

The applicant stated that it uses the plant-specific PSPM Program (AMP B.1.18) to manage loss of material for the external surfaces of emergency diesel generator and alternate Ac diesel generator system carbon steel components with internal exposure to exhaust gas, treated and untreated air, outdoor air, and the control room and auxiliary building HVAC systems. The

PSPM Program is also used for managing loss of material of carbon steel components in an external environment of air in the Halon fire protection and reactor coolant pump motor oil leakage collection system. The staff reviewed the PSPM Program and concludes that it is acceptable. Section 3.0.3.3.7 of this SER documents the staff's evaluation.

The applicant credited the Wall Thinning Monitoring Program (AMP B.1.29) for managing loss of material from the internal surfaces of the emergency diesel generator and alternate AC diesel generator system carbon steel piping, silencer, and tank with internal exposure to exhaust gas and untreated air. The staff reviewed the Wall Thinning Monitoring Program and concludes that it is acceptable. Section 3.0.3.3.10 of this SER documents this evaluation.

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

In Section 3.3.2.2.6 of the LRA, the applicant addressed further evaluation of programs to manage loss of material in the reactor coolant pump oil collection system to evaluate the effectiveness of the Fire Protection Program.

Section 3.3.2.2.6 of the SRP-LR states that loss of material due to general, galvanic, pitting, and crevice corrosion could occur in tanks, piping, valve bodies, and tubing in the RCP 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 due to corrosion. However, corrosion may occur at locations where water from washdowns may accumulate. Therefore, the applicant should assess the effectiveness of the program 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 determine that the effectiveness of the program. A one-time inspection of the bottom half of the interior surface of the tank of the RCP 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.

The applicant stated that it uses the plant-specific Periodic Surveillance and Preventive Maintenance Program (AMP B.1.18) to manage loss of material in lieu of the one-time inspection. Carbon steel components in this system are included in the visual inspection for loss of material and will be monitored for degradation. The staff reviewed the PSPM Program and finds that the program will adequately manage the effects of aging so that the intended functions will be maintained. Section 3.0.3.3.7 of this SER documents its evaluation.

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

In Section 3.3.2.2.7 of the LRA, the applicant addressed further evaluation of programs to manage loss of material in the diesel fuel oil system to determine the effectiveness of the diesel fuel monitoring program.

Section 3.3.2.2.7 of the SRP-LR states that loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling could occur in the internal surface of tanks in the diesel fuel oil system and due to general, pitting, and crevice corrosion and MIC in the tanks of the diesel fuel oil system in the EDG system. The existing AMP 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 determine 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.

The applicant stated that it uses the diesel fuel monitoring program (AMP B.1.7) to manage loss of material for the diesel fuel oil system. This program also provides for the periodic inspection of the fuel oil tanks, which addresses the one-time inspection recommendation in the GALL Report.

The staff reviewed the diesel fuel monitoring program and finds that the program will adequately manage the effects of aging so that the intended functions will be maintained. Its evaluation is documented in Section 3.0.3.1 of this SER.

3.3.2.2.8 Quality Assurance for Aging Management of Nonsafety-Related Components

Section 3.0.4 of this SER provides a separate evaluation of the applicant's Quality Assurance Program.

3.3.2.2.9 Crack Initiation and Growth due to Stress-Corrosion Cracking and Cyclic Loading

In Section 3.3.2.2.9 of the LRA, the applicant addressed further evaluation of programs to manage cracking in the CVCS to determine the effectiveness of the Water Chemistry Control Program.

Section 3.3.2.2.9 of the SRP-LR states that crack initiation and growth due to SCC and cyclic loading could occur in the channel head and access cover, tubesheet, tubes, shell and access cover, and closure bolting of the regenerative heat exchanger and in the channel head and access cover, tubesheet, and tubes of the letdown heat exchanger in the CVCS. The Water Chemistry Program relies on monitoring and control of water chemistry based on the guidelines of TR-105714 for primary water chemistry to manage the effects of crack initiation and growth due to SCC and cyclic loading. The applicant should determine the effectiveness of the Chemistry Control Program to ensure that crack initiation and growth are not occurring. The GALL Report recommends further evaluation to manage crack initiation and growth due to SCC and cyclic loading for these systems to determine the effectiveness of the Water Chemistry Program. A one-time inspection of selected components and susceptible locations is an acceptable method to ensure that crack initiation and growth are not occurring and that the component's intended function will be maintained during the period of extended operation.

The GALL Report recommends that the Water Chemistry Program be augmented by determining the absence of cracking due to SCC and cyclic loading, or loss of material due to pitting and crevice corrosion. The GALL Report states that an acceptable verification program should include temperature and radioactivity monitoring of the shell-side water and eddy-current testing of tubes.

The applicant credited the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3) with minimizing cracking in the heat exchangers and providing for the inspection of systems when they are opened for maintenance. This inspection of opened systems is used to address the verification program recommendation in the GALL Report. The staff reviewed the Primary and Secondary Water Chemistry Control Program and concludes that it is acceptable. Section 3.0.3.1 of this SER documents its evaluation.

Because the GALL Report recommends the Water Chemistry Control Program for managing SCC and cyclic loading, supplemented by a plant-specific program, the staff finds the use of the Primary and Secondary Water Chemistry Control Program acceptable. The inspection of these heat exchangers whenever they are opened for maintenance is an acceptable substitute for the one-time inspection of susceptible locations.

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

In Section 3.3.2.2.10 of the LRA, the applicant addressed reduction of neutron-absorbing capacity and loss of material due to general corrosion, which could occur in the neutron-absorbing sheets of the spent fuel storage rack in the spent fuel storage.

Section 3.3.2.2.10 of the SRP-LR states that 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.

The applicant stated that it does not credit the sheets of neutron-absorbing materials affixed to the spent fuel racks with neutron absorption and stated that ANO-2 components are not subject to this aging effect. Because the sheets of the neutron-absorption materials affixed to the spent fuel racks are not credited with neutron absorption, the staff finds that this aging effect is not applicable to ANO-2.

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

In Section 3.3.2.2.11 of the LRA, the applicant addressed the potential for loss of material in buried piping of the service water and diesel fuel oil systems.

Section 3.3.2.2.11 of the SRP-LR states that loss of material due to general, pitting, and crevice corrosion and MIC could occur in the underground piping and fittings in the open-cycle cooling water system (SW 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 due to general, pitting, and crevice corrosion and MIC. The effectiveness of the Buried Piping and Tanks Inspection Program should be reviewed to evaluate an applicant's inspection frequency and operating experience with buried components, thus ensuring that loss of material is not occurring.

The applicant credited the Buried Piping Inspection Program (AMP B.1.4) with managing loss of material for buried components of the service water and diesel fuel oil systems. This is consistent with GALL AMP XI.M34, "Buried Piping Inspection." The staff reviewed the applicant's operating history and found that the frequency of pipe excavation was sufficient to manage the effects of loss of material. The staff reviewed the Buried Piping Inspection Program and concludes that it is acceptable. Section 3.0.3.2.2 of this SER documents its evaluation.

Conclusion

On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determined that the applicant has adequately addressed the issues that it further evaluated. In addition, the staff reviewed the applicant's additional evaluations against the criteria contained in Section 3.3.2.2 of the SRP-LR. The staff finds that the applicant has demonstrated that it can adequately manage the effects of aging so that the intended functions can be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3 AMR Results That Are Not Consistent with the GALL Report

Summary of Technical Information in the Application

In Tables 3.3.2-1 through 3.3.2-11 of the LRA, the applicant gave additional details of the results of the AMRs for material, environment, aging effects requiring management, and AMP combinations that are not consistent with the GALL Report.

In Tables 3.3.2-1 through 3.3.2-11, the applicant indicated, via Notes F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report and provided information concerning how it will manage the aging effects requiring management.

Note F indicates that the material is not in the GALL Report for the identified component.

Note G indicates that the environment is not in the GALL Report for the identified component and material.

Note H indicates that the aging effect is not in the GALL Report for the component, material, and environment combination.

Note I indicates that the aging effect in the GALL Report for the identified component, material, and environment combination is not applicable.

Note J indicates that neither the identified component nor the material and environment combination is evaluated in the GALL Report.

For component type, material, and environment combination that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation.

Staff Evaluation

3.3.2.3.0 General RAIs on AMR Issues

By letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in the following general RAIs. By letters 2CAN060402 and 2CAN060404 dated June 21, 2004, the applicant responded to these RAIs. These RAIs, the applicant's responses and the staff's evaluation of the responses are described below.

Cracking Fatigue (RAI 3.3-1)

LRA Tables 3.3.2-5 and 3.3.2-11 identify cracking-fatigue as an aging effect requiring aging management, but LRA Section 4.3.2 states that, "Engineering evaluations identified no non-class 1 pressure vessels, heat exchangers, storage tanks or pumps requiring evaluation for thermal fatigue." The applicant credits the periodic surveillance and preventive maintenance program for managing this aging effect in the CVCS pump casing and the system walkdown aging management program for various components in miscellaneous systems in scope for 10CFR54.4(a)(2). The applicant was requested to clarify the type of fatigue managed by these inspections, the basis for these inspections in lieu of a TLAA and explain how the inspections are effective in detecting internal cracks prior to loss of the intended function, including operating experience.

By letter dated June 21, 2004, the applicant responded by providing the following information:

Type of Fatigue (Part 1)

The applicant stated that, for the CVCS pump casing (charging pumps), as identified in LRA Table 3.3.2-5, cracking due to high-cycle fatigue (as a result of deflection of the plunger cap during a pump cycle) is the aging effect identified. For the components in miscellaneous systems in scope for 10CFR54.4(a)(2), as identified in LRA Table 3.3.2-11, the aging effect managed is cracking due to thermal fatigue.

Basis for Inspections in Lieu of a TLAA (Part 2)

In reference to Table 3.3.2-5, the applicant stated that cracking of the charging pump plunger cap (pump casing) was discovered during plant operation and documented in the Corrective Action Program. Neither an analysis involving time-limited assumptions defined by the current operating term nor a requirement for such an analysis was found for this condition during the identification of TLAAs for license renewal. Components in LRA Table 3.3.2-11 are generally nonsafety-related components designed in accordance with American Society of Mechanical Engineers B.31.1 with an implicit analysis limit of 7000 thermal cycles. Cracking due to thermal fatigue was conservatively identified as an aging effect requiring management although it is not expected to occur. If cracking due to thermal fatigue were to occur, the System Walkdown Program would manage this aging effect as described in part 3 of this response.

Effectiveness of Inspections (Part 3)

The applicant stated that, for the charging pump plunger cap, a preventive maintenance task exists to disassemble and inspect the charging pumps and plungers. Operating experience has shown this inspection to be effective in identifying the effects of aging prior to loss of system function. For components in LRA Table 3.3.2-11, system walkdowns detect leakage and spray from liquid-filled systems. Industry operating experience has shown that age-related failures of nonsafety-related structures, systems, and components, (SSCs) containing steam or liquid that could prevent safety-related components from accomplishing their safety function have only occurred as a result of loss of material due to flow-accelerated corrosion (FAC), which is managed by the FAC Program. Leakage from causes other than FAC has been limited in extent such that it has been identified and corrected through normal operational activities or system walkdowns prior to loss of system functions. For further information on how the System Walkdown Program is effective in managing this aging effect see response to RAI 3.3.2.4.11-1.

Staff Evaluation of the Applicant's Response

The staff reviewed the applicant's response to RAI 3.3-1 and determined that the applicant's response does not completely resolve the staff's concerns. However, in general, the staff found the applicant's response adequate and acceptable because the applicant has identified the type of fatigue, the basis for inspections rather than a TLAA and information to support the effectiveness of the inspections.

The staff found that the high-cycle fatigue identified by the applicant as applicable to the charging pumps due to deflection of the plunger cap during a pump cycle to be appropriate for a reciprocating type pump. The staff also found that thermal fatigue identified by the applicant for miscellaneous systems in scope of 10CFR54.4(a)(2) to be appropriate on the basis that thermal fatigue is addressed in the ASME codes for systems that experience thermal cycles.

In regard to the basis for inspections rather than a TLAA for these components, the staff found the applicant response adequate and acceptable in that a requirement does not exist in the ASME codes of record for the charging pump casing or ASME B31.1 piping. Therefore, periodic inspections are considered to be appropriate in lieu of a TLAA to manage fatigue-cracking in these components.

The staff found that the information submitted to support the effectiveness of the charging pump inspections to be adequate and acceptable. The staff considers the identified maintenance tasks to disassemble and inspect the charging pumps and plungers to be appropriate for managing fatigue-cracking. However, the operating experience submitted by the applicant response to support the effectiveness of the Walkdown Program to manage fatigue-cracking in miscellaneous systems in scope for 10CFR54.4(a)(2) by visual inspections for leakage is not sufficient and requires additional basis for acceptability. This concern is addressed under RAI 3.3.2.4.11-1

The staff was also concerned that the Periodic Surveillance and Preventive Maintenance Program (PSPM) and AMR Table 3.3.2-5 do not address fatigue cracking in the charging pump bolting and the PSPM does not address fatigue-cracking in the casing. The staff identified this as potential open item and requested the applicant to clarify how the PSPM or other aging management program manages fatigue cracking in the charging pump casing and bolting.

By letter dated September 10, 2004, the applicant identified that, although cracking due to fatigue of the charging pump block was not identified as a likely failure mechanism, the pump block will be periodically inspected for indications of cracking. The applicant clarified that during maintenance inspections, plunger caps and blocks are visually inspected for indications of cracking and indications of cracking results in additional non-destructive examination (such as dye penetrant tests) and replacement of the affected component if cracking is confirmed. In this letter the applicant also explained that cracking of bolting due to high cycle fatigue is not a concern for license renewal since it would be discovered during the current license period in most cases where systems are frequently operated. The applicant response also stated that there have been no instances of pump casing bolting requiring replacement due to cracking or other defects. The applicant further identified that during regular pump maintenance (each pump has historically been repacked two to three times a year), bolting is inspected for defects. The applicant clarified that evidence of cracking would be detected during these inspections.

The applicant's response is adequate and acceptable to resolve the staff's concern because the applicant has clarified that maintenance inspections of the charging pump will detect fatigue-cracking in the pump block and, although most cases of high cycle fatigue would be detected during the current license period, evidence of fatigue-cracking in bolting would be detected by bolting inspections during regular pump maintenance. All issues related to RAI 3.3-1 are resolved.

<u>Chemistry Control Programs and Verification Inspections (RAI 3.3-2)</u>

The LRA aging management evaluation credits the water chemistry control program for managing aging effects for various components in the auxiliary systems, but it is not clear which specific subprogram is used to manage each component. The applicant was requested to clarify which subprogram manages each auxiliary system component. The applicant was also requested to identify any additional inspection programs such as one-time inspections, to determine the effectiveness of the chemistry control program. The applicant was further requested to provide a description of the elements of the inspection program as defined in Appendix A.1 of the SRP-LR including details such as inspection methods, how susceptible locations are determined, basis for inspection population and sample size, timing, acceptance criteria including codes and standards, and operating experience. LRA Table B-1 identifies that one-time inspections are not applicable. If periodic inspections are planned rather than one-time inspections, the applicant was requested to identify the frequency. If opportunistic inspections are planned rather than one-time inspections, the applicant was requested to explain how the program assures that the inspections will be completed prior to end of the existing operating license. The applicant was also requested to identify any specific operating experience (i.e.; inspection results) relevant to inspections to determine effective chemistry control in auxiliary systems that demonstrate the effectiveness of the inspection program.

By letter dated June 21, 2004, the applicant responded by providing the following information:
<u>Water Chemistry Control Programs to Manage Aging Effects for Various Components in the Auxiliary Systems (Part a)</u>

Components in Table 3.3.2-1, Spent Fuel Pool System, and Table 3.3.2-5, Chemical and Volume Control System, that list water chemistry control as the program are included in the Primary and Secondary Water Chemistry Control Program.

Components in Table 3.3.2-3, Emergency Diesel Generator (EDG) System, and Table 3.3.2-4, Alternate AC (AAC) Diesel Generator System, that list water chemistry control as the program are included in the Auxiliary Systems Cooling Water Chemistry Control Program.

Components in Table 3.3.2-11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2), that list water chemistry control as the program are included in the program that applies to the system in which the component resides. Since all of the water chemistry control subprograms provide assurance that the aging effect loss of material will be managed such that the applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation, the particular subprogram for a specific component is beyond the level of detail necessary in the table.

Effectiveness of the Water Chemistry Programs (Part b)

The applicant stated that the effectiveness of the water chemistry programs at ANO-2 has been confirmed through routine component inspections that are performed by chemistry, maintenance and engineering personnel. This includes the Primary and Secondary, Closed Cooling, and Auxiliary Systems Water Chemistry Programs. These inspections were performed when primary and secondary systems were opened for maintenance, when an adverse chemistry trend existed, or when requested by the chemistry or engineering departments. The areas inspected have included areas that are susceptible to the aging effects identified in the license renewal application. In addition, for many reactor coolant system components included in the Primary and Secondary Water Chemistry Control Program, inspection activities within other aging management programs provide additional confirmation of chemistry program effectiveness. These other programs include the Inservice Inspection, Alloy 600 Aging Management, Cast Austenitic Stainless Steel Evaluation, Pressurizer Examinations, Reactor Vessel Internals Inspection, and Steam Generator Integrity Programs. Some components, such as heat exchangers, have been inspected periodically providing repetitive evidence that the water chemistry programs are adequately managing aging effects. If, during these inspections significant abnormal conditions were noted, including those that were the result of aging effects such as loss of material and cracking, these conditions would have been documented under the Corrective Action Program. Actions to determine the cause of the condition and corrective actions to prevent recurrence would have then been taken. The Generic Aging Lessons Learned (GALL) One Time Inspection Program XI.M32 focuses on the most susceptible material and environment combinations in the most susceptible locations. Items such as heat exchangers, piping and valves normally in standby, and system low points or stagnant areas are representative of these susceptible locations. At ANO-2, inspections have been performed in systems such as emergency feedwater (EFW) and EDGs which are normally in standby, steam generators, condensate storage tanks, feedwater heaters, moisture separator reheaters, chillers, main steam safety valves, and blowdown heat exchangers. All of these components are made of susceptible materials (stainless and carbon steel) and are exposed to environments (treated water and steam) that would be conducive to aging effects managed by the water chemistry programs.

Many components in the steam generators are inspected under other aging management programs that provide additional assurance that significant degradation is not occurring and that the Primary and Secondary Water Chemistry Control Program is effective. These inspection activities include those contained in the Inservice Inspection and Steam Generator Integrity Programs. The inspection results of steam generator components are also applicable to the main steam, main feedwater and EFW components with the same material and environment combinations.

As additional confirmation of the effectiveness of water chemistry programs, the ANO-2 review of operating experience included a review of condition reports (CRs), CR trending data, and interviews with site personnel regarding water chemistry program operating experience. The operating experience review did not identify component failures or significant adverse conditions that were the result of an ineffective water chemistry program. Also, the CR trending data did not identify recurrent component degradation occurring in the systems covered under this aging management program. The review of CRs, CR trending data, and personnel interviews provided additional confirmation of chemistry program effectiveness.

The combination of inspections under the Inservice Inspection Program, the Steam Generator Integrity Program, and maintenance and routine chemistry inspections as a whole, constitute a more thorough confirmation of water chemistry aging management program effectiveness than could be obtained from one-time inspections of a sample of items.

Staff Evaluation of the Applicant's Response

The staff reviewed the applicant's response to RAI 3.3-2 and determined that the response does not entirely resolve the issues concerning chemistry programs applied to components in miscellaneous systems in part a) of the response and chemistry verification inspections addressed in part b) of the response. The staff identified a potential open item and requested the applicant to clarify whether auxiliary system inspections are limited to opportunistic inspections and explain how the ANO-2 chemistry program verification inspections provide an appropriate sample size required by the GALL one-time inspection program. The applicant was also requested to clarify how the chemistry verification inspections will be completed prior to the period of extended operation. Alternatively, the LRA may identify the application of planned maintenance inspections for auxiliary systems such as the periodic surveillance and preventive maintenance program or the use of future one-time inspections consistent with GALL.

By letter dated August 18, 2004, the applicant clarified that while many auxiliary system inspections are opportunistic, some are performed periodically. The applicant identified specific auxiliary system material and environmental groups crediting the water chemistry control programs and stated that inspections have confirmed the effectiveness of water chemistry control programs in managing the effects of aging on auxiliary system components.

The staff was concerned that the limited sample of auxiliary system components inspected may not have been sufficient to conclude that the effectiveness of the water chemistry programs has been confirmed and additional inspections may be required. The applicant was requested to provide technical justification that an adequate sample size has been or will be selected prior to the period of extended operation on the basis of industry criteria/operating experience.

