The applicant did not identify any aging effects for the brass, copper, and stainless steel emergency containment filtration system components exposed to an external environment of containment air, as indicated in Table 3.3-6 of the LRA. The applicant's position was found to be acceptable because the staff agreed that there are no aging effects associated with the brass, copper, and stainless steel components exposed to containment air that could cause a component to lose its ability to perform an intended function during the period of extended operation.

The loss of material of carbon steel components in the external environment of containment air is due to general and pitting corrosion.

The loss of mechanical closure integrity due to aggressive chemical attack is an aging effect that requires management of mechanical closure carbon and low alloy steel bolting that is susceptible to potential borated water leaks.

Based on the description of the emergency containment filtration system components in the internal and external environments, and the materials used in the fabrication of the various components, the staff found that the applicant adequately identified the aging effects that are applicable for this system.

3.3.6.2.2 Aging Management Programs

To manage the aging effects for the emergency containment filter housings exposed to an internal environment of air/gas, the applicant identified the following AMP:

- periodic surveillance and preventive maintenance program

To manage the aging effects for the emergency containment filtration valves, and piping/fittings, exposed to an internal environment of treated water, the applicant identified the following AMP:

- chemistry control program

To manage the aging effects for the emergency containment filter housings exposed to an external environment of containment air, the applicant identified the following AMP:

- periodic surveillance and preventive maintenance program

To manage the aging effects for the emergency containment filter housings exposed to an external environment of borated water leaks, the applicant identified the following AMP:

- boric acid wastage surveillance program

To manage the aging effects for the emergency containment filtration bolting exposed to an external environment of borated water leaks, the applicant identified the following AMP:

- boric acid wastage surveillance program

The staff reviewed the information provided in the LRA for the AMPs used by the applicant to manage the aging of the emergency containment filtration system components, and determined that the AMPs identified above are acceptable to manage the applicable aging effects. Refer to Sections 3.1.1, 3.9.3, and 3.9.11 of this SER for the review of these AMPs.

3.3.6.3 Conclusion

The staff has reviewed the information in Sections 2.3.2.6 and 3.3 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the emergency containment filtration system will be adequately managed so that there is reasonable assurance that this system will perform its intended functions in accordance with the CLB throughout the period of extended operation.

3.3.7 Containment Post-Accident Monitoring and Control

3.3.7.1 Summary of Technical Information in the Application

The applicant describes its AMR of the containment post-accident monitoring and control system for license renewal in Section 2.3.2.7, "Containment Post-Accident Monitoring and Control," and Section 3.3 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging associated with the containment post-accident monitoring and control system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The containment post-accident monitoring and control system includes the following subsystems: post-accident hydrogen monitoring, post-accident hydrogen control, containment pressure monitoring, post-accident sampling, and containment air particulate and gas monitoring. A description of these systems is provided below.

The post-accident hydrogen monitoring system provides indication of the hydrogen gas concentration in the containment atmosphere following a loss-of-coolant accident. The mechanical portions of the post-accident hydrogen monitoring system provide a flow path from the containment to the hydrogen monitors and then back to the containment.

The containment pressure monitoring system consists of redundant containment pressure signals that are provided to isolate the containment and initiate several reactor safeguard actions. The mechanical portions of the containment pressure monitoring system provide sensing lines from the containment to the containment pressure monitors.

The only mechanical portion of the post-accident sampling in the scope of license renewal is the sample cooler because it forms a part of the component cooling water pressure boundary. Component cooling water is described in UFSAR Section 9.3.

The post-accident hydrogen control system provides the means for achieving and maintaining containment post-accident hydrogen control. Post-accident hydrogen control is described in UFSAR Section 9.12.

The containment air particulate and gas monitoring system measures radioactivity in the containment air. The mechanical portions of containment air particulate and gas monitoring provide a flow path from the containment to the monitors and then back to the containment. The containment air particulate and gas monitoring system is described in UFSAR Section 11.2.3.

The containment post-accident monitoring and control components subject to an AMR include pumps and valves (pressure boundary only), orifices, piping, tubing and fittings. The intended functions for the containment post-accident monitoring and control components subject to an AMR include pressure boundary integrity and throttling. A complete list of the containment post-accident monitoring and control components requiring an AMR and the component intended functions are provided in Table 3.3-7 of the LRA.

3.3.7.2 Staff Evaluation

3.3.7.2.1 Effects of Aging

For the containment post-accident monitoring and control system, the applicant stated that the stainless steel hydrogen monitor pumps, filter housings, valves, piping, tubing, fittings, and orifices; carbon steel tubing and fittings; aluminum pump casings; brass piping and fittings and copper tubing and fittings are exposed to air/gas. As discussed in Table 3.3-7 of the LRA, for these items exposed to air/gas there is no aging effect. For the post-accident sampling system stainless steel cooler shells, covers and tube coils exposed only to treated water, loss of material is the applicable aging effect.

There are no aging effects for containment post-accident monitoring and control system components exposed to external environments on stainless steel, aluminum, brass or copper. For valves, piping, fittings, and tubing made of carbon steel, which are exposed to an "indoor-not air-conditioned," containment air environment, or borated water leaks, the applicable aging effect is loss of material. For carbon steel bolting that is exposed to borated water leaks, the aging effect is loss of mechanical closure integrity.

Based on the description of the containment post-accident monitoring and control system components in the internal and external environments, and the materials used in the fabrication of the various components, the staff finds that the applicant has adequately identified the aging effects that apply to this system.

3.3.7.2.2 Aging Management Programs

To manage the aging effects on the stainless steel components exposed to treated water, such as, the post-accident sampling system stainless steel cooler shells, covers and tube coils, the applicant identified the following AMP:

- chemistry control program

To manage aging effects for the carbon steel valves, piping, fittings and tubing exposed to "indoor-not air-conditioned" or containment air environment, the applicant identified the following AMP:

* systems and structures monitoring program

To manage the aging effects for the carbon steel valves, piping, fittings and tubing exposed to borated water leaks, the applicant identified the following AMPs:

* boric acid wastage surveillance program

To manage the aging effects for the carbon steel bolting exposed to borated water leaks, the applicant identified the following AMP:

* boric acid wastage surveillance program

The staff reviewed the information provided in the LRA for the AMPs used by the applicant to manage the aging effects of the containment post-accident monitoring and control system components, and determined that the AMPs identified above are acceptable to manage the applicable aging effects. Refer to Sections 3.1.3 and 3.9.3 of this SER for the review of these AMPs.

3.3.7.3 Conclusion

The staff has reviewed the information in Sections 2.3.2.7 and 3.3 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the containment post-accident monitoring and control system will be adequately managed so that there is reasonable assurance that this system will perform its intended functions in accordance with the CLB during the period of extended operation.