By letter dated September 10, 2004 the applicant responded that the sample of components is sufficient to conclude that the effectiveness of the water chemistry programs has been confirmed and additional inspections are not required. The applicant stated that a review of maintenance data for the past five years indicates that the number of inspections completed for each group exceeds the minimum number of random samples necessary to obtain a 90% confidence level that aging effects would have been identified, if present. The applicant further stated, "Therefore, the sample of components inspected is sufficient to conclude that the effectiveness of the water chemistry programs has been confirmed and additional inspections are not required."

The staff was concerned that, if no future one-time or periodic inspections are performed, detection of potential aging effects in the future may not be adequately detected or corrected. GALL AMP XI.M32 specifically identifies that the inspection not be scheduled too early in the current operating term, which could raise questions regarding continued absence of aging effects prior to and near the extended period of operation. The applicant was requested to clarify that future chemistry, ISI and maintenance inspections combined with past inspections constitute an adequate sample size to determine chemistry control or provide justification for not performing future inspections close to the end of the current operating license.

By letter dated September 23, 2004, the applicant clarified that maintenance activities are not expected to decline and it is proper to assume that maintenance history is representative of future numbers and diverse locations of anticipated maintenance inspections. The applicant concludes that past chemistry, maintenance and inservice inspections combined with future anticipated inspections constitute an adequate sample size to determine that the water chemistry programs are managing aging effects so that intended functions will be maintained during the period of extended operation.

The staff found the applicant's response to issues concerning chemistry control verifications for auxiliary systems to be adequate and acceptable because the applicant has identified that a combination of past chemistry, maintenance and inservice inspections combined with future anticipated inspections constitute an adequate sample size to determine that the water chemistry programs are managing aging effects so that intended functions will be maintained during the period of extended operation. All issues pertaining to RAI 3.3-2 are resolved.

Inspection Criteria for Flex Hose (RAI 3.3-3)

LRA Tables 3.3.2-3 and 3.2.3-7 state that flex hose exposed to an internal treated water and untreated air environments, and fuel oil environment, respectively, are managed by the periodic surveillance and preventive maintenance program. The description of the periodic surveillance and preventive maintenance program in LRA Section B.1.18 does not identify inspection criteria for the flex hose. The applicant was requested to identify the method of maintenance inspections applied to the flex hose, the frequency of inspections and the technical basis for the inspections. If inspection is limited to the external surfaces, the applicant was requested to justify the basis considering manufacturer's recommendations, industry practices and operating experience. The applicant was also requested to clarify if elastomer hoses used in auxiliary systems are to be replaced at specified intervals according to manufacturer's recommendations and standard industry practice.

By letter dated June 21, 2004, the applicant responded by providing the following information:

> The details on inspection criteria and frequency for the flex hoses that are included in the Periodic Surveillance and Preventive Maintenance Program will be determined prior to entering the period of extended operation. It is expected that a visual inspection of the internal and external surfaces will be performed. However, it may be determined that periodic replacement of the hoses is preferable and inspections will not be performed. None of these hoses are replaced on a specified interval since no replacement frequency was specified by the original manufacturer. If replaced at specific intervals, flex hoses would be considered short-lived and not subject to aging management review.

In their letter dated June 21, 2004 the applicant identified a specific commitment that the details of the inspection criteria and frequency of the flex hoses that are included in the Periodic Surveillance and Preventive Maintenance Program will be determined prior to the period of extended operation. It is expected that a visual inspection of the internal and external surfaces will be performed. However, it may be determined that periodic replacement of the hoses is preferable and inspections will not be performed.

Staff Evaluation of the Applicant's Response

The staff reviewed the applicant's response to RAI 3.3-3 and determined that the response does not entirely resolve the issues concerning inspection criteria for flexible hoses. In a meeting with the applicant on July 20, 2004, the staff requested the applicant to identify criteria for inspection of flexible hoses managed by the periodic surveillance and preventive maintenance program and to identify a commitment to have plant procedures updated prior to the period of extended operation. By letter dated August 18, 2004 the applicant provided the following response:

> As stated in the response to RAI 3.3-3, the PSPM Program will manage the effects of aging on flexible hoses through visual examination of external and internal surfaces. The visual examination looks for evidence of cracking and changes in material properties such as loss of flexibility and embrittlement. The flexibility of the hoses will be verified through manual manipulation of the hose concurrent with visual inspection. If evidence of degradation is detected, the hoses will be replaced. These hoses will be inspected at least once every 10 years. The hoses that credit the PSPM program are in the emergency diesel generator, fuel oil, alternate AC, and nitrogen systems. Procedures and preventive maintenance tasks for the inspection of flex hoses in these systems using the above criteria will be implemented prior to the period of extended operation. Alternatively, periodic replacement of the hose may be implemented in lieu of periodic inspection.

This response is adequate and acceptable because specific inspection criteria and a commitment for implementation were identified to demonstrate that the flexible hoses will be inspected both externally and internally at specified frequencies to provide assurance that the aging effects will be detected and corrected prior to the intended loss of function of the components. All issues related to RAI 3.3-3 are resolved.

Moisture Control in Compressed Air for Diesel Generator Systems (RAI 3.3-4)

LRA Tables 3.3.2-3 and 3.3.2.4 for the emergency diesel generator system and the alternate AC diesel generator system identify treated air and untreated air as an environment for various components in these systems. It is understood that the portions of these systems with treated and untreated air are the starting air subsystems normally containing compressed air. Compressed air systems are susceptible to loss of material due to internal condensation, unless effective measures are provided to remove moisture. Identify any specific operating practices used to remove moisture such as the continuous use of air driers or manually draining air receivers. Also provide justification that the loss of material in the starting air subsystems containing either treated air or untreated air is effectively managed. For example, identify specific operating experience including internal inspection results at susceptible locations.

By letter dated June 21, 2004, the applicant responded by providing the following information:

> The starting air for the AAC diesel in table 3.3.2-4 is specified as treated air since the system contains air dryers. In Table 3.3.2-3 for the EDG, the air is identified as untreated air since there are no air dryers on the system. However, the starting air tanks on the EDGs are drained every month. Loss of material in the starting air system for the AAC diesel will be managed thru the use of periodic maintenance that ensures the proper operation of the air dryers such that significant moisture will not be entrained in the portion of the system that is subject to aging management review. In the starting air system for the EDGs, loss of material will be managed through periodic inspections of the internals of components of the starting air system. As indicated in Table 3.3.2-3, the air receiver tanks for the EDGs are included in the Wall Thinning Monitoring Program. The tanks are the most susceptible locations for loss of material caused by moisture in the system. The operating experience review performed as part of the aging management review did not identify instances of significant corrosion or degradation of components in the starting air systems for the AAC diesel and EDGs.

In their letter dated June 21, the applicant identified a specific commitment that loss of material in the starting air system for the AAC diesel will be managed thru the use of periodic maintenance that ensures the proper operation of the dryers such that significant moisture will not be entrained in the portion of the system that is subject to aging management. In the same letter, the applicant also identified a specific commitment that in the starting air system for the EDGs, loss of material will be managed through periodic inspections of the internals of components of the starting air system.

Staff Evaluation of the Applicant's Response

The staff reviewed the applicant's response to RAI 3.3-4. The staff found the applicant's response to issues concerning moisture control in compressed air for the diesel generator systems to be adequate and acceptable because the applicant has identified specific commitments to manage loss of material in the AAC diesel and EDGs by providing for periodic maintenance of the AAC air dryers and periodic inspections of the internals of the EDG starting air system. The applicant has also performed an operating experience review to confirm that significant corrosion or degradation was not occurring in the starting air systems.

Bolting Integrity in Auxiliary Systems (RAI 3.3-6)

LRA Tables 3.3.2-3, 3.3.2-4 and 3.3.2-7 identify carbon steel bolting in auxiliary systems as subject to loss of mechanical closure integrity and the bolting and torquing activities AMP is credited with managing this aging effect. Note E is applicable to these components and this note states that this is consistent with NUREG-1801material, environment, and aging effect but a different aging management program is credited. LRA AMP B.1.2, bolting and torquing activities, indicates that this program relies on industry recommendations for comprehensive bolting maintenance based on EPRI TR-104213. EPRI report TR-104213 is also referenced in the GALL XI.M18 bolting integrity AMP. For those auxiliary systems with carbon steel bolting associated with Note E, the applicant was requested to clarify if the credited bolting and torquing activities combined with other inspections required by the system walkdown are consistent with the GALL AMP XI.M18 bolting integrity, including periodic inspection of closure bolting for indication of loss of preload with subsequent loss of mechanical closure integrity. If not consistent, the applicant was requested to identify specific exceptions to the GALL AMP and the technical justification for the exceptions.

By letter dated June 21, 2004, the applicant stated that the program described in NUREG-1801, Section XI.M18 covers all bolting within the scope of license renewal including safety-related bolting, bolting for nuclear steam supply system component supports, bolting for other pressure retaining components, and structural bolting. It includes periodic inspection of closure bolting for many aging effects, including loss of preload, cracking, and loss of material. Cracking of non-Class 1 stainless steel bolting is not an aging effect requiring management and loss of material is managed by other programs listed in the LRA. Thus, the plant specific Bolting and Torquing Activities Program, used only to manage loss of mechanical closure integrity, is not comparable to the aging management program XI.M18 of NUREG-1801. In Appendix B of the LRA, the ten attributes of the program were provided to allow for its assessment independent of NUREG-1801 Section XI.M18.

The applicant stated that the System Walkdown Program adequately manages loss of material for closure bolting as described in LRA Section B.1.28. The Bolting and Torquing Activities Program and System Walkdown Program also manage loss of mechanical closure integrity for closure bolting as described in LRA Sections B.1.2 and B.1.28. Visual inspections of bolting for loss of material and loss of mechanical closure integrity in the System Walkdown Program are adequate to assure that the closure bolting can perform its intended function since loss of material (and ultimately loss of mechanical closure integrity) for external surfaces is a long term aging effect that would be observed well before aging progressed to the point of loss of intended function. The Bolting and Torquing Activities Program assures that proper torque values are applied to bolted closures such that loss of mechanical closure integrity as a result of loss of preload due to high temperatures or significant vibration does not occur.

Staff Evaluation of the Applicant's Response

The staff reviewed the applicant's response to RAI 3.3-6. The staff found the applicant's response to issues concerning bolting integrity for auxiliary systems to be adequate and acceptable because the applicant credits more than one program to manage aging effects pertaining to bolting integrity. The System Walkdown Program manages loss of material. The Bolting and Torqing Activities Program manages loss of mechanical closure integrity, including loss of preload. The applicant identified that cracking of non-Class 1 stainless steel bolting is not an aging effect requiring management. This position is consistent with industry experience on the basis of bolting and torquing programs developed in accordance with EPRI guidance. Although the applicant indicated that their Bolting and Torqing Activites Program is not comparable to the aging management program XI.M18 of NUREG-1801, a combination of the Bolting and Torqing Activites Program and the System Walkdown Program manage appropriate aging effects concerning bolting integrity. In addition, NUREG-1801 Appendix XI.M18, states that the bolting integrity programs developed and implemented in accordance with commitments made in response to NRC communications on bolting events have provided an effective means of ensuring bolting reliability.

3.3.2.3.1 Spent Fuel Pool System

Summary of Technical Information in the Application

In Section 3.3.2.1.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the spent fuel pool system components:

- Boric Acid Corrosion Prevention Program
- System Walkdown Program
- Water Chemistry Control Program

In Table 3.3.2-1 of the LRA, the applicant summarized the AMRs for the spent fuel pool system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-1 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the spent fuel pool system component groups.

The staff reviewed the AMR of the spent fuel pool system component/material/environment/AERM combinations that are not addressed in the GALL report and specific combinations addressed in the GALL report within the scope of technical review. Component AERM combinations not addressed in the GALL report use note F through J in LRA Table 3.3.2-1. The staff confirmed that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

Table 2.3.3-1 of the LRA lists individual system components within the scope of license renewal and subject to aging management review. The component types that do not rely on the GALL report for AMR include bolting, fuel transfer tube, piping, spent fuel racks, and valves.

For these component types, the applicant identifies the following materials, environments, and AERMs:

- Stainless steel components subjected to treated borated water (internal and external) environments are subject to the aging effects of loss of material.

- Stainless steel components exposed to inside air (internal and external) environments experience no aging effect.

- Carbon steel bolting exposed to air and managed by the Boric Acid Corrosion Prevention Program is subject to loss of material.

The staff reviewed the information in Section 2.3.3.1, Table 2.3.3-1, Section 3.3.2.1.1, and Table 3.3.2-1 in the LRA. During its review, the staff determined that additional information was needed to complete its review. The Requests for Additional Information (RAIs) were organized in two groups, general RAIs and system specific RAIs. General RAIs that are applicable to this system include RAI 3.3-2.

By letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in RAI 3.3-2. By letter dated June 21, 2004, the applicant responded to the RAI. The RAI, applicant responses and the staff's evaluation of the responses are described in Section 3.3.2.3.0 of this SER.

By the same letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in the system-specific RAI 3.3.2.4.1-1. By letter dated June 21, 2004, the applicant responded to the RAI. RAI 3.3.2.4.1-1, the responses to this RAI, and the staff's evaluation of the responses are described below:

RAI 3.3.2.4.1-1

LRA Table 3.3.2-1 identifies that, for stainless steel spent fuel racks in a treated borated water environment, cracking is an applicable aging effect requiring aging management. The operating temperature for these environments is not identified. The applicant was requested to clarify why cracking is not a similarly applicable aging effect requiring aging management for the stainless steel fuel transfer tubes in a treated borated water environment.

In its response, by letter dated June 21, 2004, the applicant stated that cracking is not an aging effect requiring management for the stainless steel fuel transfer tube because the treated borated water temperature is maintained less than the 140°F threshold for cracking from stress corrosion and intergranular attack. The applicant clarified that, since spent fuel pool temperature at the spent fuel racks may exceed this threshold, cracking is applicable for the spent fuel racks.

The staff reviewed the applicant's response and found the response to be adequate and adequate because the applicant indicated that for the stainless steel fuel transfer tube the treated borated water temperature is maintained less than the 140°F threshold for cracking from stress corrosion and intergranular attack for stainless steel components.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAI the staff finds the aging effects of the above spent fuel pool cooling and cleanup system component types that are not addressed in the GALL report and the specific component types that are within the scope of the technical review are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the spent fuel pool system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement adequately describes the program.

LRA Table 3.3.2-1 identifies the following AMPs for managing the aging effects described above for the spent fuel pool system component types:

- Boric Acid Corrosion Prevention Program (Appendix B.1.3)
- System Walkdown Program (Appendix B.1.28)
- Water Chemistry Control Program (Appendix B.1.30)

The staff's detailed review of these AMPs appears in Sections 3.0.3.2.1, 3.0.3.3.9, and 3.0.3.3.11 of this SER, respectively.

The Water Chemistry Control Program is credited for managing loss of material aging effect on the stainless steel components exposed to treated borated water. During its review, the staff determined that additional information was needed to complete its review. The request for additional information is described in RAI 3.3-2. RAI 3.3-2, the applicant's response to this RAI and the staff's evaluation of the responses are described in Section 3.3.2.3.0 of this SER.

The applicant proposed to manage loss of material for stainless steel and nickel-based alloy components exposed to treated, borated water by using only the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3). The applicant stated that stainless steel components to be managed this way include heat exchanger tubes, orifices, piping, pump casings, thermowells, tubing, and valves. The Water Chemistry Control Program will also manage nozzles made of nickel-based alloy components and the stainless steel cladding of a tank made of carbon steel. The staff reviewed the Primary and Secondary Water Chemistry Control Program and concludes that it is acceptable. Section 3.0.3.1 of this SER documents its evaluation.

The staff reviewed stainless steel and nickel-based alloy components exposed to treated, borated water. The staff concludes that since the effects of pitting and crevice corrosion on stainless steel and nickel-based alloy components are not significant in chemically treated borated water, inspection of selected components to determine the absence of loss of material is not required. Because the Primary and Secondary Water Chemistry Control Program is consistent with the GALL Report, the staff finds this acceptable.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAI, the staff finds the applicant has identified appropriate AMPs for managing the aging effects of the spent fuel pool system component types that are not addressed by the GALL Report and those specific component types addressed in the GALL Report that are within the scope of the technical review. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the spent fuel pool components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.2 Water Suppression Fire Protection System

Summary of Technical Information in the Application

Section 2.3.3.2 of this SER describes the water suppression fire protection system. Tables 3.3.1 and 2.3.3-2 identify the passive, long-lived components of this system that are subject to an AMR. Table 3.3.2-2 provides a summary of the components, aging effects, and AMPs.

Aging Effects

Table 2.3.3-2 of the LRA lists the fire protection components that are within the scope of license renewal and subject to an AMR. These components include air dryer housing, blower housing, bolting, ductwork, expansion joint, filter, filter housing, flex hose, gear housing, governor housing, heat exchanger (housing), heat exchanger (shell), heat exchanger (tubes), heater housing, nozzle, orifice, pipe/fittings, piping, pump casing, tubing, and valve.

In Section 3.3.2.1.2 and Table 3.3.2-2 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The materials identified are aluminum, carbon steel, cast iron, cast iron with enameline, copper, copper alloys, elastomers, and stainless steel.

The applicant identified the environment to which these materials could be exposed as air, exhaust gas, lube oil, fresh raw water, soil, and treated water.

The applicant identified changes in material properties, cracking, fatigue cracking, fouling, loss of material, wear, and loss of mechanical closure integrity as the aging effects associated with the fire protection system components.

Aging Management Programs

The LRA identifies the following programs that manage the aging effects related to the fire protection system:

- Bolting and Torquing Activities Program (Appendix B.1.2)
- Buried Piping Inspection Program (Appendix B.1.4)
- Fire Protection Program (Appendix B.1.10)
- Oil Analysis Program (Appendix B.1.17)
- System Walkdown Program (B.1.28)

Appendix B to the LRA describes these AMPs. The applicant indicated that these AMPs will adequately manage the effects of aging associated with the components of the fire protection system during the period of extended operation.

Staff Evaluation

The staff reviewed Table 3.3.2-2 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the water suppression fire protection system component groups.

Aging Effects

The staff reviewed the LRA to determine whether the applicant had demonstrated that the effects of aging for the fire protection system will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff reviewed Section 3.3.2.1.2 and Tables 3.3.1 and 3.3.2-2 of the LRA for completeness, consistency with the GALL Report, and industry experience.

For these component types, the applicant identifies the following materials, environments, and AERMs:

- Stainless steel components subjected to air (external) and fresh raw water (internal) environments are subject to the aging effects of loss of material.
- Stainless steel components exposed to inside air (external) environments are subject to the aging effects of loss of mechanical closure integrity.
- Stainless steel components subjected to fresh raw water (external) environments are subject to the aging effects of loss of material
- Carbon steel bolting exposed to air and managed by the Boric Acid Corrosion Prevention Program is subject to loss of mechanical closure integrity.
- Carbon steel components exposed to air (internal and external) and exhaust gas (internal) environments are subject to loss of material.
- Carbon steel components exposed to air (internal and external) and exhaust gas (internal) environments are subject to loss of material.
- Carbon steel components exposed to soil (external) environments are subject to loss of material.
- Carbon steel components exposed to treated water (internal) environments are subject to loss of material.
- Carbon steel components exposed to lube oil (internal) environments are subject to loss of material.
- Cast iron components exposed to treated water (internal) and air (external) environments are subject to loss of material.
- Elastomer components exposed to air (external) and exhaust gas (internal) environments are subject to change in material properties and cracking.

- Copper alloy components exposed to fresh raw water (internal) environments are subject to loss of material.

- Copper alloy components exposed to treated water (internal) environments are subject to fouling.

LRA Table 3.3.1, Item 3.3.1-30, addresses fire barriers and references Section 3.5.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects resulting from contact of the fire protection system components with the environments described in Table 3.3.2-2 of the LRA are consistent with the GALL Report and industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant identified the applicable aging effects and associated AMPs that are appropriate for the combination of materials and environments listed.

<u>Aging Management Programs</u>

The applicant credits the following AMPs with managing the aging effects in the fire protection system:

- Bolting and Torquing Activities Program (Appendix B.1.2)
- Buried Piping Inspection Program (Appendix B.1.4)
- Fire Protection Program (Appendix B.1.10)
- Oil Analysis Program (Appendix B.1.17)
- System Walkdown Program (Appendix B.1.28)

These AMPs are credited with managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and found them acceptable for managing the aging effects identified for this system. These AMPs are evaluated in sections 3.0.3.3.2, 3.0.3.2.2, 3.0.3.2.5, 3.0.3.3.6, and 3.0.3.3.9, respectively, of this SER.

During the onsite audit, the staff asked the applicant to provide the technical basis for treating cast iron components (i.e., filter housing, heat exchanger housing, diesel engine cooling water subsystem components, and valves) in a manner similar to carbon steel components. The applicant's position is that the aging effects are the same in this environment for carbon steel and cast iron that is not gray cast iron. a The staff finds that using an AMP considered acceptable to manage the aging effects of carbon steel components is appropriate for cast iron components.

Additionally, the applicant stated that the aging effects for carbon steel and gray cast iron are the same, except gray cast iron is susceptible to selective leaching. By letter dated March 24, 2004, the applicant stated that where selective leaching is possible, an additional program is credited unless the one specified program will manage selective leaching (such as the Diesel Fuel Monitoring and Oil Analysis Programs). Selective leaching does not normally occur in air, lube oil, or fuel oil because the environment is not aqueous. In LRA Table 3.3.1, Item Number 3.3.1-29, the applicant stated that gray cast iron components exposed to an environment conducive to selective leaching are managed by the Periodic Surveillance and Preventive Maintenance Program, Service Water Integrity Program, or Fire Protection Program that includes the management of loss of material due to selective leaching. Because these programs manage the aging effects of selective leaching for gray cast iron components, the staff finds this acceptable.

The applicant's reference to the GALL Report, Volume 2, Item VII.H2.1-a, for copper-alloy valve components in treated water did not match the material, aging effect, and program cited. By letter dated March 24, 2004, the applicant stated that reference to GALL Item VII.H2.1-a is not appropriate for "valve," and the correct note is 301 rather than "E" in Table 3.3.2-2 of the LRA (page 3.3-43 of the LRA).

The staff reviewed the applicant's response and finds that the applicant has demonstrated that it will adequately manage the effects of aging so that the intended functions will be maintained consistent with the CLB during the period of extended operation.

In Table 3.3.2-2 of the LRA (page 3.3-43), the applicant proposed to manage loss of material of copper-alloy valves exposed to lube oil using the Oil Analysis Program (AMP B.1.17). Loss of material because of pitting corrosion is an applicable aging effect for copper-alloy materials in a lubricating oil environment at locations containing oxygenated water with contaminants such as halide ions, particularly chloride ions. In addition, loss of material due to galvanic corrosion in a lubricating oil environment can occur only when materials with different electrochemical potentials are in contact in the presence of water. Loss of material due to crevice corrosion can also occur in brass, bronze, and copper materials in a lubricating oil environment at locations containing oxygenated water. Oxygen is required for the initiation of crevice corrosion. Lube oil that is not contaminated with water does not contain oxygen in sufficient quantities for crevice corrosion to occur.

Water contamination of lubricating oil can occur and is required for the introduction of oxygen. However, only high-quality (water- and contaminant-free) lubricating oil is received, and periodic sampling is performed to ensure the quality is maintained.

Loss of material due to microbiologically influenced corrosion (MIC) is an applicable aging effect for brass and copper materials exposed to lubricating oil. The applicant treated the lubricating oil with biocides to limit the presence of microbiological organisms and, therefore, MIC has not been a concern for those portions of the water suppression fire protection system that are within the scope of license renewal and the associated materials exposed to lubricating oil.

On the basis of its review of the information provided by the applicant, the staff concludes that the applicant has credited the appropriate AMP with managing the aging effects from the materials and environments associated with the fire protection system and that the AMPs identified above will effectively manage these aging effects.

<u>Conclusion</u>

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the water suppression fire protection components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.3 Emergency Diesel Generator System

Summary of Technical Information in the Application

In Section 3.3.2.1.3 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the emergency diesel generator components:

- Bolting and Torquing Activities Program
- Wall Thinning Monitoring Program
- Heat Exchanger Monitoring Program
- Oil Analysis Program
- System Walkdown Program
- Periodic Surveillance and Preventive Maintenance Program
- Service Water Integrity Program
- Water Chemistry Control Program

In Table 3.3.2-3 of the LRA, the applicant provided a summary of AMRs for the emergency diesel generator system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-3 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the Emergency diesel generator system component groups.

The staff reviewed the AMR of the emergency diesel generator component/material/ environment/AERM combinations that are not addressed in the GALL report and specific combinations addressed in the GALL report within the scope of the technical review. Component AERM combinations not addressed in the GALL report use note F through J in LRA Table 3.3.2-3. Material and environment combinations addressed in GALL without a comparable component use note 301. The staff determined that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

Table 2.3.3-3 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The components that do not rely on the GALL Report for AMR include blower housing, bolting, booster housing, ejector, expansion joint, filter, filter housing, flex hose, governor house, heat exchanger shell, heat exchanger tubes, heat exchanger tubesheet, heater housing, piping, pump casing, silencer, tank, thermowell, tubing, unloader, and valve.

For these component types, the applicant identifies the following materials, environments, and

AERMs:

- Elastomer components exposed to inside and outdoor air, untreated air, or a treated water environment are subject to the aging effects of change in material properties and cracking.

- Carbon steel, cast iron, copper alloy, and stainless steel components exposed to the lube oil environment are subject to the loss of material aging effect.

- Stainless steel and copper alloy components exposed to air or outdoor air experience no aging effects.

- Carbon steel components exposed to exhaust gas are subject to loss of material and cracking-fatigue aging effect.

- Carbon steel components exposed to outdoor air and untreated air are subject to cracking-fatigue aging effects.

- Stainless steel components exposed to exhaust gas are subject to loss of material, cracking, and cracking-fatigue.

- Copper alloy and stainless steel components exposed to untreated air are subject to the aging effects of loss of material and cracking-fatigue.

- Stainless steel components exposed to treated water are subject to loss of material and cracking.

- Carbon steel, cast iron, and copper alloy components exposed to treated water are subject to the aging effect of loss of material.

- Copper alloy heat exchanger tubes, tubesheets, copper with aluminum fin exposed to fresh raw water, lube oil, or outdoor air are subject to loss of heat transfer function due to fouling.

- Carbon steel bolting exposed to air and managed by the Bolting and Torquing Activities AMP is subject to loss of mechanical closure integrity.

The staff reviewed the information in Section 2.3.3.3, Table 2.3.3-3, Section 3.3.2.1.3, and Table 3.3.2-3 in the LRA. During its review, the staff determined that it needed additional information. The RAIs were organized in two groups, general RAIs and system specific RAIs. General RAIs that are applicable to this system include RAIs 3.3-2, 3.3-3, 3.3-4 and 3.3-6.

By letter dated May 5, 2004, the staff asked the applicant for additional information on the issues described in RAIs 3.3-2, 3.3-3, and 3.3-4. By letter dated May 25, 2004, the staff requested additional information on the issues described in RAI 3.3-6. By letter dated June 21, 2004, the applicant responded to these RAIs. Section 3.3.2.3.0 of this SER describes the RAIs, the applicant's responses, and the staff's evaluation of the responses.

By the same letter dated May 5, 2004, the staff asked the applicant to provide additional information on the issues described in the system-specific RAIs 3.3.2.4.3-1 and 3.3.2.4.3-2. By letter dated June 21, 2004, the applicant responded to these RAIs. The following sections describe RAIs 3.3.2.4.3-1 and 3.3.2.4.3-2, the responses to these RAIs, and the staff's evaluation of the responses.

RAI 3.3.2.4.3-1

Loss of material due to wear is an applicable aging effect on expansion joints and flex hose. However, in Table 3.3.2-3 of the LRA, the applicant did not identify this aging effect/aging mechanism for the expansion joints and flex hose made of elastomer material or stainless steel. The staff asked the applicant to justify why it did not identify this aging effect/mechanism as an applicable aging effect on the elastomer or stainless steel expansion joints.

In its response, by letter dated June 21, 2004, the applicant stated that there is no relative motion between these components and another surface. The applicant also stated that these components are exposed to environments which do not contain abrasive particles. The applicant concluded that, as a result, loss of material due to wear is not an aging effect requiring management for these components.

The staff reviewed the applicant's response and found the response to be acceptable and adequate because expansion joints will not be subjected to conditions that would result in wear.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects of the emergency diesel generator component types that are not addressed by the GALL Report and specific component types within the scope of the technical review are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the emergency diesel generator.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-3 of the LRA identifies the following AMPs for managing the aging effects described above for the emergency diesel generator:

- Heat Exchanger Monitoring Program (Appendix B.1.12)
- Oil Analysis Program (Appendix B.1.17)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Service Water Integrity Program (Appendix B.1.24)
- Water Chemistry Control Program (Appendix B.1.30)
- Bolting and Torquing Activities Program (Appendix B.1.2)
- TLAA—Metal Fatigue Program (4.3)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.3, 3.0.3.3.6, 3.0.3.3.7, 3.0.3.2.7, 3.0.3.2.8, and 3.0.3.3.2 of this SER, respectively. Section 4.3 of this SER contains the staff's evaluation of the TLAA—Metal Fatigue Program.

The Water Chemistry Control Program is credited for managing aging effects on the stainless steel and copper components exposed to treated water. During its review, the staff determined that additional information was needed to complete its review. The request for additional information is described in RAI 3.3-2. RAI 3.3-2, the applicant's response to this RAI and the staff's evaluation of the responses are described in Section 3.3.2.3.0 of this SER.

The PSPM is credited with managing flex hose exposed to an internal treated water and untreated air. During its review, the staff determined that additional information was needed to complete its review. The request for additional information is described in RAI 3.3-3. RAI 3.3-3, the applicant's response to this RAI and the staff's evaluation of the response is described in Section 3.3.2.3.0 of this SER.

The PSPM is credited with managing various components exposed to untreated air. During its review, the staff determined that additional information was needed to complete its review. The request for additional information is described in RAI 3.3-4. RAI 3.3-4, the applicant's response to this RAI and the staff's evaluation of the response is described in Section 3.3.2.3.0 of this SER.

RAI 3.3.2.4.3-2

LRA Table 3.3.2-3 states that carbon and stainless steel expansion joints exposed to an internal exhaust gas environment is managed by the TLAA-Metal Fatigue Program and the Periodic Surveillance and Preventive Maintenance Program. The applicant was requested to explain why the Wall Thinning Program was not applied to the carbon and stainless steel expansion joints. The applicant was also requested to identify and justify the frequency of inspection and clarify if inspections will include internal inspections for cracking and loss of material as recommended in industry standards.

In its response by letter dated June 21, 2004, the applicant stated that expansion joints will be inspected every 18 months in accordance with vendor recommendations. The applicant also confirmed that internal inspections and NDE capable of detecting both loss of material and cracking will be performed. The applicant identified a specific commitment that the wall thinning program will include the exhaust expansion joints.

The staff reviewed the applicant response and found the response to be acceptable and adequate because the expansion joints will be inspected every 18 months in accordance with vendor recommendations and the wall thinning program will use NDE to detect loss of material and cracking.

During the audit, the staff asked the applicant to justify, for emergency diesel generator heat exchanger shell component types in LRA Table 3.3.2-3 that are consistent with the GALL Report, that the aging management program applied to carbon steel remains applicable to cast iron with a similar environment.

By letter dated March 24, 2004, the applicant stated that where selective leaching is possible, an additional program is credited unless the one specified program will manage selective leaching such as the diesel fuel monitoring and oil analysis programs. Selective leaching does not normally occur in air, lube oil, or fuel oil due to the lack of an aqueous environment. In its response, the applicant further stated that if cast iron components are gray cast iron and are exposed to an environment conducive to selective leaching, then they are managed by a periodic surveillance and preventive maintenance program, service water integrity program, or fire protection program that includes the management of loss of material due to selective leaching. On the basis that these programs manage the aging effects of selective leaching for gray cast iron components, the staff finds this acceptable.

The applicant credited the PSPM (AMP B.1.18) and not the service water integrity program (AMP B.1.24) for managing loss of material for components exposed to a raw water environment. The applicant agreed to add the service water integrity program for these components. By letter dated March 24, 2004, the applicant stated that the PSPM program manages loss of material for the emergency diesel generator heat exchanger bonnet in fresh raw water (page 3.3-51of the LRA) through periodic internal inspections during emergency diesel generator overhauls. In addition to the PSPM program, the service water integrity program is conservatively included as a program since it provides additional aging management of this component. On the basis that these programs manage the aging effects of loss of material for components exposed to a raw water environment, the staff finds this acceptable.

The applicant credited the PSPM (AMP B.1.18) and not the auxiliary systems water chemistry control program (AMP B.1.30.1) for managing loss of material for components internally exposed to a treated-water environment. The applicant agreed that the auxiliary water chemistry control program should have been credited for bonnet and shell components internally exposed to a treated water environment, which is acceptable to the staff. By letter dated March 24, 2004, the applicant stated that the auxiliary systems water chemistry control program applies to the emergency diesel generator heat exchanger bonnet and shell in treated water (page 3.3-51 of the LRA) rather than the PSPM program. On the basis that this program manages the aging effects of loss of material for components internally exposed to a treated water environment, the staff finds this acceptable.

The applicant credited the auxiliary systems water chemistry control program (AMP B.1.30.1) to manage loss of material of carbon steel heater housing and orifice, carbon and stainless steel piping, emergency diesel generator pump casing and tank, tubing, and valves in an internally treated water environment. This is consistent with Item VII.H2.1-a of the GALL Report with a different AMP credited than the GALL AMP XI.M21, closed-cycle cooling water system. If this is the case, LRA Note D should be changed to LRA Note E. By letter dated March 24, 2004, the applicant stated that reference to LRA Note D is not appropriate for the emergency diesel generator heater housing and orifice (page 3.3-54 of the LRA), the carbon and stainless steel piping (page 3.3-56 of the LRA), the emergency diesel generator pump casing and tank (page 3.3-57 of the LRA), tubing (page 3.3-59 of the LRA), and valve (page 3.3-61 of the LRA) in treated water. The correct note is LRA Note E. The staff finds the applicant's response acceptable and consistent with the LRA Notes.

In the case of a copper-alloy lubricator housing exposed to air, the applicant identified no aging effect. On the basis of the staff's evaluation that copper-alloy components exposed to air have no aging effects, the staff concludes that this is acceptable.

On the basis of its review of the information provided in the LRA, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the emergency diesel generator component types that are not addressed by the GALL Report and those specific component types addressed by the GALL Report that are within the scope of the technical review. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the emergency diesel generator components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.4 Alternate AC Diesel Generator System

Summary of Technical Information in the Application

In Section 3.3.2.1.4 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the alternate ac diesel generator system components:

- Bolting and Torquing Activities Program
- Wall Thinning Monitoring Program
- Oil Analysis Program
- System Walkdown Program
- Periodic Surveillance and Preventive Maintenance Program
- Water Chemistry Control Program

In Table 3.3.2-4 of the LRA, the applicant summarized the AMRs for the alternate ac diesel generator system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-4 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the alternate ac diesel generator system component groups.

The staff also reviewed the AMR of the alternate AC diesel generator system component/material/environment/AERM combinations that are not addressed in the GALL report and specific combinations that are addressed in the GALL report within the scope of the technical review. Component AERM combinations not addressed in the GALL report use note F through J in LRA Table 3.3.2-4. Material and environment combinations addressed in GALL without a comparable component use note 301. The staff confirmed that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs. During the staff evaluation of the LRA, the applicant's response to RAI 2.3.3.3.4-1 identified thermal insulation around the exhaust piping was added to the scope of components subject to an AMR.

Aging Effects

Table 2.3.3-4 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include blower housing, bolting, expansion joint, filter, filter housing, flex hose, governor housing, heat exchanger (shell), heat exchanger (tubes), heater housing, indicator housing, lubricator housing, orifice, piping, pump casing, silencer, thermowell, tubing, and valves.

For these component types, the applicant identified the following materials, environments, and AERMs:

- Stainless steel components in an exhaust gas environment are subject to loss of material. In the same environment, carbon steel and stainless steel components experience cracking-fatigue, and stainless steel components are subject to the additional aging effect of cracking.

- In a lube oil environment, carbon steel, carbon steel with aluminum fins, copper alloy, and stainless steel components are subject to loss of material. Fouling is an applicable aging effect for carbon steel with aluminum fins and copper alloy components in lube oil. Cracking is an applicable aging effect in a lube oil environment for elastomer and stainless steel. Elastomer components in a lube oil environment are subject to the additional aging effect of change of material properties.

- Carbon steel, copper alloy, and stainless steel components are subject to loss of material in a treated air environment, and stainless steel components in the same environment may experience the additional aging effect of cracking.

- In a treated water environment, carbon steel, copper alloy, and stainless steel components are subject to loss of material. In the same environment, carbon steel with aluminum fins and copper alloy components experience fouling. Also in a treated water environment, elastomer components are subject to cracking and change in material properties. Cracking is also applicable to stainless steel components in the treated water environment.

- In outdoor air, carbon steel with aluminum fins experiences fouling, and copper alloy components suffer from fouling, as well as loss of materials through wear. In an air environment, aluminum, copper alloy, glass, and stainless steel components experience no applicable aging effects. Carbon steel blower housings exposed to outdoor air are subject to cracking-fatigue. Carbon steel bolting managed by the Bolting and Torquing Activities Program is subject to loss of mechanical closure integrity.

- Neither glass components in treated water nor stainless steel components in outdoor air experience aging effects.

The staff reviewed the information in Section 2.3.3.4, Table 2.3.3-4, Section 3.3.2.1.4, and Table 3.3.2-4 in the LRA. During its review, the staff determined that it needed additional information. The RAIs were organized in two groups, general RAIs and system specific RAIs. General RAIs that are applicable to this system include RAIs 3.3-2, 3.3-3, 3.3-4 and 3.3-6.

By letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in RAIs 3.3-2, 3.3-3, 3.3-4 and 3.3-6. By letter dated May 25, 2004, the staff requested the applicant to provide additional information on the issues described in RAIs 3.3-6. By letters dated June 21, 2004, the applicant responded to these RAIs. The RAIs, the applicant's responses and the staff's review of the responses are described in Section 3.3.2.3.0 of this SER.

By a letter dated May 5, 2004, the staff asked the applicant to provide additional information on the issues described in the system-specific RAI 3.3.2.4.1-1. By letter dated June 21, 2004, the applicant responded to that RAI. The following section describes RAI 3.3.2.4.1-1, the applicant's response, and the staff's evaluation of the response.

RAI 3.3.2.4.1-1

Table 3.3.2-4 of the LRA credits the Periodic Surveillance and Preventive Maintenance Program with managing fouling in heat exchanger tubes. A periodic diesel generator test alone may not be adequate verification that the required heat transfer is maintained under all applicable design conditions. The staff asked the applicant to clarify how the inspections and testing are performed to ensure that fouling does not adversely affect heat transfer by using proven practices such as periodic heat balances to specific industry standards.

In its response, the applicant stated that the alternate ac diesel is operated on a quarterly basis for at least 2 hours at near full-rated load, and full-rated load significantly exceeds the required design loading of the diesel. The applicant also stated that during this testing, engine parameters such as inlet and outlet temperatures on heat exchangers are monitored and trended to assure that the heat exchangers are capable of removing heat loads. The applicant further stated that adverse trends or alarms noted during performance of the surveillance tests would be identified in accordance with the Corrective Action Program. The applicant concluded that appropriate actions to determine the cause and correct the condition would be taken long before the intended function of the system is affected.

The staff reviewed the applicant's response and found the response to be acceptable and adequate because the applicant indicated that (1) the alternate ac diesel is tested on a quarterly basis for at least 2 hours at near full-rated load which significantly exceeds the required design loading of the diesel, (2) during this testing, engine parameters such as inlet and outlet temperatures on heat exchangers are monitored and trended, and (3) any adverse trends or alarms noted would lead to appropriate actions being taken to determine the cause and to correct the condition long before the intended function of the system is affected.

As a result of the resolution of an unresolved issue related to RAI 2.3.3.4-1 during the scoping and screening review, the thermal insulation for the exhaust piping for the EDG was placed in the scope to license renewal and subject to an aging management review. The staff requested that the applicant identify the type of thermal insulation used on the exhaust piping and to review the applicability of NRC Information Notice 88-28 regarding the type of insulation.

By letter dated September 24, 2004, the applicant clarified that two types of insulation material cover the alternate AC generator exhaust piping in the generator building. The applicant identified that the majority of the insulation is calcium silicate with metal jacketing and a small portion is fiberglass blanket material encased in a covering. The applicant stated that no aging effects requiring management have been identified for the exhaust piping insulation in its dry, indoor environment. By e-mail from the PM dated September 23, 2004, additional information was forwarded by the applicant. The applicant clarified that a walkdown of the insulation did not detect any foil covering on the blanket insulation similar to that reported in NRC IN 88-28.

The staff reviewed the applicant's responses and found the responses to be acceptable and adequate because the type of insulation used in this application is not subjected to environmental conditions that would result in degradation of thermal properties during the period of extended operation.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAI, the staff finds the aging effects of the above alternate ac diesel generator system component types that are not addressed by the GALL Report and specific component types that are addressed by the GALL Report and are within the scope of technical review are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the alternate ac diesel generator system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-5 of the LRA identifies the following AMPs for managing the aging effects described above for the alternate ac diesel generator system:

- Wall Thinning Monitoring Program (Appendix B.1.29)
- Oil Analysis Program (Appendix B.1.17)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- System Walkdown Program (Appendix B.1.28)
- Water Chemistry Control Program (Appendix B.1.30)
- Bolting and Torquing Activities Program (Appendix B.1.2)
- TLAA—Metal Fatigue Program (4.3)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.10, 3.0.3.3.6, 3.0.3.3.7, 3.0.3.3.9, 3.0.3.3.11, and 3.0.3.3.2 of this SER, respectively. Section 4.3 of this SER contains the staff's evaluation of the TLAA—Metal Fatigue Program.