3.4 Auxiliary Systems

In LRA Section 3.4, "Auxiliary Systems," the applicant describes the AMR for the auxiliary systems. Appendices A, B, and C to the LRA also contain supplementary information related to the AMR of the auxiliary systems. The staff reviewed Section 3.4 and the applicable portions of Appendices A, B, and C to determine whether the applicant has provided sufficient information to demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB throughout the period of extended operation, in accordance with 10 CFR 54.21(a)(3) for the auxiliary system structures and components (SCs) that are determined to be within the scope of license renewal and subject to an AMR.

The Turkey Point auxiliary systems include the following 15 systems:

* intake cooling water (ICW)
* component cooling water (CCW)
* spent fuel pool cooling
* chemical and volume control
* primary water makeup
* sample systems
* waste disposal
* instrument air
* normal containment and control rod drive mechanism cooling

- auxiliary building ventilation
- control building ventilation
- emergency diesel generator building ventilation
- turbine building ventilation
- fire protection
- emergency diesel generators and support systems

In the LRA, Section 2.1, "Scoping and Screening Methodology," the applicant describes the method used to identify the SCs that are within the scope of license renewal and subject to an AMR. The applicant identifies and lists the auxiliary system SCs in Section 2.3.3 "Auxiliary Systems," of the LRA. The staff's evaluation of the scoping methodology and the auxiliary system SCs included within the scope of license renewal and subject to an AMR is documented in Sections 2.1 and 2.3.3 of this SER, respectively. In LRA Appendix A, "Updated Final Safety Analysis Report Supplement," the applicant provides a summary description of the programs and activities used to manage the effects of aging, as required in 10 CFR 54.21(d). The applicant provides a more detailed description of these AMPs for the staff to use in its evaluation in Appendix B to the LRA. In LRA Appendix C, the applicant describes the processes used to identify many of the applicable aging effects for the SCs that are subject to an AMR. In LRA Appendix D, the applicant states that no changes to the Turkey Point Technical Specifications (TS) have been identified. A discussion of each system follows.

3.4.1 Intake Cooling Water

The intake cooling water (ICW) system removes heat from the component cooling water (CCW) and the turbine plant cooling water. The ICW pumps supply salt water from the plant's intake area through two redundant piping headers to the tube side of the CCW and turbine plant cooling water heat exchangers.

3.4.1.1 Summary of Technical Information in the Application

The applicant described its AMR of the ICW system for license renewal in Section 2.3.3.1, "Intake Cooling Water," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the ICW system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The applicant identifies the following SCs of the ICW system that are within the scope of license renewal and subject to an AMR:

- SCs that are safety-related and are relied upon to remain functional during and following design-basis events

- SCs that are non-safety-related whose failure could prevent satisfactory accomplishment of the safety-related functions

- SCs that are relied on during postulated fires and station blackout events

The applicant states that the components subject to an AMR include pumps and valves (pressure boundary only), strainers, orifices, piping, tubing and fittings. The intended functions of ICW components that are subject to an AMR are pressure boundary integrity, filtration, structural integrity, structural support, and throttling. A complete list of ICW components that require an AMR and their component intended functions appears in Table 3.4-1 of the LRA.

3.4.1.2 Staff Evaluation

The components in the ICW system are fabricated from carbon steel, stainless steel, cast iron, rubber, bronze, copper-nickel, monel, and aluminum-bronze exposed to an internal environment of raw water in the cooling canals. These components include ICW pumps and pump expansion joints; basket strainer (shells and internal screens); valves, piping, and fittings; orifices; and thermowells chemical injection nozzles (Units 3 only). The aging effects of these materials in the raw water environment are identified in Table 3.4-1, and are discussed in Section 6.2, "Raw Water," of Appendix C to the LRA. The raw water environment in the cooling canals is defined as salt water used as the ultimate heat sink. Applicable aging effects in this internal environment include loss of material (due to general corrosion, pitting corrosion, galvanic corrosion, crevice corrosion, microbiologically induced corrosion (MIC), and selective leaching) and cracking (due to embrittlement for rubber).

Components in the ICW system which are exposed externally to an outdoor environment are manufactured from the following materials: stainless steel, carbon steel, cast iron, rubber, bronze, copper nickel, monel, and aluminum-bronze. The outdoor environment consists of a moist, salt-ladened atmospheric air, temperature 30°F to 95°F, and exposure to weather (including precipitation and wind). The aging effects of these materials exposed externally to the outdoor environment are identified in Table 3.4-1 and are discussed in Section 7.0, "Outdoor," of Appendix C to the LRA. Applicable aging effects for these components exposed externally to the outdoor environment include loss of material due to general, pitting, galvanic, crevice and MIC; cracking due to stress corrosion and embrittlement (in the case of rubber).

A few components in the ICW system have external surfaces which may be exposed to borated water leaks. These components include the carbon steel basket strainer shells, as well as the cast and carbon steel iron valves, piping, and fittings. The aging effects associated with external exposure to borated water leaks are identified in Table 3.4-1 and are discussed in Section 7.5, "Borated Water Leaks," of Appendix C to the LRA. Applicable aging effects include loss of material and loss of mechanical closure due to aggressive chemical attack.

3.4.1.2.1 Aging Management Programs

To manage the aging effects of stainless steel, carbon steel, cast iron, bronze, copper-nickel, monel, rubber, and aluminum-bronze components exposed internally to a raw water environment in the cooling canals, the applicant relies on the following AMPs:

- periodic surveillance and preventive maintenance program
- ICW system inspection program
- systems and structures monitoring program

The periodic surveillance and preventive maintenance program provides for visual inspection of selected surfaces of specific components and structural components, or alternatively their replacement/refurbishment during the performance of periodic surveillance and preventive maintenance activities. The description of this program is provided in Appendix B, Section 3.2.11, "Periodic Surveillance and Preventive Maintenance Program," of the LRA. This program is credited for managing the aging effects of stainless steel, carbon steel and cast iron ICW pumps; rubber ICW pump expansion joints; and aluminum-bronze pump discharge valves that are internally exposed to the raw water environment. The periodic surveillance and preventive maintenance program is a current program that will be enhanced with regard to the scope of specific inspections and their documentation. The staff requested that the applicant provide applicable frequencies, bases and the most recent operating history supporting the adequacy of this program in managing the aging effects associated with the following components: stainless steel, carbon steel and cast iron ICW pumps; rubber ICW pump expansion joints; and aluminum-bronze pump discharge valves that are externally exposed to the raw water environment. In response to the staff's RAI, the applicant indicated that this program is used to manage internal and external aging effects of these components. In addition, the scheduled frequency of preventive maintenance activity for the replacement of the ICW pumps, discharge check valves, and expansion joints is 42 months. The applicant further stated that this frequency is based on the operating and maintenance history of these components at Turkey Point, and adjustments to this frequency may be made based on future plant-specific performance and/or industry experience.