The applicant credits the Water Chemistry Control Program with managing the loss of material aging effects on the copper alloy, carbon steel and stainless steel components exposed to treated water. During its review, the staff determined that it needed additional information and issued RAI 3.3-2. Section 3.3.2.3.0 of this SER describes RAI 3.3-2, the applicant's response, and the staff's evaluation of the response.

The applicant credits the PSPM Program with managing flex hose exposed to an internal treated water, lube oil and treated air. During its review, the staff determined that it needed additional information and issued RAI 3.3-3. Section 3.3.2.3.0 of this SER describes RAI 3.3-3, the applicant's response, and the staff's evaluation of the response.

The applicant credits the PSPM Program with managing various components exposed to treated air. During its review, the staff determined that additional information was needed to complete its review. The request for additional information is described in RAI 3.3-4. RAI 3.3-4, the applicant's response to this RAI and the staff's evaluation of the response is described in Section 3.3.2.3.0 of this SER.

By letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in the system-specific RAI 3.3.2.4.1-1. By letter dated June 21, 2004, the applicant responded to the RAI. RAI 3.3.2.4.1-1, the responses to this RAI, and the staff's evaluation of the responses are described below:

RAI 3.3.2.4.4-1

LRA Table 3.3.2-4 credits the Periodic Surveillance and Preventive Maintenance Program for managing fouling in heat exchanger tubes. A periodic diesel generator test alone may not be adequate verification that the required heat transfer is maintained under all applicable design conditions. The applicant was requested to clarify how the inspections and testing are performed to ensure that fouling does not adversely affect heat transfer by using proven practices such as periodic heat balances to specific industry standards.

In its response, by letter dated June 21, 2004, the applicant stated that the AAC diesel is operated on a quarterly basis for at least two hours at near full-rated load and full-rated load significantly exceeds the required design loading of the diesel. The applicant also stated that during this testing, engine parameters such as inlet and outlet temperatures on heat exchangers are monitored and trended to assure the heat exchangers are capable of removing heat loads. The applicant further stated that adverse trends or alarms noted during performance of the surveillance tests would be identified in accordance with the Corrective Action Program. The applicant concluded that appropriate actions to determine the cause and correct the condition would be taken long before the intended function of the system is affected.

The staff reviewed the applicant's response and found the response to be adequate because the applicant indicated that a) the AAC diesel is tested on a quarterly basis for at least two hours at near full-rated load which significantly exceeds the required design loading of the diesel, b) during this testing, engine parameters such as inlet and outlet temperatures on heat exchangers are monitored and trended, and that c) any adverse trends or alarms noted would lead to appropriate actions being taken to determine the cause and to correct the condition long before the intended function of the system is affected.

During the audit, the staff asked the applicant to provide a technical basis for treating cast iron components in the diesel engine cooling water subsystem in a manner similar to carbon steel components. The applicant's position is that carbon steel and cast iron experience the same aging effects in this environment. The staff agrees that use of an AMP considered acceptable for carbon steel is appropriate for these components.

The staff identified a discrepancy in the classification of AMRs involving Water Chemistry Control Programs. The applicant assigned Notes B and D of the LRA in cases where LRA Note E is more appropriate. By letter dated March 24, 2004, the applicant stated that reference to "water chemistry control" for the alternate ac diesel generator stainless steel expansion joint in treated water (page 3.3-67 of the LRA) in Table 3.3.2-4 means the Auxiliary Systems Water Chemistry Control Program. In addition, wherever LRA Note B or D appears in Tables 3.3.2-3 and 3.3.2-4 with the Auxiliary Systems Water Chemistry Control Program as an AMP, LRA Note E should have been used since the Auxiliary Systems Water Chemistry Control Program is the water chemistry control program for treated water, and it is a plant-specific program. Based on its review of the applicant's response, the staff finds that these corrections are consistent with the LRA note classifications and are acceptable.

The staff reviewed the alternate ac diesel generator system stainless steel components exposed to an air environment. The staff has observed that stainless steel components exposed to air/gas, containment air, indoor air (not air-conditioned), and outdoor environments show no aging effect. The GALL Report does not identify an air/gas environment for these components and materials. The staff finds that no aging effects are applicable, and thus, the absence of an AMP for stainless steel components exposed to air is acceptable.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAIs, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the alternate ac diesel generator system component types that are not addressed by the GALL Report and specific component types that are addressed in the GALL Report and are within the scope of the technical review. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the alternate ac diesel generator system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.5 Chemical and Volume Control System

Summary of Technical Information in the Application

In Section 3.3.2.1.5 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the CVCS components:

- Bolting and Torquing Activities Program
- Boric Acid Corrosion Prevention Program
- Oil Analysis Program
- System Walkdown Program
- Periodic Surveillance and Preventive Maintenance Program
- Water Chemistry Control Program

In Table 3.3.2-5 of the LRA, the applicant summarized the AMRs for the CVCS components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-5 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the CVCS component groups.

The staff reviewed the AMR of the chemical and volume control system component/material/environment/AERM combinations that are not addressed in the GALL report and specific combinations that are addressed in the GALL report within the scope of the technical review. Component AERM combinations not addressed in the GALL report use note F through J in LRA Table 3.3.2-5. Material and environment combinations addressed in GALL without a comparable component use note 301. The staff determined that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

Table 2.3.3-5 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include bolting, gear housing, heat exchanger (shell, including the heat exchanger channel head/bonnet), piping, pump casing, sight glass, sight glass housing, tank, thermowell, tubing, and valves. Carbon steel bolting managed by the Boric Acid Corrosion Prevention Program and stainless steel bolting managed by the Bolting and Torquing Activities Program are within the scope of the technical review.

For these component types, the applicant identified the following materials, environments, and AERMs:

- In a treated borated water environment, stainless steel components are subject to loss of material.

- In a lube oil environment, stainless steel components are subject to cracking and loss of material. In the same lube oil environment, carbon steel components are subject to loss of material only, and glass components experience no aging effect.

- Stainless steel and glass components exposed to an air environment experience no aging effects.

- Stainless steel components in a nitrogen environment also experience no aging effects.

- Carbon steel and stainless steel bolting exposed to air is subject to loss of mechanical closure integrity.

- Stainless steel heat exchanger shells, piping, themowells, tubing, and valves exposed to treated borated water above 132 °C (270 °F) are subject to cracking-fatigue. Stainless steel pump casings exposed to treated borated water are also subject to cracking-fatigue.

The staff reviewed the information in Section 2.3.3.5, Table 2.3.3-5, Section 3.3.2.1.5, and Table 3.3.2-5 in the LRA. During its review, the staff determined that it needed additional information. The RAIs were organized into two groups, general RAIs and system-specific RAIs. General RAIs applicable to this system include RAIs 3.3-1 and 3.3-2.

By letter dated May 5, 2004, the staff asked the applicant for additional information on the issues described in RAIs 3.3-1 and 3.3-2. By letter dated June 21, 2004, the applicant responded to these RAIs. Section 3.3.2.3.0 of this SER describes the RAIs, the applicant's responses, and the staff's evaluation of the responses.

By the same letter dated May 5, 2004, the staff asked for additional information on the issues described in the system-specific RAI 3.3.2.5.1-1. By letter dated June 21, 2004, the applicant responded to the RAI. The following section describes RAI 3.3.2.5.1-1, the responses to this RAI, and the staff's evaluation of the responses.

RAI 3.3.2.4.5-1

For stainless steel components in a treated borated water environment, the staff asked the applicant to clarify whether loss of fracture toughness/thermal aging embrittlement is an applicable aging effect. The staff also asked the applicant to provide the technical basis if this aging effect is not applicable or otherwise specify the applicable AMP.

In its response by letter dated June 21, 2004, the applicant stated that loss of fracture toughness can occur in cast stainless steel materials exposed to temperatures greater than 250 °C (482 °F). The applicant clarified that components on the tube-side inlet and shell-side outlet of the regenerative heat exchanger are exposed to temperatures above the threshold, but none are constructed of cast austenitic stainless steel. The applicant concluded that fracture toughness is not an aging effect requiring management for CVCS components.

The staff reviewed the applicant's response and found it to be adequate and acceptable because the applicant indicated that the stainless steel used in the CVCS at temperatures above 250 °C (482 °F) is not cast austenitic and is therefore not susceptible to loss of fracture toughness.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAIs, the staff finds that the aging effects of the CVCS component types that are not addressed by the GALL Report and the specific component types that are addressed in the GALL Report and are within the scope of technical review are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the CVCS.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-5 of the LRA identifies the following AMPs for managing the aging effects described above for managing the aging effects described above for the CVCS:

- Water Chemistry Control Program (Appendix B.1.30)
- Oil Analysis Program (Appendix B.1.17)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Bolting and Torquing Activities Program (Appendix B.1.2)
- Boric Acid Corrosion Prevention Program (Appendix B.1.3)
- TLAA—Metal Fatigue Program (4.3)

The staff's detailed review of these AMPs appears in Sections 3.0.3.1, 3.0.3.3.6, 3.0.3.3.7, 3.0.3.3.2, and 3.0.3.2.1 of this SER, respectively. Section 4.3 of this SER contains the staff's evaluation of the TLAA—Metal Fatigue Program.

The applicant credits the Water Chemistry Control Program with managing the loss of material aging effect on the stainless steel components exposed to treated borated water. During its review, the staff determined that it needed additional information and issued RAI 3.3-2. Section 3.3.2.3.0 of this SER describes RAI 3.3-2, the applicant's response to this RAI, and the staff's evaluation of the response.

For the CVCS pump casing, the applicant identified cracking-fatigue as an aging effect managed with the Periodic Surveillance and Preventive Maintenance Program (AMP B.1.18). This aging effect is not included in the detection of aging effects program element description in Appendix B, Section B.1.18, to the LRA. By letter dated March 24, 2004, the applicant stated that cracking-fatigue is identified as an aging effect for the CVCS pump casing (page 3.3-84 of the LRA) in Table 3.3.2-5 with the PSPM Program as an AMP. Cracking-fatigue should be included as an aging effect for the CVCS charging pumps in the "detection of aging effects" program element of Appendix B, Section B.1.18, to the LRA. Based on its review of the applicant's response, the staff finds the correction to the "detection of aging effects" program element for the PSPM AMP acceptable.

The staff reviewed the CVCS stainless steel components exposed to an air environment. The staff has observed that stainless steel components exposed to air/gas, containment air, indoor air (not air-conditioned), and outdoor environments show no aging effect. The GALL Report does not identify an air/gas environment for these components and materials. The staff finds that no aging effects are applicable, and thus, the absence of an AMP for stainless steel components exposed to air is acceptable.

For the management of cracking in the stainless steel regenerative heat exchanger exposed internally to treated borated water greater than 132 °C (270 °F) (page 3.3-83 of the LRA), the applicant credited the Water Chemistry Control Program.

The GALL Report, Volume 2, Item VII.E1.7-c, calls for augmentation of water chemistry control by verification that cracking is absent using temperature and radioactivity monitoring of the shell-side water and eddy-current testing of tubes. The applicant responded that the heat exchanger tubes are not required to satisfy the pressure boundary function of the regenerative heat exchanger. On this basis, the staff finds the response acceptable.
On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAIs, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the CVCS component types that are not addressed by the GALL Report and those specific component types addressed in the GALL Report that are within the scope of the technical review. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the chemical and volume control system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.6 Halon Fire Protection and Reactor Coolant Pump Motor Oil Leakage Collection System

Summary of Technical Information in the Application

Section 2.3.3.6 of this SER describes the Halon fire protection system and the RCP Motor Oil Leakage Collection system. Table 2.3.3-6 of the LRA identifies the passive, long-lived components of this system that are subject to an AMR. Tables 3.3.1 and 3.3.2-6 summarize the components, aging effects, and AMPs.

Aging Effects

Table 2.3.3.6 of the LRA lists the fire protection components that are within the scope of license renewal and subject to an AMR. These components include bolting, flex hose, indicator housing, nozzle, pan, piping, tank, tubing, and valve.

In Section 3.3.2.1.6 and Table 3.3.2-6 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The materials identified are aluminum, brass, carbon steel, cast bronze, glass, stainless steel, and stainless steel braid with Teflon liner.

The applicant identified the environments to which these materials could be exposed as air, Halon 1301, lube oil, nitrogen, and untreated borated water.

The applicant identified loss of material and loss of mechanical closure integrity as the aging effects associated with the fire protection system components.

Aging Management Programs

The LRA identifies the following programs that manage the aging effects related to the fire protection system.

- Boric Acid Corrosion Prevention (Appendix B.1.3)
- Periodic Surveillance and Preventive Maintenance (Appendix B.1.18)

Appendix B to the LRA describes these AMPs. The applicant indicated that these AMPs will adequately manage the effects of aging associated with the components of the fire protection system during the period of extended operation.

Staff Evaluation

The staff reviewed Table 3.3.2-6 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the Halon fire protection and RCP motor oil leakage collection system component groups.

The staff reviewed the LRA to determine whether the applicant demonstrated that it would adequately manage the effects of aging for the fire protection system during the extended period of operation, as required by 10 CFR 54.21(a)(3). The staff reviewed Section 3.3.2.1.6 and Tables 3.3.1 and 3.3.2-6 of the LRA for completeness, consistency with the GALL Report, and industry experience.

For these component types, the applicant identifies the following materials, environments, and AERMs:

- Stainless steel components subjected to untreated borated water (external) and lube oil (internal) environments are subject to the aging effects of loss of material.

- Carbon steel components exposed to inside air (external) and untreated borated water (external) environments are subject to the aging effects of loss of material.

- Carbon steel components subjected to air (external) and lube oil (internal) environments are subject to the aging effects of loss of material

- Carbon steel bolting exposed to untreated borated water environment is subject to loss of mechanical closure integrity.

- Carbon steel components exposed to untreated borated water (internal) environments are subject to loss of material.

Table 3.3.1 includes the RCP oil collection system under Item 3.3.1-6 and references Section 3.3.2.2.6.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects resulting from contact of the Halon fire protection system components and RCP motor oil collection system components with the environments described in Table 3.3.2-6 of the LRA are consistent with the GALL Report and industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant identified the applicable aging effects and associated AMPs, and they are appropriate for the combination of materials and environments listed.

Aging Management Programs

The applicant credits the following AMPs with managing the aging effects in the Halon fire protection and RCP motor oil leakage collection system:

- Boric Acid Corrosion Prevention Program (Appendix B.1.3)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)

These AMPs are credited with managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and found them acceptable for managing the aging effects identified for this system. These AMPs are evaluated in sections 3.0.3.2.1 and 3.0.3.3.7 of this SER.

During the onsite audit, the staff reviewed the stainless steel components of the Halon fire protection and RCP motor oil leakage collection system that are exposed to an air environment. The staff has observed that stainless steel components exposed to air/gas, containment air, indoor air (not air-conditioned), and outdoor environments show no aging effects. The GALL Report does not identify an air/gas environment for these components and materials. The staff finds that no aging effects requiring management are applicable, and thus, the absence of an AMP for stainless steel components exposed to air is acceptable.

On the basis of its review of the information provided by the applicant, the staff concludes that the applicant has credited the appropriate AMPs with managing the aging effects from the materials and environments associated with the Halon fire protection system and RCP motor oil collection system, and that the AMPs identified above will effectively manage these aging effects.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the spent fuel pool components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.7 Fuel Oil System

Summary of Technical Information in the Application

In Section 3.3.2.1.7 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the fuel oil system components:

- Bolting and Torquing Activities Program (Appendix B.1.2)
- Buried Piping Inspection Program (Appendix B.1.4)
- Oil Analysis Program (Appendix B.1.17)
- System Walkdown Program (Appendix B.1.28)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Diesel Fuel Monitoring Program (Appendix B.1.7)

In Table 3.3.2-7 of the LRA, the applicant summarized the AMRs for the fuel oil system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-7 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the fuel oil system component groups.

The technical staff reviewed the AMR of the fuel oil system component/material/ environment/AERM combinations that are not addressed in the GALL report and specific combinations addressed in the GALL report within the scope of the technical review. Component AERM combinations not addressed in GALL use note F through J in LRA Table 3.3.2-7. Material and environment combinations addressed in GALL without a comparable component use note 301. The staff determined that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

The technical staff reviewed the AMR of the fuel oil system component/material/environment/ AERM combinations that are not addressed in the GALL Report and specific combinations addressed in the GALL Report that are within the scope of the technical review. Component AERM combinations not addressed in the GALL Report use Notes F through J in LRA Table 3.3.2-7. Material and environment combinations addressed in the GALL Report without a comparable component use Note 301. The staff determined that the applicant identified all applicable AERMs and credited appropriate AMPs with managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.3-7 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include bolting, filter, filter housing, flame arrestor, flex hose, heat exchanger (tubes), indicator housing, injector housing, orifice, piping, tank, thermowell, tubing, and valves.

For these component types, the applicant identified the following materials, environments, and AERMs:

- Carbon steel, copper alloys, elastomer, and stainless steel components exposed to fuel oil environment are subject to the aging effects of loss of material. In the same fuel oil environment, stainless steel and elastomer components are subject to the additional aging effects of cracking and change of material properties.

- Carbon steel components in air, lube oil, outdoor air, and sand and concrete environments are subject to loss of material.

- In an outdoor environment, loss of material is an applicable aging effect for carbon steel with aluminum fin and copper alloy components.

- Copper alloy components in an air environment and aluminum and stainless steel components exposed to an outdoor air environment experience no applicable aging effects.

- Carbon steel and stainless steel bolting exposed to air and managed by the Bolting and Torquing Activities Program is subject to loss of mechanical closure integrity.

The staff reviewed the information in Section 2.3.3.7, Table 2.3.3-7, Section 3.3.2.1.7, and Table 3.3.2-7 in the LRA. During its review, the staff determined that it needed additional information. The RAIs were organized in two groups, general RAIs and system-specific RAIs. A general RAI applicable to this system is RAI 3.3-3.

By letter dated May 5, 2004, the staff asked the applicant for additional information on the issues described in RAI 3.3-3. By letter dated May 25, 2004, the staff requested additional information on the issues described in RAI 3.3-6. By letter dated June 21, 2004, the applicant responded to the RAIs. Section 3.3.2.3.0 of this SER describes the RAI, the applicant's responses, and the staff's evaluation of the responses.

By the same letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in the system-specific RAI 3.3.2.4.7-1. By letter dated June 21, 2004, the applicant responded to this RAI. The following section describes RAI 3.3.2.4.7-1, the responses to this RAI, and the staff's evaluation of the responses.

RAI 3.3.2.4.7-1

The LRA identifies cracking as an applicable aging effect for some stainless steel components in a fuel oil environment (such as filter and thermowell) but not others in the same environment (such as indicator housing and orifice). The staff asked the applicant to clarify the environments, including temperatures, applicable to stainless steel components in the fuel oil system to justify the difference in the identified aging effects.

In its response, by letter dated June 21, 2004, the applicant stated that cracking is identified as an aging effect requiring management for stainless steel components in fuel oil when the fluid temperature can exceed 60 °C (140 °F) and there is a potential for water in the oil. The applicant clarified that portions of the fuel oil system for the alternate ac diesel, emergency diesel generator, and fire pump diesel can exceed 60 °C (140 °F) during engine operation. The applicant further stated that for these portions of the fuel oil system, it identified cracking as an aging effect for stainless steel components. Finally the applicant stated that stainless steel components in the remainder of the fuel oil system are not exposed to temperatures in excess of 60 °C (140 °F).

The staff reviewed the applicant's response and found it to be acceptable and adequate because the applicant indicated that portions of the fuel oil system can exceed 60 °C (140 °F) during engine operation and for these portions of the fuel oil system, cracking was identified as an aging effect for stainless steel components, while stainless steel components in the remainder of the fuel oil system are not exposed to temperatures in excess of 60 °C (140 °F).

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAIs, the staff finds that the aging effects of the fuel oil system component types that are not addressed by the GALL Report and those specific component types addressed in the GALL Report that are within the scope of the technical review are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components of the fuel oil system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-7 of the LRA identifies the following AMPs for managing the aging effects described above for the fuel oil system:

- Diesel Fuel Monitoring Program (Appendix B.1.7)
- System Walkdown Program (Appendix B.1.28)
- Oil Analysis Program (Appendix B.1.17)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Bolting and Torquing Activities Program (Appendix B.1.2)

The staff's detailed review of these AMPs appears in Sections 3.0.3.2.3, 3.0.3.3.9, 3.0.3.3.6, 3.0.3.3.7 and 3.0.3.3.2 of this SER, respectively.