On the basis of this information, the staff finds this program acceptable in managing the aging effects associated with these components in the ICW system. The staff's detailed evaluation of the periodic surveillance and preventive maintenance program is provided in Section 3.9.11 of this SER.

The ICW system inspection program was developed in response to NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment." This program includes performance testing and evaluations, systematic inspections, leakage evaluations, and corrective actions to ensure that loss of material, cracking or biological fouling does not lead to loss of component intended function. The description of this program is provided in LRA Appendix B, Section 3.2.10, "Intake Cooling Water System Inspection Program." This program is credited for managing the aging effects of carbon steel basket strainer shell; stainless steel basket internal screen and cast iron, copper-nickel, and bronze valves, piping, and fittings exposed internally to the raw water environment. The staff finds this program adequate in managing the aging effects for these components in the ICW system. The staff's detailed evaluation of the ICW system inspection program is provided in Section 3.9.10 of this SER.

The systems and structures monitoring program provides for visual inspection and examination of accessible surfaces of specific systems, structures and components, including welds and bolting. The description of this program is provided in Appendix B, Section 3.2.15, "Systems and Structures Monitoring Program," of the LRA. This program is credited for managing the aging effects of cast iron, carbon steel, bronze, monel, and stainless steel valves, piping, tubing, and fittings; stainless steel orifices; monel chemical injection nozzles and stainless steel thermowells that are internally exposed to the raw water environment. For structures that are inaccessible for inspection through the systems and structures monitoring program, an inspection of structures with similar materials and environments may be indicative of aging effects. Several components in the ICW system credit this program for managing loss of material in the raw water environment. The staff requested the applicant provide the applicable frequencies, bases and the most recent operating history supporting the adequacy of this program for the following components in the ICW system: cast iron, carbon steel, bronze, monel, and stainless steel valves, piping, tubing, and fittings; stainless steel orifices; and stainless steel thermowells. In response to the staff's request, the applicant provided the following information: leakage inspection of the ICW orifices, thermowells and tubing/fittings was inadvertently omitted from the systems and structures monitoring program description of Appendix B, Section 3.2.15, of the LRA. In addition, the applicant responded that the leakage inspection is performed at least once per 18 months and that evaluations have been performed to show that throughwall leakage equivalent to a 1-inch diameter opening will not reduce ICW flow to the CCW heat exchangers below design requirements. The applicant provided the following reasons supporting the adequacy of this program in managing the aging effect of loss of material for these components:

- For above ground cement-lined cast iron piping, the maintenance history shows that localized failures of the cement lining have occurred. This results in small corrosion cells which will be detected through small throughwall leakage.

- For carbon steel piping/fitting and valves on the discharge channel of the CCW heat exchangers, leakage does not impact the intended function because of the heat transfer capability of this component.

- For small instrument valves and piping/tubing/fittings and thermowells and orifices made of stainless steel, monel and bronze, leakage does not affect the system function due to the size of these components. In addition, operating maintenance history has shown that leakage from these components has not been significant at Turkey Point.

On the basis of the information provided by the applicant, the staff finds that this program is appropriate and adequate for managing the aging effects associated with components in the ICW system. The staff's detailed evaluation of the systems and structures monitoring program is provided in Section 3.1.3 of this SER.

To manage the aging effects of the stainless steel, carbon steel, cast iron, rubber, bronze, copper-nickel, monel, and aluminum-bronze components externally exposed to an outdoor environment, the applicant relies on the following AMPs:

- periodic surveillance and preventive maintenance program
- systems and structures monitoring program

The periodic surveillance and preventive maintenance program provides for visual inspection of selected surfaces of specific components and structural components, or alternatively their replacement/refurbishment during the performance of periodic surveillance and preventive maintenance activities. The description of this program is provided in Appendix B, Section 3.2.11, of the LRA. This program is credited for managing the aging effects of stainless steel, carbon steel, and cast iron intake cooling pumps, as well as rubber ICW pump expansion joints externally exposed to an outdoor environment. This program is discussed above.

The systems and structures monitoring program provides for visual inspection and examination of accessible surfaces of specific systems, structures and components, including welds and bolting. The description of this program is provided in Appendix B, Section 3.2.15, of the LRA. This program is credited for managing the aging effects of carbon steel basket strainers shell; stainless steel, carbon steel, and cast iron valves, piping, and fittings; stainless steel orifices; and stainless steel thermowells externally exposed to an outdoor environment. This program is discussed above.

To manage the aging effects of the carbon steel and cast iron components externally exposed to borated water leaks, the applicant relies on the following AMP:

- boric acid wastage surveillance program

The boric acid wastage surveillance program is an enhanced program which uses systematic inspections, leakage evaluations, and corrective actions to ensure that boric acid corrosion does not lead to degradation of the pressure boundary or structural integrity of components, supports or structures. The description of this program is provided in Appendix B, Section 3.2.3, "Boric Acid Wastage Surveillance Program," of the LRA. This program is credited for managing the aging effects of carbon steel basket strainers shell; carbon steel bolting; and cast iron and carbon steel valves, piping, and fittings externally exposed to borated water leaks. The boric acid wastage surveillance program provides for visual inspection of external surfaces for evidence of corrosion, cracking, leakage, fouling or coating damage. In RAI 3.4-3, dated February 2, 2001, the staff requested the applicant to provide more detail of the location of the bolts in the CCW heat exchanger room and the applicable frequencies, bases, and the most recent operating history supporting the adequacy of this program in managing the aging effects for these components. In its March 22, 2001, response to the staff's request, the applicant provided additional information that carbon and low alloy steel mechanical closures located near borated water systems are considered susceptible to aggressive chemical attack. In the ICW system, the bolted connections for piping, fittings and equipment (including valve bonnets) located in the CCW heat exchanger rooms are potentially exposed to leakage from the borated water systems. The applicant further stated that a review of the condition report and metallurgical report databases (1992 through 2000) did not identify any instance of bolting degradation due to boric acid corrosion in this system.

On the basis of the information provided, the staff finds that this program is appropriate and acceptable for managing the aging effects associated with these components. The staff's detailed evaluation of the boric acid wastage surveillance program is provided in Section 3.9.3 of this SER.

3.4.1.3 Conclusion

The staff has reviewed the information in Section 2.3.3.1 and Section 3.4 of the LRA and the applicant's responses to the staff's RAIs. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the ICW system will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB throughout the period of extended operation.

3.4.2 Component Cooling Water

The CCW system removes heat from safety-related and non-safety-related components during normal and emergency operation. The component cooling water pumps circulate component cooling water through heat exchangers and coolers that are associated with other systems. The component cooling water heat exchangers transfer the heat from these systems to the intake cooling water.

3.4.2.1 Summary of Technical Information in the Application

The applicant described its AMR of the component cooling water system for license renewal in Section 2.3.3.2, "Component Cooling Water," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the component cooling water system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The applicant identifies the following SCs of the CCW system that are within the scope of license renewal and subject to an AMR:

- SCs that are safety-related and are relied upon to remain functional during and following design-basis events
- SCs that are non-safety-related whose failure could prevent satisfactory accomplishment of the safety-related functions
- SCs that are part of the environmental qualification program
- SCs that are relied on during postulated fires and station blackout events

The applicant states that the components subject to an AMR include pumps and valves (pressure boundary only), heat exchangers, tanks, orifices, piping, tubing and fittings. The intended functions for component cooling water components subject to an AMR include pressure boundary integrity, heat transfer, and throttling. A complete list of component cooling water components that require AMR and their component intended functions appears in Table 3.4-2 of the LRA.

3.4.2.2 Staff Evaluation

The components in the CCW system are fabricated from stainless steel, carbon steel, cast iron, copper nickel, brass, aluminum-brass, and copper internally exposed to the treated water environment. The components exposed internally to the treated water environment are: stainless steel component cooling water head tanks; carbon steel component cooling water surge tanks; cast iron component cooling water pumps; carbon steel, copper-nickel, and aluminum-brass component cooling water heat exchanger internals; carbon steel and stainless steel valves, piping, fittings, and thermowells; brass valves, carbon steel and stainless steel rotometers; and stainless steel orifices. The aging effects of these materials in the treated water environment are identified in Table 3.4-2 and are discussed in Section 6.1, "Treated Water," of Appendix C to the LRA. Applicable internal aging effects in the treated water environment are loss of material due to general, pitting, and galvanic corrosion, MIC, and selective leaching; cracking due to stress corrosion, intergranular stress-corrosion, embrittlement, and high-cycle fatigue of stainless steel materials; and fouling due to biological and particulate fouling. Although cracking due to stress corrosion, intergranular stress corrosion, embrittlement, and high-cycle fatigue are applicable aging effects for stainless steel materials that are internally exposed to the treated water environment, these aging effects are not identified for any stainless steel component in Table 3.4-2 of the LRA. In RAI 3.4.2-1, dated February 2, 2001, the staff requested the applicant provide the bases for excluding these applicable aging effects for stainless steel components in the CCW system. In its March 22, 2001, response, the applicant provided the following information:

- The highest operating temperature in the CCW system is 140 °F, the threshold temperature for stress corrosion cracking (SCC) in a treated water environment. In addition, at this temperature, components of the CCW system are not susceptible to intergranular stress-corrosion cracking (IGSCC) or embrittlement. The applicant further stated that this conclusion is supported by plant operating experience which did not identify any instances of SCC or IGSCC in stainless steel CCW components.

- High cycle fatigue (such as vibration-induced fatigue) is fast acting, and typically occurs early in a component's life. The applicant did not find any instances of fatigue-induced cracking of stainless steel components in the CCW system.

On the basis of this information, the staff finds that stainless steel components in the CCW system are not subject to stress corrosion, intergranular stress corrosion, embrittlement, and high-cycle fatigue.

The CCW system also has components internally exposed to the raw water environment in the closed cooling canals. These components are the copper-nickel component cooling water heat exchanger tube sheets (tube side), channels, and channel door overlay, as well as the aluminum-brass component cooling water heat exchanger tubes (inside diameter). The aging effects of these materials in the raw water environment are identified in Table 3.4-2 and are discussed in Section 6.2 of Appendix C of the LRA. The raw water environment in the cooling canals is defined as salt water used as the ultimate heat sink. Applicable aging effects in this internal environment include loss of material due to pitting corrosion, crevice corrosion, and MIC.

The air/gas environment is an applicable internal environment for the stainless steel component cooling water head tanks; carbon steel pressure vessels (air reservoirs); stainless steel, carbon steel, and brass valves, piping, fittings, tubing, and filters; and stainless steel orifices. The applicant did not identify any aging effects of these components in the air/gas environment. The aging effects associated with exposure to the air/gas environment are identified in Table 3.4-2 and are discussed in Section 6.3, "Air/Gas," of Appendix C to the LRA. Several air/gas environment descriptions are provided for each of the air/gas environments found in the plant. Aging effects of components exposed to the air/gas environment is dependent, in part, on the type of air/gas environment, the operating temperature, and the water content. The staff requested the applicant provide the characteristic parameters of the air/gas environments applicable to the components found in the CCW system and to provide the bases by which the determination of no aging effects requiring management was concluded for all components exposed to the air/gas environment. This RAI is similar to information requested for stainless steel components exposed to an air/gas environment in the chemical and volume control system (RAI 3.4.4-1). The staff evaluated the information and on the basis of the applicant's response, stainless steel is not susceptible to loss of material in this environment and therefore, no AMP is required.

Components in the CCW system which are exposed externally to an outdoor environment are manufactured from the following materials: stainless steel, carbon steel, cast iron, brass and copper-nickel. The outdoor environment consists of a moist, salt-ladened atmospheric air, temperature 30 °F to 95 °F, and exposure to weather, including precipitation and wind. The aging effects associated with external exposure to an outdoor environment are identified in Table 3.4-2 and are discussed in Section 7.1, "Outdoor," of Appendix C to the LRA. Applicable aging effects for the remaining components exposed externally to the outdoor environment include loss of material due to general, and pitting corrosion.

Components in the CCW system which are exposed externally to an indoor environment - not air-conditioned are carbon steel component cooling water surge tanks; carbon steel pressure vessels (air reservoirs); carbon steel valves, pipings, and fittings; stainless steel valves, piping, fittings, filters, and thermowells; stainless steel orifices and rotometers; carbon steel rotometers; and brass valves. The indoor, not air-conditioned environment, is defined as atmospheric air with a maximum air temperature of 104 °F, humidity between 5% and 95%, and no exposure to weather. The aging effects associated with external exposure to an outdoor environment are identified in Table 3.4-2 and are discussed in Section 7.2, "Indoor - Not Air Conditioned," of Appendix C to the LRA. The applicable aging effect is loss of material due to general and pitting corrosion for carbon steel.