The applicant credits the Periodic Surveillance and Preventive Maintenance Program with managing flex hose exposed to an internal fuel oil environment. During its review, the staff determined that it needed additional information and issued RAI 3.3-3. Section 3.3.2.3.0 of this SER describes RAI 3.3-3, the applicant's response to this RAI, and the staff's evaluation of the response.

The staff asked the applicant to provide a technical basis for treating cast iron components in the fuel oil system in a manner similar to carbon steel components. The applicant's position is that the aging effects for carbon steel and cast iron in this environment are the same. The staff agrees that use of an AMP considered acceptable for carbon steel is appropriate for these components.

The applicant credited the System Walkdown Program (AMP B.1.28) with managing the aging effects of loss of material of heat exchangers (tubes) made of carbon steel with aluminum fins in external air. In Note 302 of the table, the applicant states that the aging effect applies only to the carbon steel portion of the component. The staff finds that aluminum is corrosion resistant in a dry air environment and that there are no applicable aging effects requiring aging management. On that basis, the staff finds the applicant's position acceptable.

The staff reviewed the fuel oil system stainless steel components exposed to an air environment. The staff has observed that stainless steel components exposed to air/gas, containment air, indoor air (not air-conditioned), and outdoor environments show no aging effects. The GALL Report does not identify an air/gas environment for these components and materials. The staff finds that no aging effects are applicable, and thus, the absence of an AMP for stainless steel components exposed to air is acceptable.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAI, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the fuel oil system component types that are not addressed by the GALL Report and those specific component types addressed in the GALL Report that are within the scope of the technical review. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the fuel oil system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.8 Service Water System

Summary of Technical Information in the Application

In Section 3.3.2.1.8 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the service water system components:

- Buried Piping Inspection Program (Appendix B.1.4)
- System Walkdown Program (Appendix B.1.28)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Service Water Integrity Program (Appendix B.1.24)

In Table 3.3.2-8 of the LRA, the applicant summarized the AMRs for the service water system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-8 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the service water system component groups.

The staff reviewed the AMR of the service water system component/material/environment/ AERM combinations that are not addressed in the GALL report and specific combinations addressed in the GALL report within the scope of the technical review. Component AERM combinations not addressed in the GALL report use note F through J in LRA Table 3.3.2-8. Material and environment combinations addressed in GALL without a comparable component use note 301. The staff determined that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

Table 2.3.3-8 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include bolting, expansion joint, filter housing, flow straightener, orifice, piping, thermowell, tubing, and valves.

For these component types, the applicant identifies the following materials, environments, and AERMs:

- Stainless steel components exposed to a condensation environment experience loss of material.

- In a fresh raw water environment, stainless steel components are subject to the aging effect of cracking.

- Carbon steel and stainless steel bolting in a fresh raw water environment or condensation are subject to loss of material.

The staff reviewed the information in Section 2.3.3.8, Table 2.3.3-8, Section 3.3.2.1.8, and Table 3.3.2-8 in the LRA. During its review, the staff determined that it needed additional information.

The RAIs are organized in two groups, general RAIs and system-specific RAIs. There are no general RAIs applicable to this system.

By letter dated May 5, 2004, the staff asked the applicant for additional information on the issues described in the system-specific RAI 3.3.2.4.8-1 and RAI 3.3.2.4.8-2. By letter dated June 21, 2004, the applicant responded to the RAIs. The following section describes RAI 3.3.2.4.8-1 and RAI 3.3.2.4.8-2, the applicant's responses to these RAIs, and the staff's evaluation of the responses.

RAI 3.3.2.4.8-1

The LRA does not identify biofouling as an aging effect/mechanism in the service water system. The GALL Report identifies biofouling as an aging effect/mechanism for service water systems. The staff asked the applicant to clarify what aging effect due to biofouling and/or silting is applicable to service water components. If this applicable aging effect is not loss of material, the applicant should clarify which specific AMP is applicable to manage biofouling in service water components.

In its response, by letter dated June 21, 2004, the applicant stated that biofouling and silting can create conditions that are conducive to the aging mechanisms of pitting, crevice corrosion, and microbiologically influenced corrosion. The applicant concluded that loss of material is the applicable aging effect resulting from the mechanisms of pitting, crevice corrosion, and microbiologically influenced corrosion for the service water system.

The staff reviewed the applicant's response and found it to be acceptable and adequate because the applicant clarified that biofouling and silting can create conditions that are conducive to the aging mechanisms of pitting, crevice corrosion, and microbiologically influenced corrosion, and that loss of material is the applicable aging effect.

RAI 3.3.2.4.8-2

Table 3.3.2-8 of the LRA identifies loss of material as an aging effect requiring aging management for the stainless steel expansion joints, but cracking is not addressed. Industry documents such as EPRI Report 1008035, "Expansion Joint Maintenance Guide," Revision 1, dated May 2003, indicate that stainless steel expansion joints are susceptible to cracking when exposed to contaminants. The staff asked the applicant to identify if cracking is considered an aging effect for these expansion joints and to explain how the credited AMPs effectively manage cracking, if applicable.

In its response, by letter dated June 21, 2004, the applicant stated that stainless steel is susceptible to cracking when exposed to contaminants and temperatures above 60 °C (140 °F). The applicant clarified that the service water system stainless steel expansion joints subject to AMR are located in the service water pump discharge lines, and these expansion joints are exposed to temperatures well below the 60 °C (140 °F) threshold for cracking. The applicant also stated that these expansion joints are constructed of nickel-based alloy which is more resistant to SCC than 300-series stainless steels. The applicant concluded that cracking is not an aging effect requiring management for the stainless steel expansion joints in the service water system.

The staff reviewed the applicant's response and found it to be acceptable and adequate because the applicant clarified that the service water system stainless steel expansion joints subject to AMR are exposed to temperatures well below the 60 °C (140 °F) threshold for cracking, and that these expansion joints are constructed of nickel-based alloy which is more resistant to SCC than 300-series stainless steels.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAIs, the staff finds that the aging effects of the service water system component types that are not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the service water system.

<u>Aging Management Programs</u>

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-8 of the LRA identifies the following AMPs for managing the aging effects described above for the service water system:

- System Walkdown Program (Appendix B.1.28)
- Service Water Integrity Program (Appendix B.1.24)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Bolting and Torquing Activities Program (Appendix B.1.2)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.9, 3.0.3.2.7, 3.0.3.3.7, and 3.0.3.3.2 of this SER, respectively.

During the audit, the staff asked the applicant to justify, for service water system component types in LRA Table 3.3.2-8 that are consistent with the GALL Report (LRA Note A), that the AMP applied to carbon steel remains applicable to cast iron in a similar environment.

By letter dated March 24, 2004, the applicant stated that where selective leaching is possible, it credits an additional program unless the one specified program will manage selective leaching (such as the Diesel Fuel Monitoring and Oil Analysis Programs). Selective leaching does not normally occur in air, lube oil, or fuel oil because the environment is not aqueous. In its response, the applicant further stated that if cast iron components are gray cast iron and are exposed to an environment conducive to selective leaching, then they are managed by the Periodic Surveillance and Preventive Maintenance Program, Service Water Integrity Program, or Fire Protection Program that includes the management of loss of material due to selective leaching. Because these programs manage the aging effects of selective leaching for gray cast iron components, the staff finds this approach acceptable.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAIs, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the service water system component types that are not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the service water system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.9 Auxiliary Building Ventilation System

Summary of Technical Information in the Application

In Section 3.3.2.1.9 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the auxiliary building ventilation system components:

- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Service Water Integrity Program (Appendix B.1.24)

In Table 3.3.2-9 of the LRA, the applicant summarized the AMRs for the auxiliary building ventilation system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-9 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the auxiliary building ventilation system component groups.

The staff reviewed the AMR of the auxiliary building ventilation system component/material/environment/AERM combinations that are not addressed in the GALL Report. Component AERM combinations not addressed in the GALL Report use Notes F through J in LRA Table 3.3.2-9. The staff determined that the applicant had identified all applicable AERMs and had credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.3-9 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The components that do not rely on the GALL Report for AMR include heat exchanger (tubes) and tubing.

For these component types, the applicant identifies the following materials, environments, and AERMs:

- Copper alloy components exposed to condensation are subject to the aging effects of fouling and loss of material—wear.
- In a fresh raw water environment, the same components are subject only to fouling.
- In both air and Freon environments, copper alloy components experience no aging effects requiring management.

The staff reviewed the information in Section 2.3.3.9, Table 2.3.3-9, Section 3.3.2.1.9, and Table 3.3.2-9 in the LRA. There are no RAIs related to aging effects for this system.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects of the auxiliary building ventilation system component types that are not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the auxiliary building ventilation system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-9 of the LRA identifies the following AMPs for managing the aging effects described above for the auxiliary and radwaste area ventilation system:

- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Service Water Integrity Program (Appendix B.1.24)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.7 and 3.0.3.2.7 of this SER, respectively.

The staff reviewed the auxiliary building ventilation system component groups exposed to an air environment. The staff has observed that stainless steel components exposed to air/gas, containment air, indoor air (not air-conditioned), and outdoor environments show no aging effect. The GALL Report does not identify an air/gas environment for these components and materials. The staff finds that no aging effects are applicable, and thus, the absence of an AMP for stainless steel components exposed to air is acceptable.

On the basis of its review of the information provided in the LRA, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the auxiliary building ventilation system component types that are not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the auxiliary building ventilation system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.10 Control Room Ventilation System

Summary of Technical Information in the Application

In Section 3.3.2.1.10 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the control ventilation system components:

- System Walkdown Program
- Periodic Surveillance and Preventive Maintenance Program
- Service Water Integrity Program

In Table 3.3.2-10 of the LRA, the applicant summarized the AMRs for the control ventilation system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-10 of the LRA, which summarizes the results of AMR evaluations in the SRP-LR for the control room ventilation system component groups.

The staff reviewed the AMR of the control room ventilation system component/material/ environment/AERM combinations that are not addressed in the GALL Report and specific combinations addressed in the GALL Report that are within the scope of the technical review. These combinations use Notes F through J in LRA Table 3.3.2-10. Material and environment combinations addressed in the GALL Report without a comparable component use Note 301. The staff determined that the applicant has identified all applicable AERMs and has credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.3-10 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The components that do not rely on the GALL Report for AMR include bolting, compressor casing, damper housing, filter housing, heat exchanger (shell), heat exchanger (tubes), indicator housing, sight glass, sight glass housing, tubing, and valves.

For these component types, the applicant identifies the following materials, environments, and AERMs:

- Copper alloy components exposed to condensation and lube oil environments are subject to the aging effect of loss of material. In a fresh raw water environment, these components experience fouling.
- Carbon steel components in a lube oil environment are also subject to loss of material.
- Aluminum, glass, and stainless steel components in air do not experience aging effects.
- There is no aging effect for carbon steel components in a carbon dioxide environment.
- In a Freon environment, both carbon steel and copper alloy components experience no applicable aging degradation.
- Neither glass nor stainless steel components in a condensation environment experience aging effects.
- In an air environment, copper alloy components, in general, do not experience aging degradation. However, copper alloy heat transfer tube components in an air environment are subject to fouling.

The staff reviewed the information in Section 2.3.3.10, Table 2.3.3-10, Section 3.3.2.1.10, and Table 3.3.2-10 in the LRA. During its review, the staff determined that it needed additional information. The RAIs were organized in two groups, general RAIs and system-specific RAIs. There are no general RAIs applicable to the control room ventilation system.

By letter dated May 5, 2004, the staff requested the applicant to provide additional information on the issues described in the system-specific RAI 3.3.2.4.10-1. By letter dated June 21, 2004, the applicant responded to the RAI. The following section describes RAI 3.3.2.4.10-1, the applicant's responses to the RAI, and the staff's evaluation of the responses.

RAI 3.3.2.4.10-1

The LRA states that all components in a carbon dioxide environment are not subject to any aging effect. Dry carbon dioxide is not a degrading environment for carbon steel, brass, or bronze components, but carbon steel components may be susceptible to corrosion in the presence of moisture in the carbon dioxide environment. The staff asked the applicant to clarify the degree of dryness of the carbon dioxide environment and to identify the activities in place to establish and maintain the degree of dryness of the carbon dioxide environment necessary to minimize aging degradation of carbon steel components during the period of extended operation, including the effects resulting from operations to replenish or refill the carbon dioxide.

In response, by letter dated June 21, 2004, the applicant stated that carbon dioxide is an environment only for the control room ventilation system. The applicant clarified that carbon steel bottles contain anhydrous (dry) carbon dioxide with a low level of impurities that minimizes the effects of aging on components. The applicant further stated that the carbon dioxide bottles are normally isolated from the system. The applicant concluded that, since the bottles are pressurized, moisture cannot be introduced into them. The applicant confirmed that refilling is done by a vendor according to vendor recommendations and that periodic monitoring of bottle pressure detects the occurrence of leaks and identifies the need for refilling.

The staff reviewed the applicant's response and found the response to be acceptable and adequate because the applicant indicated (1) that the carbon dioxide bottles containing anhydrous (dry) carbon dioxide with a low level of impurities are normally isolated from the system, and since they are pressurized, moisture cannot be introduced into the bottles, and (2) periodic monitoring of bottle pressure detects the occurrence of leaks and identifies the need for refilling.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects of the control room ventilation system component types that are not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects for the combinations in LRA Table 3.3.2-10 using Notes F through J. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the control room ventilation system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-9 of the LRA identifies the following AMPs for managing the aging effects described above for the control room ventilation system:

- System Walkdown Program (Appendix B.1.28)
- Periodic Surveillance and Preventive Maintenance Program (Appendix B.1.18)
- Service Water Integrity Program (Appendix B.1.24)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.9, 3.0.3.3.7, and 3.0.3.2.7 of this SER, respectively.

The staff reviewed the control room ventilation system stainless steel components exposed to an air environment. The staff observed that stainless steel components exposed to air/gas, containment air, indoor air (not air-conditioned), and outdoor environments show no aging effects. The GALL Report does not identify an air/gas environment for these components and materials. The staff finds that no aging effects are applicable, and thus, the absence of an

AMP for stainless steel components exposed to air is acceptable.

On the basis of its review of the information provided in the LRA, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the control room ventilation system component types that are not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the control room ventilation system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions can be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.2.3.11 Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)

Summary of Technical Information in the Application

In Section 3.3.2.1.11 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the miscellaneous systems in scope for 10 CFR 54.4(a)(2) components:

- Bolting and Torquing Activities Program
- Boric Acid Corrosion Prevention Program
- Flow-Accelerated Corrosion Program
- System Walkdown Program
- Water Chemistry Control Program

In Table 3.3.2-11 of the LRA, the applicant summarized the AMRs for the miscellaneous systems in scope for 10 CFR 54.4(a)(2) components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.3.2-11 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the miscellaneous systems in scope for 10 CFR 54.4(a)(2) component groups.

The staff reviewed the AMR of the miscellaneous systems in scope for 10 CFR 54.4(a)(2) component/material/environment/AERM combinations in various systems that, in general, are not addressed in the GALL Report. These combinations use Note 304 in LRA Table 3.3.2-11. The staff determined that the applicant had identified all applicable AERMs and had credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

Aging Effects

Table 2.3.3-11 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The components that do not rely on the GALL Report for AMR include bolting, filter housing, heat exchanger (shell, channel head), heat exchanger (heating or cooling coil when not enclosed in a housing), level glass gauge, orifice, piping, pump casing, tank, thermowell, tubing, valve, and ventilation unit housing.

For these component types, the applicant identified the following materials, environments, and AERMs:

- In an air environment, aluminum, carbon steel, and carbon steel (coated) components are subject to loss of material. In the same environment, copper alloy, glass and stainless steel components experience no aging effect.
- In both condensation and treated water environments, aluminum, carbon steel copper alloy, and stainless steel components experience the aging effect of loss of material.
- In a hydrazine/ammonia environment, stainless steel components are subject to loss of material and cracking. Carbon steel, copper alloy, and stainless steel components experience loss of material, but glass components in the same environment experience no aging effects.
- In steam or treated water greater than 104 °C (220 °F), carbon steel components are subject to cracking-fatigue, loss of material, and erosion.
- Stainless steel components experience loss of material and cracking in sodium hydroxide, treated borated water greater than 60 °C (140 °F), treated borated water greater than 132 °C (270 °F), and untreated water greater than 60 °C (140 °F).
- Stainless steel components experience cracking-fatigue in treated borated water greater than 132 °C (270 °F).
- In an untreated water environment, carbon steel, carbon steel (coated) copper alloy, and stainless steel components are subject to loss of material.
- Stainless steel components in an untreated borated water environment experience loss of material.
- Carbon steel bolting exposed to air and condensation is subject to loss of material and loss of mechanical closure integrity.

The staff reviewed the information in Section 2.3.3.11, Table 2.3.3-11, Section 3.3.2.1.11, and Table 3.3.2-11 in the LRA. During its review, the staff determined that it needed additional information. The RAIs were organized in two groups, general RAIs and system-specific RAIs. General RAIs applicable to this system include RAIs 3.3-1 and 3.3-2.

By letter dated May 5, 2004, the staff asked the applicant to provide additional information on the issues described in RAIs 3.3-1 and 3.3-2. By letter dated June 21, 2004, the applicant responded to the RAIs. Section 3.3.2.3.0 of this SER describes the general RAIs, applicant's responses, and the staff's evaluation of the responses.

On the basis of its review of the information provided in the LRA, the staff finds that the aging effects of the above miscellaneous systems in scope for 10 CFR 54.4(a)(2) component types that are not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects for the combinations in LRA Table 3.3.2-11 using Notes F through J. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the above components in the miscellaneous systems in scope for 10 CFR 54.4(a)(2).

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also determined that the UFSAR Supplement contains an adequate description of the program.

Table 3.3.2-9 of the LRA identifies the following AMPs for managing the aging effects described above for the miscellaneous systems in scope for 10 CFR 54.4(a)(2):

- System Walkdown Program (Appendix B.1.28)
- Flow-Accelerated Corrosion Program (Appendix B.1.11)
- Water Chemistry Control Program (Appendix B.1.30)
- Bolting and Torquing Activities Program (Appendix B.1.2)
- Boric Acid Corrosion Prevention Program (Appendix B.1.3)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.9, 3.0.3.1, 3.0.3.3.11, 3.0.3.3.2, and 3.0.3.2.1 of this SER, respectively.

The applicant credits the Water Chemistry Control Program with managing aging effects in the stainless steel, carbon steel, copper alloy, and aluminum components exposed to treated borated water or treated water. During its review, the staff determined that it needed additional information and issued RAI 3.3-2. Section 3.3.2.3.0 of this RAI describes RAI 3.3-2, the applicant's response to this RAI, and the staff's evaluation of the response.

By letter dated May 5, 2004, the staff asked the applicant for additional information on the issues described in the system-specific RAI 3.3.2.4.11-1. By letter dated June 21, 2004, the applicant responded to the RAI. The following section describes RAI 3.3.2.4.11-1, the applicant's responses to this RAI, and the staff's evaluation of the responses.

RAI 3.3.2.4.11-1

Table 3.3.2-11 of the LRA identifies various components exposed internally to treated water and other environments with a pressure boundary function. The applicant credited the System

Walkdown and Water Chemistry Control Programs with managing the loss of material and cracking of the internal surfaces of these components. The system walkdown is a visual inspection of external surfaces. The staff asked the applicant to clarify how a visual inspection of external surfaces assures that internal surfaces are effectively managed when the internal and external environments are different. If evidence of leakage is necessary to determine if an aging effect has occurred, the staff asked the applicant to provide technical justification that a failure of the pressure boundary is acceptable.

In its response, by letter dated June 21, 2004, the applicant cited five programs credited with managing aging effects for equipment that meets the 10 CFR 54.4(a)(2) criteria. Although three of the programs do not require leakage detection, the applicant explained that the System Walkdown Program manages the effects of aging by detecting leakage through visual inspections. The applicant addressed long-term and short-term exposure effects resulting from the leakage which would be detected by walkdowns and other normal plant operational activities. The applicant concluded that the operating experience and routine operator rounds/system walkdowns, in conjunction with a Flow-Accelerated Corrosion Program, Water Chemistry Program, Bolting and Torquing Activities Program, and Boric Acid Corrosion Prevention Program, provide assurance that leaks from nonsafety-related SSCs will not preclude the satisfactory accomplishment of required safety functions.