The CCW system also contains carbon steel valves, piping, and fittings that are externally exposed to containment air. The containment air environment is described as atmospheric air with a maximum temperature of 120 °F, humidity between 5% and 95%, radiation total integrated dose rate of 1 rad/hr, and no exposure to weather. The aging effects associated with external exposure to the containment air environment are identified in Table 3.4-2 and are discussed in Section 7.4, "Containment Air," of Appendix C to the LRA. Applicable aging effects for carbon steel components include loss of material due to general and pitting corrosion.

A few components in the CCW system have external surfaces which may be exposed to borated water leaks. These components include the carbon steel pressure vessels (air reservoirs); cast iron component cooling water pumps; carbon steel component cooling water heat exchanger shells, flanges, and doors; carbon steel valves, piping, fittings, rotometers, and bolting. The aging effects associated with external exposure to borated water leaks are identified in Table 3.4-2 and are discussed in Section 7.5 of Appendix C to the LRA. Borated water leaking from systems undergoes evaporation, which results in a highly concentrated solution of boric acid or deposits of boric acid crystals. Applicable aging effects include loss of material and loss of mechanical closure due to aggressive chemical attack. The staff finds that the aging effects identified by the applicant are acceptable.

3.4.2.2.1 Aging Management Programs

To manage the aging effects of stainless steel, carbon steel, cast iron, copper-nickel, aluminum-brass, and brass that are internally exposed to a treated water environment, the applicant relies on the following AMPs:

- chemistry control program
- galvanic susceptibility inspection program (carbon steel only)

The chemistry control program provides for sampling and analysis of treated water. The description of this program is provided in Appendix B, Section 3.2.4 "Chemistry Control Program," of the LRA. The staff finds this program appropriate in managing the aging effects associated with the treated water environment. The staff's detailed evaluation of this program is found in Section 3.1.1 of this SER.

The galvanic susceptibility inspection program is a new program which will provide for one-time inspections the results of which will be used to determine the need for additional actions. The description of this program is provided in Appendix B, Section 3.1.5, "Galvanic Corrosion Susceptibility Inspection Program," of the LRA. The staff requested that the applicant provide the bases for the determination of corrosion rates and for the techniques which will be used in this new program. The applicant stated in its response to the staff's RAI that plant experience with galvanic corrosion has been limited and typically has occurred in saltwater. In addition, the applicant stated that examination techniques that have previously been employed at Turkey Point include ultrasonic, radiographic, and visual inspections. The type of examination employed will be selected based on component geometry, material of construction, and accessibility, and will utilize accepted industry practices and standards (e.g., American Society of Mechanical Engineers standards). The applicant further stated that the corrosion rate will be estimated from the original thickness, if known, or from an unaffected zone and the service time of the component. On the basis of the information provided, the staff finds that this new program is appropriate and acceptable for managing components in the chemical and volume control system. The staff's detailed evaluation of this program is provided in Section 3.8.5 of this SER.

To manage the aging effects of the carbon steel and cast iron components externally exposed to containment air, outdoor and indoor - not air-conditioned environment, the applicant relies on the following AMP:

- systems and structures monitoring program

The systems and structures monitoring program provides for visual inspection and examination of accessible surfaces of specific systems, structures and components, including welds and bolting. The description of this program is provided in Appendix B, Section 3.2.15 of the LRA. The staff's detailed evaluation of these programs are provided in Sections 3.9.11 and 3.1.3 of this SER.

To manage the aging effects of the carbon steel and cast iron components externally exposed to borated water leaks, the applicant relies on the following AMP:

- boric acid wastage surveillance program

The boric acid wastage surveillance program is an enhanced program which uses systematic inspections, leakage evaluations, and corrective actions to ensure that boric acid corrosion does not lead to degradation of the pressure boundary or structural integrity of components, supports or structures. The description of this program is provided in Appendix B, Section 3.2.3 of the LRA. The staff's detailed evaluation of this program is provided in Section 3.9.3 to this SER.

3.4.2.3 Conclusion

The staff has reviewed the information in Section 2.3.3.2 and Section 3.4 of the LRA and the applicant's responses to the staff's RAIs. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the CCW system will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB during the period of extended operation.

3.4.3 Spent Fuel Pool Cooling

The spent fuel pool (SFP) cooling system removes decay heat from the spent fuel pool and filters and demineralizes the water in the spent fuel pool. There are two SFPs and SFP cooling systems. Spent fuel pool cooling consists of three separate cooling, purification, and skimmer loops.

3.4.3.1 Summary of Technical Information in the Application

The applicant described its AMR of the SFP cooling system for license renewal in Section 2.3.3.3, "Spent Fuel Pool Cooling," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the SFP cooling system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The applicant identifies the following SCs of the SFP cooling that are within the scope of license renewal and subject to an AMR:

- SCs that are safety-related and are relied upon to remain functional during and following design-basis events

- SCs that are non-safety-related whose failure could prevent satisfactory accomplishment of the safety-related functions

- SCs that are relied on during station blackout events

The applicant states that the components that are subject to an AMR include pumps and valves (pressure boundary only), heat exchangers, filters, demineralizers, orifices, piping, tubing, and fittings. The intended functions of SFP cooling components that are subject to an AMR include pressure boundary integrity, heat transfer, and throttling. A complete list of SFP cooling components that require AMR and the component intended functions appears in Table 3.4-3 of the LRA.

3.4.3.2 Staff Evaluation

The components in the SFP cooling system are fabricated from stainless steel, worthite (nickel-based alloy), and carbon steel exposed to an internal environment of treated water. These components include SFP cooling pumps (refueling water purification pumps), emergency SFP cooling pumps, SFP cooling heat exchanger internals, valves, piping, fittings, tubing, filters, demineralizers, flow elements, and orifices. The aging effects of these materials in the treated water environment are identified in Table 3.4-3 and are discussed in Section 6.1 of Appendix C of the LRA. The treated water environments are treated water-borated and treated water for this application. Applicable internal aging effects in the treated water environment are loss of material due to general, pitting, and galvanic corrosion, MIC, and fouling due to biological and particulate fouling.

Components in the SFP cooling system which are exposed externally to an indoor environment - not air-conditioned are stainless steel SFP cooling pumps; stainless steel refueling water purification pumps; worthite (nickel-based alloy) emergency SFP cooling pumps; carbon steel SFP cooling heat exchanger shells and covers; stainless steel valves, piping, fittings, filters, demineralizers, flow elements, and orifices. The "indoor environment-not air-conditioned," is defined as atmospheric air with a maximum air temperature of 104 °F, humidity between 5% and 95%, and no exposure to weather. The aging effects associated with external exposure to an outdoor environment are identified in Table 3.4-3, and are discussed in Section 7.2 of Appendix C to the LRA. Applicable aging effects include loss of material due to general and pitting corrosion for carbon steel.

Components in the SFP cooling system that are exposed externally to an outdoor environment are the stainless steel refueling water purification pumps, valves, piping, fittings, tubing, filters and demineralizers. The outdoor environment consists of a moist, salt-ladened atmospheric air, temperature 30 °F to 95 °F, and exposure to weather, including precipitation and wind. The aging effects of these materials which are externally exposed to the outdoor environment are identified in Table 3.4-3 and discussed in Section 7.0 to Appendix C of the LRA. There are no applicable aging effects for these stainless steel components, which are externally exposed to the outdoor environment.

A few components in the SFP cooling system have external surfaces that may be exposed to borated water leaks. These components include carbon steel bolting and the carbon steel SFP cooling heat exchanger shells and covers. Borated water leaking from systems undergoes evaporation, which results in a highly concentrated solution of boric acid or deposits of boric acid crystals. The aging effects associated with external exposure to borated water leaks are identified in Table 3.4-3 and are discussed in Section 7.5 of Appendix C of the LRA. Applicable aging effects include loss of material and loss of mechanical closure due to aggressive chemical attack.

The SFP cooling system has stainless steel piping and fittings which are encased or embedded in concrete. There are no applicable aging effects requiring management for these components.

3.4.3.2.1 Aging Management Programs

To manage the aging effects of stainless steel, worthite (nickel-based alloy), and carbon steel components that are internally exposed to a treated water environment, and submerged stainless steel piping and fittings in the same environment, the applicant relies on the following AMPs:

- chemistry control program
- galvanic susceptibility inspection program (carbon steel only)

The chemistry control program provides for sampling and analysis of treated water. The description of this program is provided in Appendix B, Section 3.2.4 of the LRA. The staff finds this program appropriate in managing the aging effects associated with the treated water environment. The staff's detailed evaluation of this program is found in Section 3.1.1 of this SER.

The galvanic susceptibility inspection program is a new program which will provide for one-time inspections, the results of which will be used to determine the need for additional actions. The description of this program is provided in Appendix B, Section 3.1.5. The staff requested that the applicant provide the bases for the determination of corrosion rates and for the techniques which will be used in this new program. The applicant stated in its response to the staff's RAI that plant experience with galvanic corrosion has been limited and typically has occurred in saltwater. In addition, the applicant stated that examination techniques that have previously been employed at Turkey Point include ultrasonic, radiographic, and visual inspections. The type of examination employed will be selected based on component geometry, material of construction, and accessibility, and will utilize accepted industry practices and standards (e.g., American Society of Mechanical Engineers standards). The applicant further stated that the corrosion rate will be estimated from the original thickness, if known, or from an unaffected zone and the service time of the component.

On the basis of the information provided, the staff finds that this new program is appropriate and acceptable for managing components in the SFP cooling system. The staff's detailed evaluation of this program is provided in Section 3.8.5 of this SER.

To manage the aging effects of carbon steel exposed externally to an indoor - not air-conditioned environment, the applicant relies on the following AMP:

- systems and structures monitoring program

The systems and structures monitoring program provides for visual inspection and examination of accessible surfaces of specific systems, structures and components, including welds and bolting. The description of this program is provided in Section 3.2.15 of Appendix B to the LRA. The staff's detailed evaluation of this program is provided in Section 3.1.3 of this SER.

To manage the aging effects of the carbon steel components externally exposed to borated water leaks, the applicant relies on the following AMP:

- boric acid wastage surveillance program

The boric acid wastage surveillance program is an enhanced program which uses systematic inspections, leakage evaluations, and corrective actions to ensure that boric acid corrosion does not lead to degradation of the pressure boundary or structural integrity of components, supports or structures. The description of this program is provided in Appendix B, Section 3.2.3 of the LRA. This program is credited for managing the aging effects of carbon steel SFP cooling heat exchanger shells and covers and carbon steel bolting externally exposed to borated water leaks. The boric acid wastage surveillance program provides for visual inspection of external surfaces for evidence of corrosion, cracking, leakage, fouling or coating damage. The staff requested the applicant provide more detail of the location of the bolts in the SFP cooling water system and the applicable frequencies, bases and the most recent operating history supporting the adequacy of this program in managing the aging effects for these components. In response to the staff's request, the applicant provided the following additional information: carbon and low alloy steel mechanical closures located near borated water systems are considered susceptible to aggressive chemical attack. In the SFP cooling water system, all bolted connections for piping, fittings and equipment (including valve bonnets), regardless of location, are potentially exposed to leakage from the borated water systems. The applicant further stated that a review of the condition report and metallurgical report databases (1992 through 2000) did not identify any instance of bolting degradation due to boric acid corrosion in this system.

On the basis of the information provided, the staff finds that this program is appropriate and acceptable for managing the aging effects associated with these components. The staff's detailed evaluation of the boric acid wastage surveillance program is provided in Section 3.9.3 of this SER.

3.4.3.3 Conclusion

The staff has reviewed the information in Section 2.3.3.3 and Section 3.4 of the LRA and the applicant's responses to the staff's RAIs. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the SFP cooling system will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB throughout the period of extended operation.

3.4.4 Chemical and Volume Control

The chemical and volume control system provides for continuous feed and bleed for the reactor coolant system to maintain proper water level and to adjust boron concentration. This system includes the boron addition and supply system, which provides makeup, transfer boric acid solution, and maintains reactor water purity.

3.4.4.1 Summary of Technical Information in the Application

The applicant described its AMR of the chemical and volume control system for license renewal in Section 2.3.3.4 "Chemical and Volume Control," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the chemical and volume control system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The applicant identifies the following SCs of the chemical and volume control system that are within the scope of license renewal and subject to an AMR:

- SCs that are safety-related and are relied upon to remain functional during and following design-basis events
- SCs that are non-safety-related whose failure could prevent satisfactory accomplishment of the safety-related functions
- SCs that are part of the environmental qualification program
- SCs that are relied on during postulated fires and station blackout events

The applicant states that the components subject to an AMR include pumps and valves (pressure boundary only), tanks, heat exchangers, orifices, piping, tubing, and fittings. The intended functions for chemical and volume control components subject to an AMR are pressure boundary integrity, heat transfer, and throttling. A complete list of chemical and volume control system (CVCS) components that require AMR and the component intended functions appears in Table 3.4-4 of the LRA.