Staff Evaluation of the Applicant's Response

The staff reviewed the applicant's response to RAI 3.3.2.4.11-1 and does not concur that the external visual inspections for leakage are appropriate for managing internal aging effects for (a)(2) system components using the System Walkdown Program alone. For all components within license renewal scope, the staff requires AMPs to prevent fluid leaks rather than only detecting and mitigating the consequences of the leak. An NRC letter to NEI dated March 15, 2002, clarified that the applicant has two options when performing its scoping evaluation for nonsafety-related SSCs. If the applicant cannot demonstrate that the mitigative features (e.g., spray and drip shields, seismic supports, flood barriers, etc.) are adequate to protect safety-related SSCs from the consequences of failures of nonsafety-related SCCs, then the applicant should use the preventive option by including the nonsafety-related SCCs within scope. Since the ANO-2 nonsafety-related SSCs are within scope, the preventive action is applicable with appropriate preventive rather than mitigative AMPs. Leak detection is considered a mitigative program, and internal inspections are considered a preventive program. The staff explained this concern to the applicant in a phone call on June 22, 2004, and the applicant agreed to supply additional information regarding aging management of system components that rely only on the plant walkdown program. On July 2, 2004, the applicant provided additional information to support the aging management of (a)(2) components. This response states that, for the nine pressurized systems containing raw or untreated water, operating experience and maintenance inspections have not identified any abnormal corrosion in 25 years of operation.

The staff was concerned that the use of external visual inspections alone is not appropriate to manage internal aging effects. By letter dated September 10, 2004, the applicant stated that ANO-2 will implement a one-time inspection program for the components subject to aging management review that were included for 10CFR54.4(a)(2) in the following systems:

- Auxiliary building heating and ventilation
- Auxiliary building sump

- Drain collection header
- Liquid radwaste management
- Post accident sampling
- Resin Transfer
- Regenerative waste
- Spent Resin

The applicant response further stated that the one-time inspection program will be consistent with NUREG-1801 Vol.2, XI.M32, one-time inspection and a new SAR Section A.2.1.34 was included.

The staff was concerned that one-time inspections may not be appropriate for systems containing raw or untreated water unless there is sufficient data to conclude that degradation is not occurring or is occurring very slowly. The staff was also concerned that the one-time inspection program does not apply to the floor drains in the turbine building sump system. GALL AMP XI.M32 states that one-time inspections or any other action or program are to be reviewed by the staff on a plant-specific basis. The applicant was requested to submit for review their Appendix B program for one-time inspections. The applicant was requested to justify that one-time inspections are appropriate rather than periodic inspections. For example, the applicant was requested to clarify that, for these systems, there is sufficient data to conclude that degradation is not expected to occur or is expected to progress very slowly and that follow-up examinations would be performed to monitor the progression of any aging degradation. The applicant was also requested to justify why one-time inspections are not required for the in scope floor drains in the turbine building sump system.

By letter dated September 23, 2004, the applicant clarified that the one-time inspection will be performed near the end of the current operating term and aging of these components, if any, should progress slowly. The applicant indicated that, if loss of material due to corrosion is found, an evaluation will be performed to determine the rate of corrosion and appropriate corrective action taken. The applicant also stated that the turbine building sump system will be included with the eight systems managed by the one-time inspection program.

This response is adequate and acceptable to resolve the staff's concern regarding one-time inspections for 10CFR54.4(a)(2) components because the applicant has identified that the aging effects should progress very slowly in these components and the turbine building sump system will also be managed by the one-time inspection program. All issues related to RAI 3.3.2.4.11-1 are resolved.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAIs, the staff finds the applicant has identified appropriate AMPs for managing the aging effects of the miscellaneous systems in scope for 10CFR54.4(a)(2) component types that are not addressed by the GALL report. In addition, the staff finds the program descriptions in the UFSAR supplement acceptable.

3.3.2.4.12 Miscellaneous Components

During the site inspection that was conducted by the staff on November 15 through 19, 2004, a walk-down of various systems was conducted. The staff noted that several component types that were brought into the scope of license renewal as a result of RAI 2.1-4 were included in the scope of license renewal. The applicant stated that the material and environment combinations of these components had been previously reviewed by the NRC staff. In a letter dated February 28, the applicant submitted the a table describing the additional components. The staff reviewed the table and determined that the aging effects could be adequately managed by the AMP's credited for the components. The inspection item associated with this issue is closed.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and the AMPs credited with managing the aging effects for the miscellaneous system components that are not addressed by the GALL Report and those specific component types within the scope of the technical review, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable UFSAR Supplement program descriptions and concludes that the UFSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.3.3 Conclusion

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the aging effects associated with the auxiliary systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging of the auxiliary systems, as required by 10 CFR 54.21(d).

3.4 Steam and Power Conversion Systems

This section of the SER documents the staff's review of the applicant's AMR results for the steam and power conversion system components and component groups associated with the following systems:

- main steam system
- main feedwater system
- emergency feedwater system

3.4.1 Summary of Technical Information in the Application

In Section 3.4 of the LRA, the applicant provided the results of the AMRs of the main steam, main feedwater, and emergency feedwater system components and component types listed in Tables 2.3.4-1 through 2.3.4-3 of the LRA. The applicant also listed the materials, environments, aging effects requiring management, and AMPs associated with each system.

In Table 3.4.1, "Summary of the Aging Management Programs for the Steam and Power Conversion System Evaluated in Chapter VIII of NUREG-1801," of the LRA, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the main steam, main feedwater, and emergency feedwater system components and component types. In Section 3.4.2.2 of the LRA, the applicant provided information concerning Table 3.4.1 components for which the GALL Report recommends further evaluation.

3.4.2 Staff Evaluation

The staff reviewed LRA Section 3.4 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff performed an audit and review to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. Section 3.0.3 of this SER documents the staff's evaluations of the AMPs. The staff's audit and review findings are documented in the audit report issued on August 19, 2004 and summarized in Section 3.4.2.1 of this SER.

The staff also performed an audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. During the audit, the staff determined that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.4.2.2 of the SRP-LR. The staff's audit findings are documented in the audit report and summarized in Section 3.4.2.2 of this SER.

The staff conducted a technical review of the remaining AMRs that were not consistent with the GALL Report. The review included evaluating whether the applicant had identified all plausible aging effects and whether the aging effects listed were appropriate for the combination of materials and environments specified. Section 3.4.2.3 of this SER documents the staff's review findings.

Finally, the staff reviewed the AMP summary descriptions in the FSAR Supplement to ensure that they adequately describe the programs credited with managing or monitoring aging for the reactor system components.

Table 3.4-1 below summarizes the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.4 that are addressed in the GALL Report.

Table 3.4-1 Staff Evaluation for Steam and Power Conversion System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping and fittings in main feedwater line, steam line, and auxiliary feedwater (AFW) piping (PWR only) (Item 3.4.1-1)	Cumulative fatigue damage	TLAA in accordance with 10 CFR 54.21(c))	TLAA—Metal Fatigue	Consistent with GALL, which recommends further evaluation
Piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head, and shell (except main steam system) (Item 3.4.1-2)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Water Chemistry Control (B.1.30), Periodic Surveillance and Preventive Maintenance (B.1.18)	Consistent with GALL, which recommends further evaluation
AFW piping (Item 3.4.1-3)	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Plant specific	Water Chemistry Control (B.1.30), PSPM (B.1.18), Service Water Integrity (B.1.24)	Consistent with GALL, which recommends further evaluation
Oil coolers in AFW system (lubricating oil side possibly contaminated with water) (Item 3.4.1-4)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, and MIC	Plant specific	Oil Analysis (B.1.17)	Consistent with GALL, which recommends further evaluation
External surface of carbon steel components (Item 3.4.1-5)	Loss of material due to general corrosion	Plant specific	System Walkdown (B.1.28)	Consistent with GALL, which recommends further evaluation
Carbon steel piping and valve bodies (Item 3.4.1-6)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion (B.1.11)	Consistent with GALL, which recommends no further evaluation

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Carbon steel piping and valve bodies in main steam system (Item 3.4.1-7)	Loss of material due to pitting and crevice corrosion	Water Chemistry	Water Chemistry Control (b.1.30)	Consistent with GALL, which recommends no further evaluation
Closure bolting in high-pressure or high-temperature systems (Item 3.4.1-8)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC	Bolting Integrity	System Walkdown (B.1.28), Bolting and Torquing Activities (B.1.2)	Consistent with GALL, which recommends no further evaluation
Heat exchangers and coolers/ condensers serviced by open-cycle cooling water (Item 3.4.1-9)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, MIC, and biofouling; buildup of deposits due to biofouling	Open-Cycle Cooling Water System	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation
Heat exchangers and coolers/ condensers serviced by closed-cycle cooling water (Item 3.4.1-10)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Closed-Cycle Cooling Water System	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation
External surface of aboveground condensate storage tank (Item 3.4.1-11)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Aboveground Carbon Steel Tanks	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation
External surface of buried condensate storage tank and AFW piping (Item 3.4.1-12)	Loss of material due to general, pitting, and crevice corrosion, MIC	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation Consistent with GALL, which recommends further evaluation
External surface of carbon steel components (Item 3.4.1-13)	Loss of material due to boric acid corrosion	Boric Acid Corrosion Prevention	Not Applicable to ANO-2	Consistent with GALL, which recommends no further evaluation

The staff's review of the ANO-2 steam and power conversion system and associated components followed one of several approaches. One approach, documented in Section 3.4.2.1, involves the staff's audit and review of the AMR results for components in the steam and power conversion system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.4.2.2, involves the staff's audit and review of the AMR results for components in the steam and power conversion system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.4.2.3, involves the staff's technical review of the AMR results for components in the steam and power conversion system that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. Section 3.0.3 of this SER documents the staff's review of AMPs that are credited with managing or monitoring the aging effects of the steam and power conversion system components.

3.4.2.1 AMR Results That Are Consistent with the GALL Report

In Sections 3.4.2.1.1 through 3.4.2.1.3 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the power and conversion system components:

- Bolting and Torquing Activities Program
- Flow-Accelerated Corrosion Program
- System Walkdown Program
- Water Chemistry Control Program
- Oil Analysis Program
- Periodic Surveillance and Preventive Maintenance Program

In Tables 3.4.2-1 through 3.4.2-3 of the LRA, the applicant summarized the AMRs for the steam and power conversion systems and identified which AMRs it considered to be consistent with the GALL Report.

The staff conducted an audit of the information provided in the LRA and program bases documents, which are available at the applicant's engineering office. On the basis of its audit, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicable aging effects were identified and are appropriate for the combination of materials and environments listed.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined that it had reviewed and accepted the identified exceptions to the GALL Report. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the AMR line item of the different component applies to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff determined that the AMR line item of the different component applies to the component under review. The staff determined that it had reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA and program bases documents, which are available at the applicant's engineering office. On the basis of its audit and review, the staff confirms that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant identified the applicable aging effects, and they are appropriate for the combination of materials and environments listed.

On the basis of its audit, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>Conclusion</u>

The staff has determined the applicant's claim of consistency with the GALL Report. The staff reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging in these components, as required by 10 CFR 54.21(d).

3.4.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application

In Section 3.4.2.2 of the LRA, the applicant provides further evaluation of aging management as recommended by the GALL Report for steam and power conversion systems. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, and crevice corrosion, microbiologically influenced corrosion, and biofouling
- general corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion
- quality assurance for aging management for nonsafety-related components

Staff Evaluation

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues in its additional evaluation. The staff also audited the applicant's further evaluations against the criteria contained in Section 3.4.2.2 of the SRP-LR. The audit report issued August 19, 2004, documents the details of the staff's audit.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.4.2.2.1 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA as defined in 10 CFR 54.3. In accordance with 10 CFR 54.21(c)(1), TLAAs must be evaluated in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

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

In Section 3.4.2.2.2 of the LRA, the applicant addressed the GALL Report recommendation for further evaluation to evaluate the effectiveness of the Water Chemistry Control Program in managing loss of material due to general, pitting, and crevice corrosion.

Section 3.4.2.2.2 of the SRP-LR states that the management of loss of material due to general, pitting, and crevice corrosion should be evaluated further for carbon steel piping and fittings, valve bodies and bonnets, pump casings, pump suction and discharge lines, tanks, tubesheets, channel heads, and shells except for main steam system components. It also recommends further evaluation of loss of material due to pitting and crevice corrosion for stainless steel tanks and heat exchanger/cooler tubes. The Water Chemistry Program relies on monitoring and control of water chemistry based on the EPRI guidelines of TR-102134 for secondary water chemistry to manage the effects of loss of material due to general, pitting, or crevice corrosion. However, corrosion may occur at locations of stagnant flow conditions. Therefore, the effectiveness of the Chemistry Control Program should be evaluated to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion to determine the effectiveness of the Water Chemistry Program. A one-time inspection of selected components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the components' intended function will be maintained during the period of extended operation.

For the components for which this evaluation is required, the applicant credited the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3) with managing loss of material. The Water Chemistry Control Program minimizes loss of material and provides for the inspection of systems when they are opened for maintenance, which addresses the verification program recommendation in the GALL Report. The applicant credited the Periodic Surveillance and Preventive Maintenance Program (AMP B.1.18) with supplementing the Water Chemistry Control Program for portions of the emergency feedwater system. The Water Chemistry Control Program provides for the inspection of systems when they are opened for maintenance, which addresses the one-time inspection recommendation in the GALL Report. The applicant's existing Primary and Secondary Water Chemistry Control Program relies on the EPRI guidelines of TR-102134 for secondary water chemistry to manage the effects of loss of material due to general, pitting, or crevice corrosion. The applicant does not have a one-time inspection program of selected components and susceptible locations, which is suggested in the GALL AMP XI.M32 as a means to determine the program's effectiveness. Rather, the applicant credited on-going routine maintenance and inspection activities with determining the effectiveness of the Primary and Secondary Water Chemistry Control Program.

The staff reviewed the effectiveness of the Primary and Secondary Water Chemistry Control Program by examining routine component inspections that are performed by chemistry, maintenance, and engineering staff when primary and secondary systems were opened for maintenance, when an adverse chemistry trend existed, or when requested by the chemistry or engineering departments. The components inspected have included areas that are susceptible to the aging effects identified in the LRA. The inspections performed include inspections in systems such as emergency feedwater and EDGs which are normally in standby, condensate storage tanks, feedwater heaters, moisture separator reheaters, chillers, main steam safety valves, and blowdown heat exchangers. All of these components have areas that are susceptible to the aging effects addressed in Section 3.4.2.2.2 of the LRA.

Seeking additional confirmation of the effectiveness of the Water Chemistry Programs, the staff reviewed operating experience documented in the applicant's engineering report, which included an audit of condition reports (CRs), CR trending data, and interviews with the applicant's technical staff regarding the Water Chemistry Program's operating experience. The operating experience review did not identify component failures or significant adverse conditions such as aging effects in the systems that were the result of an ineffective Water Chemistry Program. Also, the CR trending data did not identify recurrent component degradation occurring in the steam and power conversion systems. The audit of CRs, CR trending data, and personnel interviews provided additional confirmation of the effectiveness of the Primary and Secondary Water Chemistry Control Program.

The staff finds that the applicant has demonstrated that the effects of aging for loss of material will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation.

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

In Section 3.4.2.2.3 of the LRA, the applicant addressed loss of material in carbon steel piping and fittings for untreated water from the backup water supply in the emergency feedwater system.

Section 3.4.2.2.3 of the SRP-LR states that loss of material due to general corrosion, pitting, and crevice corrosion, MIC, and biofouling could occur in carbon steel piping and fittings for untreated water from the backup water supply in the auxiliary feedwater system. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

The applicant stated that it addressed the portion of the lines from the service water system to the emergency feedwater system that are exposed to untreated water as part of the service water system (LRA Item 3.3.1-17 of Table 3.3.1). With exceptions, the Service Water Integrity Program (AMP B.1.24) is the equivalent of the Open-Cycle Cooling System Program described in the GALL AMP XI.M20, "Open-Cycle Cooling Water System." Section 3.0.3.2.7 of this SER evaluates the Service Water Integrity Program.

The Service Water Integrity Program is supplemented by the Primary and Secondary Water Chemistry Control Program (AMP B.1.30.3) and the Periodic Surveillance and Preventive Maintenance Program (AMP B.1.18) which manage loss of material and fouling. Although biofouling is not, in itself, an aging effect, these programs manage the effects that may result from biofouling in carbon steel piping and fittings for untreated water from the backup water supply in the emergency feedwater system. The staff reviewed the Primary and Secondary Water Chemistry Control Program and the PSPM Program. Sections 3.0.3.1 and 3.0.3.3.7 of this SER, respectively, document the staff's evaluation of these programs. The staff finds that the PSPM Program effectively manages the aging effects of loss of material.

3.4.2.2.4 General Corrosion

In Section 3.4.2.2.4 of the LRA, the applicant stated that loss of material due to general corrosion could occur on external surfaces of carbon steel SCs, including closure bolting. The applicant credited the System Walkdown Program (AMP B.1.28) with managing loss of material for the external surfaces of carbon steel SCs, including bolting indoors and outdoors.

Section 3.4.2.2.4 of the SRP-LR states that loss of material due to general corrosion could occur on the external surfaces of all carbon steel SCs, including closure boltings, exposed to operating temperatures less than 212 °F. The GALL Report recommends further evaluation to ensure adequate management of this aging effect.

The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of this aging effect. Based on its review of the System Walkdown Program, the staff concludes that the program will adequately manage these aging effects. Section 3.0.3.3.9 of this SER documents the staff's evaluation of this program.

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

In Section 3.4.2.2.5 of the LRA, the applicant addressed (1) loss of material due to general corrosion (carbon steel only), pitting and crevice corrosion, and microbiologically influenced corrosion in stainless steel and carbon steel components exposed to lubricating oil in the emergency feedwater system and (2) loss of material in underground piping and fittings and storage tanks for steam and power conversion systems.

Section 3.4.2.2.5 of the SRP-LR addresses loss of material due to general corrosion (carbon steel only), pitting and crevice corrosion, and MIC which could occur in stainless steel and carbon steel shells, tubes, and tubesheets within the bearing oil coolers (for steam turbine pumps) in the auxiliary feedwater system. The GALL Report recommends further evaluation to ensure adequate management of these aging effects.

Section 3.4.2.2.5 of the SRP-LR also addresses loss of material due to general corrosion, pitting and crevice corrosion, and MIC, which could occur in underground piping and fittings and the emergency condensate storage tank in the auxiliary feedwater system and the underground condensate storage tank in the condensate 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 due to general corrosion, pitting and crevice corrosion, and MIC. The effectiveness of the Buried Piping and Tanks Inspection Program should be reviewed to evaluate an applicant's inspection frequency and operating experience with buried components, thus ensuring that loss of material is not occurring.

The applicant stated that the Oil Analysis Program (AMP B.1.17) manages the loss of material aging effect for stainless steel and carbon steel components exposed to lubricating oil in the emergency feedwater system. The staff review found that the Oil Analysis Program adequately manages the effects of aging of loss of material for stainless and carbon steel components exposed to lubricating oil. Section 3.0.3.3.6 of this SER documents the staff's evaluation of this AMP.

3.4.2.2.6 Quality Assurance for Aging Management for Nonsafety-Related Components

Section 3.0.4 of this SER provides the staff's evaluation of the applicant's Quality Assurance Program.

Conclusion

On the basis of its audit and review, the staff finds that the applicant's further evaluations, conducted in accordance with the GALL Report, are consistent with the acceptance criteria in Section 3.4.2.2 of the SRP-LR. Since the applicant's AMR results are otherwise consistent with the GALL report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3 AMR Results That Are Not Consistent with the GALL Report

Summary of Technical Information in the Application

In Tables 3.4.2-1 through 3.4.2-3 of the LRA, the applicant gave additional details of the results of the AMRs for material, environment, aging effects requiring management, and AMP combinations that are not evaluated in the GALL Report.

In Tables 3.4.2-1 through 3.4.2-3, the applicant indicated, via Notes F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report and provided information concerning how the aging effect will be managed.

Note F indicates that the material is not in the GALL Report for the identified component.

Note G indicates that the environment is not in the GALL Report for the identified component and material.

Note H indicates that the aging effect is not in the GALL Report for component, material, and environment combination.

Note I indicates that the aging effect in the GALL Report for the identified component, material, and environment combination is not applicable.

Note J indicates that neither the identified component nor the material and environment combination is evaluated in the GALL Report.

For component type, material, and environment combination that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant demonstrated that it will adequately manage the effects of aging so that the intended function will be maintained consistent with the CLB during the period of extended operation.

The staff evaluation is discussed below.

3.4.2.3.1 Main Steam System

Summary of Technical Information in the Application

In Section 3.4.2.1.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the main steam system components:

- Bolting and Torquing Activities
- Flow-Accelerated Corrosion
- System Walkdown
- Water Chemistry Control

In Table 3.4.2-1 of the LRA, the applicant summarized the AMRs for the main steam system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.4.2-1 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the main steam system component groups. The staff reviewed the AMR of the main steam system component/material/environment/AERM combinations that are not addressed in the GALL Report. These combinations use Notes F through J in LRA Table 3.4.2-1, except for those that had past precedents. The staff also reviewed those combinations in Table 3.4.2-1, with Notes A through E, which had associated emerging issues. The staff confirmed that the applicant had identified all applicable AERMs and had credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions were adequate.

The applicant identified no aging effects for stainless steel components exposed to air, including expansion joint, piping, thermowell, tubing, and valve component types. The GALL Report does not identify air as an environment for these components and materials.

On the basis of current industry research and operating experience, dry air on metal will not result in aging that will be of concern during the period of extended operation. The external environments referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Therefore, the staff concludes that there are no aging effects requiring management for stainless steels in an air environment.

Aging Effects

Table 2.3.4-1 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include bolting, expansion joint, orifice, piping, steam trap, thermowell, tubing, and valve.

For these component types, the applicant identified the following materials, environments, and AERMS:

- Carbon steel bolting in air (external) environments is subject to loss of material and loss of mechanical closure integrity.
- Carbon steel components in air (external), steam greater than 220 °F (internal), and treated water greater than 220 °F (internal) environments are subject to loss of material.
- Stainless steel bolting in air (external) environments is subject to loss of mechanical closure integrity.
- Stainless steel components in steam greater than 270 °F (internal) and treated water greater than 270 °F (internal) environments are subject to loss of material and cracking.
- Stainless steel components in air (external) environments experience no aging effects.

During its review, the staff determined that it needed additional information.

In LRA Table 3.4.1, Item 3.4.1-8, under "Discussion," the applicant stated that for closure bolting, the aging effect requiring management is loss of mechanical closure integrity, which includes a broader range of aging mechanisms than those included in this line item (i.e., loss of material due to general corrosion and crack initiation and growth due to cyclic loading and/or SCC). The applicant also stated that it uses the System Walkdown Program to supplement the Bolting and Torquing Activities Program to maintain bolting integrity. In RAI 3.2-1(1), (2), and (3), the staff asked the applicant to (1) explain the extent to which AMR Item 3.4.1-8 deviates from the ANO-2 AMR results; (2) clarify whether the aging effect of "loss of mechanical closure integrity" indeed includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range"; and (3) discuss how it will manage each of the identified aging effects and why the approach to managing the aging effects is adequate.

By letter dated April 6, 2004, the applicant stated that it does not consider LRA Table 3.4-1, Item 3.4.1-8, to match the ANO-2 AMR results because the aging effects and programs used to manage them do not match. The applicant stated that the differences in the ANO-2 aging effects are that loss of mechanical closure integrity is considered an aging effect requiring management for high-temperature bolting, and cracking is not considered an aging effect requiring management. At ANO-2, the potential for SCC of bolting in non-Class 1 systems is minimized by using lower yield strength carbon steel bolting material and limiting contaminants such as chlorides and sulfur in lubricants and sealant compounds. Consistent with the GALL Report, the ANO-2 AMR identifies loss of material as an aging effect requiring management. However, for carbon steel bolting in the steam and power conversion systems, the System Walkdown Program manages loss of material.

The staff found that the applicant's response adequately explains the differences between AMR Item 3.4.1-8 and the ANO-2 AMR results for the closure bolting in the steam and power conversion systems, including how the aging effect of loss of material will be managed. RAI 3.4-1(1) is therefore closed.

The applicant stated that the words "broad range" refer to the fact that loss of mechanical closure integrity is identified as an aging effect requiring management for bolting in two cases. First, bolting in high-temperature systems, and in applications subject to significant vibration, is subject to loss of mechanical closure integrity resulting from loss of pre-load, which is managed by the Bolting and Torquing Activities Program. The same bolted closures may be subject to loss of material, if they are carbon steel or wetted stainless steel. If so, another program, such as the System Walkdown Program, would manage the loss of material. Second, in a case where the carbon steel bolting is exposed to borated water leakage, loss of material may progress to such an extent that it will affect the mechanical closure integrity. Thus, the applicant conservatively considered both loss of material and loss of mechanical closure integrity to be aging effects requiring management. In general, however, loss of mechanical closure integrity does not cover the aging effects of loss of material or cracking. Based on this information, the staff determined that the applicant has adequately delineated the aging effects included under the "loss of mechanical closure integrity" and has identified the associated AMPs to manage these aging effects. RAIs 3.2-1(2) and (3) are therefore closed.

In LRA Table 3.4.2-1, the applicant stated that for the main steam system, a Water Chemistry Control Program manages cracking and loss of material for stainless steel components in steam greater than 270 °F (internal) and treated water greater than 270 °F (internal) environments. In RAI 3.4-3, the staff requested that the applicant explain why a supplemental inspection is not needed to determine the effectiveness of the Water Chemistry Control Program. By letter dated April 6, 2004, the applicant stated that for the steam and power conversion systems' stainless steel components, the GALL Report identifies only the condensate storage tank and heat exchanger tubes as requiring augmentation of the Water Chemistry Program. Other stainless steel components require no confirmation. However, the applicant provided the following information to confirm the effectiveness of the Water Chemistry Programs at ANO-2:

> The effectiveness of the Water Chemistry programs at ANO-2 has been confirmed through routine component inspections that are performed by chemistry, maintenance and engineering personnel. This includes the primary and secondary water chemistry programs. These inspections were performed when systems were opened for maintenance, when an adverse chemistry trend existed, or when requested by the chemistry or engineering departments. The areas inspected have included stagnant areas that are most susceptible to aging effects identified in the LRA. In addition, for many components covered by the Primary and Secondary Water Chemistry Control Program, such as those in the reactor coolant system and steam generators, inspection activities included in other aging management programs provide additional confirmation of chemistry program effectiveness. These other programs include the Inservice Inspection, Alloy 600 Aging Management, Cast Austenitic Stainless Steel Evaluation, Pressurizer Examinations, Reactor Vessel Internals Inspection, and Steam Generator Integrity Programs. Some components, such as heat exchangers and steam generators, have been inspected on a periodic basis providing further evidence that the water chemistry programs are adequately managing aging effects. If during these inspections significant abnormal conditions were noted, including those that were the result of aging effects such as loss of material and cracking, these conditions would have been documented under the corrective action program. Subsequently, actions to determine cause of the condition and corrective actions to correct and prevent recurrence would have been taken.

The GALL One Time Inspection Program XI.M32, focuses on the most susceptible material and environment combinations in the most susceptible locations. Items such as heat exchangers, piping and valves normally in standby, and system low points or stagnant areas are representative of these susceptible locations. At ANO-2, inspections have been performed in systems such as emergency feedwater and emergency diesel generators which are normally in standby, steam generators, condensate storage tanks, feedwater heaters, moisture separator reheaters, chillers, main steam safety valves, and blowdown heat exchangers. All of these components are made of susceptible materials (stainless and carbon steel) and are exposed to environments (treated water and steam) that would be conducive to aging effects managed by the chemistry programs.

Many components in the steam generators have inspection activities included in other aging management programs that provide additional assurance that significant degradation is not occurring and that the Water Chemistry Control Program is effective. These inspection activities include those contained in the Inservice Inspection and Steam Generator Integrity Programs. These inspection results of steam generator components are also applicable to the main steam, main feedwater and emergency feedwater components which possess the same material and environment combinations.

As additional confirmation of the effectiveness of the water chemistry programs, the ANO-2 review of operating experience included a review of condition reports (CRs), CR trending data, and interviews with site personnel regarding water chemistry program operating experience. The operating experience review did not identify component failures or significant adverse conditions that were the result of an ineffective water chemistry program. Also, the CR trending data did not identify recurrent component degradation occurring in the systems covered under this aging management program. The review of CRs, CR trending data, and personnel interviews provided additional confirmation of chemistry program effectiveness.

The combination of inspections under the Inservice Inspection Program, the Steam Generator integrity Program, and maintenance and routine chemistry inspections as a whole, constitute a more thorough confirmation of water chemistry aging management program effectiveness than would be obtained from one-time inspections of a sample of items.

The staff has confirmed that LRA Table 3.1.2-5 lists stainless steel components of steam generators in treated water (internal) environments, which are managed by the Water Chemistry Control Program and also inspected under the Inservice Inspection and Steam Generator Integrity Programs. These inspection results of steam generator components are also applicable to the main steam, main feedwater, and emergency feedwater components that have the same material and environment combinations. Based on the above, the staff found that the combination of inspections under the Inservice Inspection Program, the Steam Generator Integrity Program, and those inspection activities included in the other AMPs constitute an adequate confirmation of the effectiveness of the Water Chemistry Control Program. The staff therefore considers the GALL recommendations satisfied for these components, and RAI 3.4-3 is closed.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the main steam system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the main steam system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also confirmed that the UFSAR Supplement contains an adequate description of the programs.

Table 3.4.2-1 of the LRA identifies the following AMPs for managing the aging effects described above for the main steam system.

- Bolting and Torquing Activities (B.1.2)
- Flow-Accelerated Corrosion (B.1.11)
- System Walkdown (B.1.28)
- Water Chemistry Control (B.1.30)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.2, 3.0.3.1, 3.0.3.3.9, and 3.0.3.3.11 of this SER, respectively.

During its review, the staff determined that it needed additional information.

In LRA Table 3.4-1, Item 3.4.1-8, under "Discussion," the applicant stated that the System Walkdown Program supplements Bolting and Torquing Activities to maintain bolting integrity in the steam and power conversion systems. In RAI 3.4-1(4), the staff asked the applicant to demonstrate that with the combination of these AMPs, the aging effects associated with closure bolting will be adequately managed, or managed in a manner equivalent to that described in GALL AMP XI.M18, "Bolting Integrity." By letter dated April 6, 2004, the applicant stated that the System Walkdown Program manages loss of material for closure bolting and the Bolting and Torquing Activities Program manages loss of mechanical closure integrity for closure bolting. The applicant stated that visual inspections of bolting for loss of material in the System Walkdown Program are adequate to assure that the closure bolting can perform its intended function. This is because loss of material from external surfaces such as closure bolting is a long-term aging effect that would be observed well before aging progressed to the point of loss of intended function. The applicant stated that the Bolting and Torquing Activities Program assures that proper torque values are applied to bolted closures such that loss of mechanical closure integrity as a result of loss of pre-load because of high temperatures does not occur.

The Bolting and Torquing Activities and System Walkdown Programs are plant-specific programs and are not intended to be comparable to GALL AMP XI.M18, "Bolting Integrity," which stipulates the inservice inspection requirements of the ASME Code, Section XI. These

ISI requirements are included in the ANO-2 Inservice Inspection Program for Class 1, 2, and 3 bolted closures. However, these ISI requirements are focused on identifying the aging effect of cracking. Since cracking is not an aging effect requiring management for non-Class 1 bolted closures, the applicant did not include the Inservice Inspection Program as an AMP for the steam and power conversion systems.

Because the bolted closures under these systems include only ASME Class 2 and 3 closure bolting, the staff found that the applicant's response adequately addresses the staff's concern regarding the adequacy and sufficiency of the Bolting and Torquing Activities and System Walkdown Programs for the ANO-2 bolted closures. The applicant's response also clarified, for closure bolting, the difference between these AMPs and the ANO-2 Inservice Inspection Program, which primarily focuses on identifying the aging effect of cracking. Based on this information, the staff considers RAI 3.4-1(4) to be closed.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAI, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the main steam system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the main steam system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 51.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program descriptions and concludes that the FSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.4.2.3.2 Main Feedwater System

Summary of Technical Information in the Application

In Section 3.4.2.1.2 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the main feedwater system components:

- Bolting and Torquing Activities
- Flow-Accelerated Corrosion
- System Walkdown
- Water Chemistry Control

In Table 3.4.2-2 of the LRA, the applicant summarized the AMRs for the main feedwater system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.4.2-2 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the main feedwater system component groups. The staff reviewed the AMR of the main feedwater system component/material/environment/AERM combinations that are not addressed in the GALL Report. These combinations use Notes F through J in LRA Table 3.4.2-2, except for those with past precedents. The staff also reviewed those combinations in Table 3.4.2-2, with Notes A through E, which had associated emerging issues. The staff confirmed that the applicant had identified all applicable AERMs and had credited appropriate AMPs for managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

The applicant identified no aging effects for stainless steel components exposed to air, including bolting, tubing, and valve component types. The GALL Report does not identify air as an environment for these components and materials.

On the basis of current industry research and operating experience, dry air on metal will not result in aging that will be of concern during the period of extended operation. The external environments referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Therefore, the staff concludes that there are no aging effects requiring management for stainless steel in a dry air environment.

Aging Effects

Table 2.3.4-2 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include bolting, piping, tubing, and valve.

For these component types, the applicant identifies the following materials, environments, and AERMS:

- Carbon steel bolting in air (external) environments is subject to loss of material and loss of mechanical closure integrity.
- Carbon steel components in air (external) and treated water greater than 220 °F (internal) environments are subject to loss of material.
- Stainless steel bolting in air (external) environments is subject to loss of mechanical closure integrity.
- Stainless steel components in treated water greater than 270 °F (internal) environments are subject to loss of material and cracking.
- Stainless steel components in air (external) environments experience no aging effects.

During its review, the staff determined that it needed additional information.

In LRA Table 3.4.1, Item 3.4.1-8, under "Discussion," the applicant stated that for closure bolting, the aging effect requiring management is loss of mechanical closure integrity, which includes a broader range of aging mechanisms than those included in this AMR line item. The applicant also stated that it used programs other than the GALL Report's Bolting Integrity Program. In RAI 3.4-1(1), (2), and (3), the staff asked the applicant to (1) explain the extent to which AMR Item 3.4.1-8 deviates from the ANO-2 results; (2) clarify whether the aging effect of "loss of mechanical closure integrity" includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range"; and (3) discuss how it will manage each of the identified aging effects and why the approach for managing the aging effects is adequate. Section 3.4.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

In LRA Table 3.4.2-2, the applicant stated that for the main feedwater system, it uses a Water Chemistry Control Program to manage cracking and loss of material for stainless steel components in an environment of treated water greater than 270 °F (internal). In RAI 3.4-4, the staff asked the applicant to explain why a supplemental inspection program is not needed to determine the effectiveness of the Water Chemistry Control Program. The staff's discussion of this RAI and its resolution by the applicant is similar to RAI 3.4-3 and appears in Section 3.4.2.4.1 of this SER.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the main feedwater system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components of the main feedwater system.

<u>Aging Management Programs</u>

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also confirmed that the UFSAR Supplement adequately describes the program.

Table 3.4.2-2 of the LRA identifies the following AMPs for managing the aging effects described above for the main feedwater system:

- Bolting and Torquing Activities (B.1.2)
- Flow-Accelerated Corrosion (B.1.11)
- System Walkdown (B.1.28)
- Water Chemistry Control (B.1.30)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.2, 3.0.3.1, 3.0.3.3.9, and 3.0.3.2.8 of this SER, respectively.

During its review, the staff determined that it needed additional information.

In LRA Table 3.4-1, Item 3.4.1-8, under "Discussion," the applicant stated that the System Walkdown Program supplements Bolting and Torquing Activities to maintain bolting integrity in the steam and power conversion systems. In RAI 3.4-1(4), the staff asked the applicant to demonstrate that the combination of these AMPs will adequately manage the aging effects associated with closure bolting or will manage them in a manner equivalent to that described in GALL AMP XI.M18, "Bolting Integrity." Section 3.4.2.4.1 of this SER contains the staff's discussion of this RAI and its resolution by the applicant.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAI, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the main feedwater system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the main feedwater system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 51.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program descriptions and concludes that the FSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.4.2.3.3 Emergency Feedwater System

Summary of Technical Information in the Application

In Section 3.4.2.1.3 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the emergency feedwater system components:

- Bolting and Torquing Activities
- Flow-Accelerated Corrosion
- Oil Analysis
- Periodic Surveillance and Preventive Maintenance
- System Walkdown
- Water Chemistry Control

In Table 3.4.2-3 of the LRA, the applicant summarized the AMRs for the emergency feedwater system components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

The staff reviewed Table 3.4.2-3 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the emergency feedwater system component groups. The staff reviewed the AMR of the emergency feedwater system component/material/environment/AERM combinations that are not addressed in the GALL Report. These combinations use Notes F through J in LRA Table 3.4.2-3, except where there were past precedents. The staff also reviewed those combinations in Table 3.4.2-3, with Notes A through E, for which there were emerging issues. The staff confirmed that the applicant had identified all applicable AERMs and had credited appropriate AMPs with managing the AERMs. The staff also reviewed the applicable UFSAR Supplements for the AMPs to ensure that the program descriptions are adequate.

The applicant identified no aging effects for stainless steel components exposed to air, including bolting, orifice, piping, tank, thermowell, tubing, and valve component types. The GALL Report does not identify air as an environment for these components and materials.

On the basis of current industry research and operating experience, dry air on metal will not result in aging that will be of concern during the period of extended operation. The external environments referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Therefore, the staff concludes that there are no aging effects requiring management for stainless steel in a dry air environment.

In the case of a copper alloy heat exchanger tubesheet exposed to lube oil, the applicant proposed to manage loss of material using the Oil Analysis Program (AMP B.1.17). The staff reviewed and accepted the Oil Analysis Program. Section 3.0.3.3.6 of this SER documents the staff's evaluation of this program.

The staff notes that loss of material due to pitting corrosion is an applicable aging effect for brass, bronze, and copper materials in a lubricating oil environment at locations containing oxygenated water with contaminants such as halide ions, particularly chloride ions. In addition, loss of material due to galvanic corrosion in a lubricating oil environment can occur only when materials with different electrochemical potentials are in contact in the presence of water.

The staff also notes that loss of material due to crevice corrosion can also occur in brass, bronze, and copper materials in a lubricating oil environment at locations containing oxygenated water. Oxygen is required for the initiation of crevice corrosion. Lube oil that is not contaminated with water does not contain oxygen in sufficient quantities for crevice corrosion to occur. Water contamination of lubricating oil can occur and is required for the introduction of oxygen. Although only high-quality (water- and contaminant-free) lubricating oil is received, and periodic sampling is performed to ensure the quality is maintained, the potential contamination of lubricating oil makes the loss of material due to general corrosion, pitting, galvanic corrosion, and crevice corrosion an applicable aging effect for brass, bronze, and copper materials exposed to lubricating oil in the emergency feedwater system.

The staff further notes that loss of material due to microbiologically influenced corrosion is an applicable aging effect for brass and copper materials exposed to lubricating oil. The applicant treated the lubricating oil with biocides to limit the presence of microbiological organisms and, therefore, microbiologically influenced corrosion has not been a concern for those portions of the steam and power conversion systems that are within the scope of license renewal, and the associated materials exposed to lubricating oil. However, the potential for microbiological organisms to be found in lubricating oil makes microbiologically influenced corrosion an applicable aging effect for brass and copper materials exposed to lubricating oil in the steam and power conversion systems.

Because the Oil Analysis Program maintains oil systems free of contaminants (primarily water and particles), the staff finds that this program adequately manages loss of material for components exposed to lubricating oil.

Aging Effects

Table 2.3.4-3 of the LRA lists individual system components within the scope of license renewal and subject to AMR. The component types that do not rely on the GALL Report for AMR include bearing housing, bolting, equalizer pipe, filter housing, governor housing, heat exchanger (tubes), heat exchanger (tubesheet), heater housing, orifice, piping, pump casing, servo housing, sight glass, sight glass housing, steam trap, tank, thermowell, tubing, turbine casing, and valve.

For these component types, the applicant identified the following materials, environments, and AERMS:

- Carbon steel bolting in air (external) environments is subject to loss of material and loss of mechanical closure integrity. In an outdoor air (external) environment, it is also subject to loss of material.
- Carbon steel and cast iron components in air (external) and lube oil (internal) environments are subject to loss of material.
- Carbon steel components in steam greater than 220 °F (internal), treated water (internal), and treated water greater than 220 °F (internal) environments are subject to loss of material.
- Stainless steel bolting in air (external) environments is subject to loss of mechanical closure integrity.
- Stainless steel components in treated water (internal), lube oil (internal), and steam greater than 270 °F (internal) environments are subject to loss of material and cracking.
- Copper components in lube oil (internal) and treated water (internal) environments are subject to fouling and loss of material.
- Copper alloy components in lube oil (internal) are subject to loss of material.
- Stainless steel components in air (internal and external) and outdoor air (external) environments experience no aging effects.
- Glass components in air (external) and lube oil (internal) environments experience no aging effects.
- Copper alloy components in air (external) environments experience no aging effects.

During its review, the staff determined that it needed additional information.

In LRA Table 3.4.1, Item 3.4.1-8, under "Discussion," the applicant stated that for closure bolting, the aging effect requiring management is loss of mechanical closure integrity, which includes a broader range of aging mechanisms than those included in this AMR line item. The applicant also stated that it uses programs other than the GALL Bolting Integrity Program. In RAI 3.4-1(1), (2), and (3), the staff requested the applicant to (1) explain the extent to which AMR Item 3.4.1-8 deviates from the ANO-2 results; (2) clarify whether the aging effect of "loss of mechanical closure integrity" includes loss of material and cracking, and, specifically, what other aging effects/mechanisms are included in the "broader range"; and (3) discuss how it will manage each of the identified aging effects and why the approach to managing the aging effects is adequate. Section 3.4.2.4.1 of this SER contains the staff's discussion of this RAI and its resolution by the applicant.