3.4.4.2 Staff Evaluation

The components exposed internally to the treated water environment are: stainless steel boric acid storage and batching tanks, volume control tanks, holdup tanks, boric acid storage tank pumps, charging pump suction stabilizers and pulsation dampeners, non-regenerative heat exchanger internals, valves, piping, fittings, thermowells charging pumps, demineralizers and filters, orifices and flow meters; copper charging pump oil cooler tubes; cast iron charging pump oil cooler bonnets and tubes; and carbon steel non-regenerative heat exchanger shells and tube supports. The aging effects of these materials in the treated water environment are identified in Table 3.4-4 and are discussed in Section 6.1 of Appendix C of the LRA. The treated water environment is defined as either borated water or water with corrosion and/or biocides added. Applicable internal aging effects in the treated water environment are loss of material due to general, pitting, and galvanic corrosion, MIC, and selective leaching; cracking due to stress corrosion, intergranular stress corrosion and high-cycle fatigue of stainless steel materials; and fouling due to biological and particulate fouling.

The outside diameter of the copper charging pump oil cooler tubes is exposed to a lubricating oil environment. The aging effects associated with this component are identified in Table 3.4-4 and are discussed in Section 6.5, "Lubricating Oil," of Appendix C to the LRA. There are no applicable aging effects for the copper tubes.

The air/gas environment is an applicable internal environment for the stainless steel boric acid storage and batching tanks; stainless steel volume control and holdup tanks; stainless steel valves, piping, tubing, and fittings; and brass valves. The applicant did not identify any aging effects of these components in the air/gas environment. The aging effects associated with exposure to the air/gas environment are identified in Table 3.4-4 and are discussed in Section 6.3 of Appendix C to the LRA. Several air/gas environment descriptions are provided for each of the air/gas environments found in the plant. Aging effects of components exposed to the air/gas environment is dependent, in part, on the type of air/gas environment, the operating temperature, and the water content. The staff requested the applicant to provide the characteristic parameters of the air/gas environments applicable to the components found in the chemical and volume control system and to provide the bases by which the determination of no aging effects requiring management was concluded for all components exposed to the air/gas environment. In response to the staff's request, the applicant provided the following information:

- The volume control tanks internal gas space surfaces and associated valves, piping/fittings, and tubing/fittings are made up of stainless steel and exposed to a non-wetted hydrogen environment with traces of nitrogen, oxygen, and helium at a temperature of 100 °F to 130 °F.

- The holdup tanks gas space surfaces are constructed from stainless steel and are exposed to a non-wetted nitrogen environment with traces of hydrogen, helium, and oxygen at a temperature of 50 °F to 130 °F.

- The boric acid storage and boric acid batching tanks gas space surfaces and associated valves and tubing/fittings are constructed from stainless steel and exposed to a non-wetted indoor not-air conditioned environment at a maximum temperature of 104 °F.

Since stainless steel is not susceptible to loss of material in any of these environments, the applicant concluded that no AMP is required. In addition, plant operating history supports this conclusion. Based on this additional information, the staff finds that there are no applicable aging effects for stainless steel components the chemical and volume control system exposed to these environments. Therefore, there is no need for an AMP for these components.

Components in the chemical and volume control system which are exposed externally to an indoor environment not air conditioned are: stainless steel boric acid storage and batching tanks, volume control and holdup tanks, boric acid storage tank pumps, charging pumps, charging pump suction stabilizers and discharge dampeners, valves, piping fittings, thermowells, tubings, fittings, filters, demineralizers, orifices, and flow meters; brass solenoid valves; cast iron charging pump oil cooler bonnets; and carbon steel non-regenerative heat exchanger shells. The indoor environment - not air-conditioned, is defined as atmospheric air with a maximum air temperature of 104 °F, humidity between 5% and 95%, and no exposure to weather. The aging effects associated with external exposure to an outdoor environment are identified in Table 3.4-4 and are discussed in Section 7.2 of Appendix C to the LRA.

The applicable aging effect for carbon steel and cast iron components exposed to a non-air conditioned indoor environment is loss of material due to general and pitting corrosion. There are no applicable aging effects for stainless steel components exposed to a non-air-conditioned indoor environment except for components that were previously heat traced. Cracking due to stress corrosion is an applicable aging effect for stainless steel components exposed to a non-air conditioned indoor environment and previously heat-traced.

The chemical and volume control system also contains stainless steel valves, piping, fittings, thermowells, tubing, and orifices, as well as brass instrument solenoid valves that are externally exposed to containment air. The containment air environment is described as atmospheric air with a maximum temperature of 120 °F, humidity between 5% and 95%, radiation total integrated dose rate of 1 rad/hr, and no exposure to weather. The aging effects associated with external exposure to the containment air environment are identified in Table 3.4-4 and are discussed in Section 7.4 of Appendix C to the LRA. There are no applicable aging effects for these components in the containment air environment.

A few components in the chemical and volume control system have external surfaces which may be exposed to borated water leaks. These components include the cast iron charging pump oil cooler bonnets, carbon steel non-regenerative heat exchanger shells, and carbon steel bolting. The aging effects associated with external exposure to borated water leaks are identified in Table 3.4-4 and are discussed in Section 7.5 of Appendix C of the LRA. Borated water leaking from systems undergoes evaporation, which results in a highly concentrated solution of boric acid or deposits of boric acid crystals. Applicable aging effects include loss of material and loss of mechanical closure due to aggressive chemical attack.

3.4.4.2.1 Aging Management Programs

To manage the aging effects of stainless steel, carbon steel, cast iron, and copper exposed internally to a treated water environment, the applicant relies on the following AMPs:

- chemistry control program
- periodic surveillance and preventive maintenance program
- galvanic susceptibility inspection program (carbon steel, cast iron, copper)

The chemistry control program provides for sampling and analysis of treated water. The description of this program is provided in Appendix B, Section 3.2.4 of the LRA. The staff's detailed evaluation of this program is provided in Section 3.1.1 of the SER.

The periodic surveillance and preventive maintenance program provides visual inspection of selected surfaces of specific components and structural components, or alternatively their replacement/refurbishment during performance of periodic surveillance and preventive maintenance activities. The description of this program is provided in Appendix B, Section 3.2.11.

The galvanic susceptibility inspection program is a new program which will provide for a one-time inspection, the results of which will be used to determine the need for additional actions. The description of this program is provided in Appendix B, Section 3.1.5 of the LRA. The staff requested that the applicant provide the bases for the determination of corrosion rates and for the techniques which will be used in this new program. The applicant stated in its response to the staff's RAI that plant experience with galvanic corrosion has been limited and typically has occurred in saltwater. In addition, the applicant stated that examination techniques that have previously been employed at Turkey Point include ultrasonic, radiographic, and visual inspections. The type of examination employed will be selected based on component geometry, material of construction, and accessibility, and will utilize accepted industry practices and standards (e.g., American Society of Mechanical Engineers standards). The applicant further stated that the corrosion rate will be estimated from the original thickness, if known, or from an unaffected zone and the service time of the component.