In LRA Table 3.4.2-3, the applicant stated that for the emergency feedwater system, it uses a Water Chemistry Control Program to manage cracking and loss of material for stainless steel components in a steam greater than 270 °F (internal) environment. In RAI 3.4-5, the staff requested that the applicant explain why a supplemental inspection program is not needed to determine the effectiveness of the Water Chemistry Control Program. The staff's discussion of this RAI and of its resolution by the applicant is similar to that for RAI 3.4-3 and appears in Section 3.4.2.4.1 of this SER.

In LRA Table 3.4.2-3, the applicant stated that for the emergency feedwater system, it specifies a Water Chemistry Control Program as an AMP for loss of material for stainless steel components in treated water (internal and external) environments, and for carbon steel components in treated water (internal) and treated water greater than 220 °F (internal) environments. In RAI 3.4-6, the staff asked the applicant to explain why an augmented inspection program is not needed to determine the effectiveness of the Water Chemistry Control Program, as recommended by GALL (VIII.G.1-c, VIII.G.3-a, and VIII.G.4-b) for carbon steel piping and valves in treated water in the emergency feedwater system and the stainless steel condensate storage tank.

By letter dated April 6, 2004, the applicant stated that, as noted in its response to RAI 3.4-3, since the environment and material combinations in the steam generators are the same or more problematic than those in the emergency feedwater system, the results of steam generator component inspections to determine the effectiveness of the Water Chemistry Control Program are also applicable to the emergency feedwater carbon steel piping and valves and the condensate storage tank. These inspection activities include those that are part of the Inservice Inspection and Steam Generator Integrity Programs. Table 3.1.2-5 of the LRA lists carbon (low alloy) and stainless steel components inspected under these programs. Based on this information and the applicant's response to RAI 3.4-3, the staff determined that the inspection activities conducted for components in the steam generators are applicable to the components in the steam and power conversion systems, and the GALL recommendations of augmenting the Water Chemistry Control Program with an inspection to determine the effectiveness of the Water Chemistry Program are satisfied for the steam and power conversion components. RAI 3.4-6 is therefore closed.

In LRA Table 3.4.2-3, the applicant stated that, for the emergency feedwater system, it identified no aging effect for the glass component in lube oil (internal) environments. In RAI 3.4-7, the staff asked the applicant to provide the basis for such a conclusion. By letter dated April 6, 2004, the applicant stated that glass is an amorphous, inorganic oxide that is mostly silica and is cooled to a rigid condition without crystallization. It is highly resistant to corrosion but is susceptible to degradation in hydrofluoric acid, caustic, and high-temperature water. The applicant stated that lubricating oil does not contain hydrofluoric acid or caustic, and this glass is not exposed to high-temperature water. Therefore, there are no aging effects requiring management for the glass. The staff considered the applicant's response to adequately rule out possible aging effects for the glass based on the material and environmental consideration. RAI 3.4-7 is therefore closed.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's responses to the above RAIs, the staff finds that the aging effects of the emergency feedwater system component types not addressed by the GALL Report are consistent with industry experience for these combinations of materials and environments. The staff did not identify any omitted aging effects. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components of the emergency feedwater system.

Aging Management Programs

After evaluating the applicant's identification of aging effects for each of the above components, the staff evaluated the AMPs to determine if they are appropriate for managing the identified aging effects. The staff also confirmed that the UFSAR Supplement contains an adequate description of the program.

Table 3.4.2-3 of the LRA identifies the following AMPs for managing the aging effects described above for the emergency feedwater system.

- Bolting and Torquing Activities (B.1.2)
- Flow-Accelerated Corrosion (B.1.11)
- Oil Analysis (B.1.17)
- Periodic Surveillance and Preventive Maintenance (B.1.18)
- System Walkdown (B.1.28)
- Water Chemistry Control (B.1.30)

The staff's detailed review of these AMPs appears in Sections 3.0.3.3.2, 3.0.3.1, 3.0.3.3.6, 3.0.3.3.7, 3.0.3.3.9, and 3.0.3.2.8 of this SER, respectively.

During its review, the staff determined that it needed additional information.

In LRA Table 3.4-1, Item 3.4.1-8, under "Discussion," the applicant stated that the System Walkdown Program supplements Bolting and Torquing Activities to maintain bolting integrity in the steam and power conversion systems. In RAI 3.4-1(4), the staff requested that the applicant demonstrate that with the combination of these AMPs, the aging effects associated with closure bolting will be adequately managed, or managed in a manner equivalent to that described in GALL AMP XI.M18, "Bolting Integrity." Section 3.4.2.4.1 of this SER provides the staff's discussion of this RAI and its resolution by the applicant.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAI, the staff finds that the applicant has identified appropriate AMPs for managing the aging effects of the emergency feedwater system component types not addressed by the GALL Report. In addition, the staff finds the program descriptions in the UFSAR Supplement acceptable.

Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the emergency feedwater system components that are not addressed by the GALL Report, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 51.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program descriptions and concludes that the FSAR Supplement adequately describes the AMPs credited with managing aging in these components, as required by 10 CFR 54.21(d).

3.4.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the steam and power conversion system components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR Supplement program summaries and concludes that the FSAR Supplement adequately describes the AMPs credited for managing aging in steam and power conversion system components, as required by 10 CFR 54.21(d).

3.5 Structures and Component Supports

This section of the SER documents the staff's review of the applicant's AMR results for the structures and component supports system components and component groups associated with the following systems:

- containment and containment internals
- auxiliary building, turbine building, and yard structures
- intake structure and emergency cooling pond
- bulk commodities

3.5.1 Summary of Technical Information in the Application

In Section 3.5 of the LRA, the applicant provided the results of the AMR of the structures and component supports components and component types listed in Tables 2.4-1 through 2.4-4 of the LRA. The applicant also listed the materials, environments, AERMs, and AMPs associated with each structure and component support type.

In Table 3.5.1 of the LRA, the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the structures and component supports. In Section 3.5.2.2 of the LRA, the applicant provided information concerning Table 3.5.1 components for which the GALL Report recommends further evaluation.

3.5.2 Staff Evaluation

The staff reviewed LRA Section 3.5 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the reactor system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff performed an audit and review to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. Section 3.0.3 of this SER documents the staff's evaluations of the AMPs. The staff documented its audit findings in the audit report issued on August 19, 2004, and summarizes them in Section 3.5.2.1 of this SER.

The staff also performed an audit of those AMRs that are consistent with the GALL Report and for which further evaluation is recommended. During the audit, the staff determined that the applicant's further evaluations are consistent with the acceptance criteria in Section 3.5.2.2 of the SRP-LR. The staff documented its audit findings in the audit report and summarizes them in Section 3.5.2.2 of this SER.

The staff conducted a technical review of the remaining AMRs that are not consistent with the GALL Report. The review included evaluating whether the applicant identified all plausible aging effects and listed the appropriate aging effects for the combinations of materials and environments specified. Section 3.5.2.3 of this SER documents the staff's review findings.

Finally, the staff reviewed the AMP summary descriptions in the FSAR Supplement to ensure that they adequately describe the programs credited with managing or monitoring aging for the reactor system components.

Table 3.5-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.3 that are addressed in the GALL Report.

Table 3.5-1 Staff Evaluation for Structures and Component Supports System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Penetration sleeves, penetration bellows, and dissimilar metal welds (Item Number 3.5.1-1)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)		Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.6)
Penetration sleeves, bellows, and dissimilar metal welds (Item Number 3.5.1-2)	Cracking due to cyclic loading; crack initiation and growth due to SCC	Containment inservice inspection (ISI) and containment leak rate test	Containment Leak Rate (B.1.6), Containment Inservice Inspection (B.1.13)	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.7)
Penetration sleeves, penetrations bellows, and dissimilar metal welds (Item Number 3.5.1-3)	Loss of material due to corrosion	Containment ISI and containment leak rate test	Containment Inservice Inspection (B.1.13), Containment Leak Rate (B.1.6)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Personnel airlock and equipment hatch (Item Number 3.5.1-4)	Loss of material due to corrosion	Containment ISI and containment leak rate test	Containment Inservice Inspection (B.1.13), Containment Leak Rate (B.1.6)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Personnel airlock and equipment hatch (Item Number 3.5.1-5)	Loss of leak tightness in closed position due to mechanical wear of locks, hinges, and closure mechanisms	Containment leak rate test and plant technical specifications		Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Seals, gaskets, and moisture barriers (Item Number 3.5.1-6)	Loss of sealant and leakage through containment due to deterioration of join seals, gaskets, and moisture barriers	Containment ISI and containment leak rate test	Containment Leak Rate (B.1.6)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Concrete elements; foundation, dome, and wall (Item Number 3.5.1-7)	Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Containment ISI	Inservice Inspection - Containment Inservice Inspection (B.1.13), Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.1)
Concrete elements: foundation (Item Number 3.5.1-8)	Cracks, distortion, and increases in component stress level due to settlement	Structures monitoring	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.2.1.2)
Concrete elements: foundation (Item Number 3.5.1-9)	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures monitoring	Inservice Inspection - Containment Inservice Inspection (B.1.13), Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.2.1.2)
Concrete elements: foundation, dome, and wall (Item Number 3.5.1-10)	Reduction in strength and modulus due to elevated temperature	Plant specific	Inservice Inspection - Containment Inservice Inspection (B.1.13), Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.3)
Prestressed containment: tendons and anchorage component (Item Number 3.5.1-11)	Loss of prestress due to relaxation shrinkage, creep, and elevated temperature	TLAA evaluated in accordance with 10 CFR 54.21(c)		Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.5)
Steel elements: liner plate and containment shell (Item Number 3.5.1-12)	Loss of material due to corrosion in accessible and inaccessible areas	Containment ISI and containment leak rate test	Structures Monitoring - Structures Monitoring (B.1.27), Inservice Inspection - Containment Inservice Inspection (B.1.13)	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.4)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel elements: protected by coating (Item Number 3.5.1-14)	Loss of material due to corrosion in accessible areas only	Protective coating monitoring and maintenance	Not Applicable at ANO-2	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Prestressed containment: tendons and anchorage components (Item Number 3.5.1-15)	Loss of material due to corrosion of prestressing tendons and anchorage components	Containment ISI	Inservice Inspection - Containment Inservice Inspection (B.1.13)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1.1)
Concrete elements: foundation, dome, and wall (Item Number 3.5.1-16)	Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reactor with aggregate	Containment ISI	Structures Monitoring - Structures Monitoring (B.1.27), Inservice Inspection - Containment Inservice Inspection (B.1.13)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.2.2.1)
All groups except Group 6: accessible interior/ exterior concrete and steel components (Item Number 3.5.1-20)	All types of aging effects	Structures monitoring	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Group 1-3, 5, 7-9; inaccessible concrete components, such as exterior walls below grade and foundation (Item Number 3.5.1-21)	Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	Plant specific	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.2.2)
Group 6: all accessible/ inaccessible concrete, steel, and earthen components (Item Number 3.5.1-22)	All types of aging effects, including loss of material due to abrasion, cavitation, and corrosion	Inspection of water-control structures or FERC/US Army Corp of Engineers dam inspection and maintenance	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Group 5: liners (Item Number 3.5.1-23)	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Water chemistry and monitoring of spent fuel pool water level	Water Chemistry Control (B.1.30)	Consistent with GALL, which recommends no further evaluation

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Groups 1-3, 5, 6: all masonry block walls (Item Number 3.5.1-24)	Cracking due to restraint, shrinkage, creep, and aggressive environment	Masonry wall	Structures Monitoring - Masonry Wall (B.1.26)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Groups 1-3, 5, 7-9: foundation (Item Number 3.5.1-25)	Cracks, distortion, and increases in component stress level due to settlement	Structures monitoring	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Groups 1-3, 5-9: foundation (Item Number 3.5.1-26)	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures monitoring	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Groups 1-5: concrete (Item Number 3.5.1-27)	Reduction of strength and modulus due to elevated temperature	Plant specific	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.1.3)
Groups 7,8: liners (Item Number 3.5.1-28)	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Plant specific	Not Applicable to ANO-2	Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.2.1(9))
All groups: support members: anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc. (Item Number 3.5.1-29)	Aging of component supports	Structures monitoring	Structures Monitoring - Structures Monitoring (B.1.27)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Group B1.1, B1.2, and B1.3: support members: anchor bolts and welds (Item Number 3.5.1-30)	Cumulative fatigue damage (CLB fatigue analyses exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)		Consistent with GALL, which recommends further evaluation (See Section 3.5.2.2.3.2)
All groups: support members: anchor bolts and welds (Item Number 3.5.1-31)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric Acid Corrosion Prevention (B.1.3)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds, spring hangers, guides, stops, and vibration isolators (Item Number 3.5.1-32)	Loss of material due to environmental corrosion; loss of mechanical function due to corrosion, distortion, dirt, overload, etc.	ISI	Inservice Inspection -Inservice Inspection (B.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)
Group B1.1: high strength low-alloy bolts (Item Number 3.5.1-33)	Crack initiation and growth due to SCC	Bolting integrity	Inservice Inspection -Inservice Inspection (B.1.14), Boric Acid Corrosion Prevention (B.1.3)	Consistent with GALL, which recommends no further evaluation (See Section 3.5.2.1)

The staff's review of the ANO-2 structures and component supports system and associated components followed one of several approaches. One approach, documented in Section 3.5.2.1 of this SER, involves the staff's audit and review of the AMR results for components in the structures and component supports system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. The second approach, documented in Section 3.5.2.2 of this SER, involves the staff's audit and review of the AMR results for components in the structures and component supports system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.5.2.3 of this SER, involves the staff's technical review of the AMR results for components in the structures and component supports system that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. Section 3.0.3 of this SER documents the staff's review of AMPs that are credited to manage or monitor aging effects of the structures and component supports system components.

3.5.2.1 AMR Results That Are Consistent with the GALL Report

Summary of Technical Information in the Application

In Section 3.5.2.1 of the LRA, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the aging effects related to the structures and component supports components:

- Boric Acid Corrosion Prevention Program
- Containment Leak Rate Program
- Inservice Inspection—Containment Inservice Inspection (IWE and IWL) Program
- Inservice Inspection (IWF) Program
- Structures Monitoring Program
- Structures Monitoring—Masonry Wall Program
- Water Chemistry Control Program
- Service Water Integrity Program
- Periodic Surveillance and Preventive Maintenance Program

- Fire Protection Program

In Tables 3.5.2-1 through 3.5.2-4 of the LRA, the applicant provided a summary of AMRs for the structures and component supports systems and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation

In Tables 3.5.2-1 through 3.5.2-4 of the LRA, the applicant provided a summary of AMRs for the containment and containment internals, auxiliary building, turbine building, yard structures, intake structure, emergency cooling pond, and bulk commodities components and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups are bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicate that the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for the component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for the component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff confirmed that it has reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note C indicates that the component for the AMR line item is different, but consistent with the GALL Report for the material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant could not find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that has the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the AMR line item of the different component applies to the component under review and whether the AMR is valid for the site-specific conditions.

Note D indicates that the component for the AMR line item is different, but consistent with the GALL Report for the material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to determine consistency with the GALL Report. The staff noted whether the AMR line item of the different component applies to the component under review. The staff confirmed that it reviewed and accepted the identified exceptions to the GALL AMPs. The staff also determined whether the AMP identified by the applicant is consistent with the AMP identified in the GALL Report and whether the AMR is valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for the material, environment, and aging effect, but a different AMP is credited. The staff audited these line items to determine consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR is valid for the site-specific conditions.

The staff conducted an audit and review, discussed below, to confirm the applicant's claim that certain identified AMRs are consistent with the staff-approved AMRs in the GALL Report. The staff reviewed the information provided in the LRA and program basis documents, which are available at the applicant's engineering office. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA is applicable and that the applicant has identified the appropriate GALL Report AMRs.

3.5.2.1.1 Structures and Components Supports, Containment, and Containment Internals

The staff reviewed Table 3.5.1, Item 3.5.1-3 of the LRA, and associated AMRs consistent with the GALL Report.

In Table 3.5.2-1 of the LRA, the applicant associated the incorrect Table 3.5.1, Item 3.5.1-3, for loss of material of carbon steel tendon anchorage and the tendon wires component type (page 3.5-27). The staff requested that the applicant revise the LRA Table 3.5.2-1 line entry with the correct Table 3.5.1 item number.

By letter dated March 24, 2004, the applicant submitted a clarification to reference the correct Table 3.5.1, Item 3.5.1-15, to anchorage and tendon wires. The applicant also submitted a clarification that Table 3.5.1, Item 3.5.1-15 (LRA page 3.5-17), should credit the Inservice Inspection (IWL) Program rather than the Inservice Inspection (IWE) Program in the discussion column.

The staff reviewed the Inservice Inspection—Containment Inservice Inspection Program (AMP B.1.13) and determined that the ASME Code, Section XI, Subsection IWL Program manages the containment anchorage and tendon wires. On the basis of its review, the staff concludes that this line item is acceptable.

3.5.2.1.2 Structures and Components Supports, Bulk Commodities

In Table 3.5.2-4 (page 3.5-38) of the LRA, the applicant associated component type "HVAC missile barrier" with the GALL Report, Volume 2, Chapter III.A2.2-a. The staff requested that the applicant revise the LRA Table 3.5.2-4 line entry with the correct GALL Report, Volume 2, item number.

By letter dated March 24, 2004, the applicant submitted a clarification to reference the correct GALL Report, Volume 2, Item III.A3.2-a. The staff reviewed the GALL Report, Volume 2, Item

III.A3.2-a, and determined that the HVAC missile barrier component group should reference the GALL Report, Volume 2, Chapter III, for Group 3 structures rather than Chapter II, Group 2 structures. On this basis, the staff concludes that this line item is acceptable.

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion

The staff determined the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

Summary of Technical Information in the Application

In Section 3.5.2.2 of the LRA, the applicant provided further evaluation of aging management as recommended by the GALL Report for structures and component supports. The applicant provided information concerning how it will manage the following aging effects:

- (PWR containments) aging of inaccessible concrete areas
- (PWR containments) cracking, distortion, and increase in component stress levels due to settlement; reduction of foundation strength due to erosion of porous concrete subfoundations, if not covered by Structures Monitoring Program
- (PWR containments) reduction of strength and modulus of concrete structures due to elevated temperature
- (PWR containments) loss of material due to corrosion in inaccessible areas of steel containment shell or liner plate
- (PWR containments) loss of prestress due to relaxation, shrinkage, creep, and elevated temperature
- (PWR containments) cumulative fatigue damage
- (PWR containments) cracking due to cyclic loading and SCC
- (Class I structures) aging of structures not covered by Structures Monitoring Program
- (Class I structures) aging management of inaccessible areas

- (component supports) aging of supports not covered by Structures Monitoring Program
- (component supports) cumulative fatigue damage due to cyclic loading
- quality assurance for aging management of nonsafety-related components

Staff Evaluation

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed these issues. In addition, the staff audited the applicant's further evaluations against the criteria contained in Section 3.5.2.2 of the SRP-LR. The ANO-2 ANO-2 Audit and Review Report provides details of the staff's audit and review.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.5.2.2.1 PWR Containments

The staff reviewed Section 3.5.2.2.1 of the LRA against the criteria in Section 3.5.2.2.1 of the SRP-LR, which addresses several areas discussed below.

3.5.2.2.1.1 Aging of Inaccessible Concrete Areas. In Section 3.5.2.2.1.1 of the LRA, the applicant addressed aging of inaccessible concrete areas for the containment.

For inaccessible portions of the containment structure, 10 CFR 50.55a(b)(2)(ix) requires that the licensee evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to inaccessible areas.

The GALL Report recommends GALL AMP XI.S2, "ASME Section XI, Subsection IWL," for managing the aging of the accessible portions of the containment structures. The applicant addressed this issue with LRA AMP B.1.13, "Inservice Inspection—Containment Inservice Inspection," which is evaluated in Section 3.0.3.3.4 of this SER. Subsection IWL exempts from examination those portions of the concrete containment that are inaccessible (e.g., foundation, belowgrade exterior walls, or concrete covered by liner).

The applicant also credited the Structures Monitoring Program (AMP B.1.27), where accessible areas are monitored for evidence of aging effects that may apply to containment structures. Section 3.0.3.1 of this SER evaluates this program, which is consistent with GALL AMP XI.S6, "Structures Monitoring Program." It is also used for the examination of belowgrade concrete when it is exposed by excavation.

The GALL Report, Volume 2, Chapter II, Table A1 (as modified by ISG-3), recommends further evaluation to manage the aging effects for containment concrete components located in inaccessible areas if the aging mechanisms of (1) freeze-thaw, (2) leaching of calcium hydroxide, (3) aggressive chemical attack, (4) reaction with aggregates, or (5) corrosion of embedded steel are significant. Possible aging effects for containment concrete structural