On the basis of the information provided, the staff finds that this new program is appropriate and acceptable for managing components in the chemical and volume control system. The staff's detailed evaluation of this program is provided in Section 3.8.5 of the SER.

To manage the aging effects of the stainless steel, cast iron, and carbon steel components externally exposed to an "indoor-not air-conditioned environment," the applicant relies on the following AMPs:

- periodic surveillance and preventive maintenance program
- systems and structures monitoring program

The periodic surveillance and preventive maintenance program provides for visual inspection of selected surfaces of specific components and structural components, or alternatively their replacement/refurbishment during the performance of periodic surveillance and preventive maintenance activities. The description of this program is provided in Appendix B, Section 3.2.1.1 of the LRA. Cracking has been identified as a potential aging effect for stainless steel components which have been previously heat-traced. The staff requested the applicant to provide the justification of crediting a sampling program of visual inspections for detecting cracking in these stainless steel components. In addition, the staff requested additional information on the most recent inspection of these stainless steel components, the baseline inspection of these components, if applicable, and the plant history of previously heat-traced components. The applicant responded to the staff's RAI by stating that all safety-related components in the chemical and volume control system which were previously heat traced are visually inspected for leakage on a periodic basis. In addition, plant operating experience has shown that leakage in a previously heat-traced component occurred due to SCC resulting from halogen contaminants. Corrective actions resulting from this experience included inspections and replacement, as needed. The applicant stated that the most recent visual leakage inspection did not reveal any throughwall leakage, and there are no other stainless steel components at Turkey Point, presently in service, where previously existing heat tracing was removed.

On the basis of this information, the staff finds that this program will adequately manage the aging effects associated with previously heat-traced components. The staff's detailed evaluation of this program is provided in Section 3.9.11 of this SER.

The systems and structures monitoring program provides for visual inspection and examination of accessible surfaces of specific systems, structures and components, including welds and bolting. The description of this program is provided in Appendix B, Section 3.2.15 of the LRA. The staff's detailed evaluation of this program is provided in Section 3.1.3 of this SER.

To manage the aging effects of the carbon steel and cast iron components externally exposed to borated water leaks, the applicant relies on the following AMP:

- boric acid wastage surveillance program

The boric acid wastage surveillance program is an enhanced program which uses systematic inspections, leakage evaluations, and corrective actions to ensure that boric acid corrosion does not lead to degradation of the pressure boundary or structural integrity of components, supports or structures. The description of this program is provided in Appendix B, Section 3.2.3 of the LRA. The staff's detailed evaluation of this program is provided in Section 3.9.3 of this SER.

3.4.4.3 Conclusion

The staff has reviewed the information in Sections 2.3.3.4 and 3.4 of the LRA and the applicant's responses to the staff's RAIs. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the chemical and volume control system will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB throughout the period of extended operation.

3.4.5 Primary Water Makeup

The primary water makeup system provides demineralized and deaerated water for makeup to various systems throughout the plant.

3.4.5.1 Summary of Technical Information in the Application

The applicant described its AMR of the primary water makeup system for license renewal in Section 2.3.3.5, "Primary Water Makeup," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the primary water makeup system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The applicant identifies the following SCs of the primary water makeup system that are within the scope of license renewal and subject to an AMR:

- SCs that are safety-related and are relied upon to remain functional during and following design-basis events

- SCs that are non-safety-related whose failure could prevent satisfactory accomplishment of the safety-related functions

- SCs that are relied on during postulated fires and station blackout events

The applicant states that the components that are subject to an AMR include valves (pressure boundary only), piping, tubing and fittings. The intended function for primary water makeup components that are subject to an AMR is pressure boundary integrity. A complete list of primary water makeup components that require AMR and the component intended functions appears in Table 3.4-5.

3.4.5.2 Staff Evaluation

The components in the primary water makeup system are fabricated from stainless steel and carbon steel exposed to an internal environment of treated water. These components are stainless steel valves, piping, and fittings. The aging effects of these materials in the treated water environment are identified in Table 3.4-5 and are discussed in Section 6.1 of Appendix C of the LRA. Applicable internal aging effects in the treated water environment are loss of material due to pitting corrosion. Components in the primary water makeup system, which are exposed externally to an indoor not air conditioned environment are stainless steel valves, piping, and fittings. The indoor environment not air conditioned, is defined as atmospheric air with a maximum air temperature of 104 °F, humidity between 5% and 95%, and no exposure to weather. The aging effects associated with external exposure to an outdoor environment are identified in Table 3.4-5 and discussed in Section 7.2 of Appendix C to the LRA. There are no applicable aging effects for these components.

Carbon steel bolts in the primary water makeup system have external surfaces which may be exposed to borated water leaks. The aging effects associated with external exposure to borated water leaks are identified in Table 3.4-5 and discussed in Section 7.5 of Appendix C to the LRA. Borated water leaking from systems undergoes evaporation, which results in a highly concentrated solution of boric acid or deposits of boric acid crystals. Applicable aging effects are loss of mechanical closure due to aggressive chemical attack.

3.4.5.2.1 Aging Management Programs

To manage the aging effects of stainless steel components exposed internally to a treated water environment, the applicant relies on the following AMP:

- chemistry control program

The chemistry control program provides for sampling and analysis of treated water. The description of this program is provided in Appendix B, Section 3.2.4 of the LRA. The staff finds this program appropriate in managing the aging effects associated with the treated water environment. The staff's detailed evaluation of this program is found in Section 3.1.1 of this SER.

To manage the aging effects of the carbon steel bolts externally exposed to borated water leaks, the applicant relies on the following AMP:

- boric acid wastage surveillance program

The boric acid wastage surveillance program is an enhanced program which uses systematic inspections, leakage evaluations, and corrective actions to ensure that boric acid corrosion does not lead to degradation of the pressure boundary or structural integrity of components, supports or structures. The description of this program is provided in Appendix B, Section 3.2.3 of the LRA. This program is credited for managing the aging effects of carbon steel externally exposed to borated water leaks. The boric acid wastage surveillance program provides for visual inspection of external surfaces for evidence of corrosion, cracking, leakage, fouling or coating damage. The staff requested the applicant to provide more detail of the location of the bolts in the primary water makeup system and the applicable frequencies, bases and the most recent operating history supporting the adequacy of this program in managing the aging effects for these components. In response to the staff's request, the applicant provided the following additional information: carbon and low alloy steel mechanical closures located near borated water systems are considered susceptible to aggressive chemical attack. In the primary water makeup system, the bolted connections for piping, fittings, and equipment (including valve bonnets) located in the auxiliary and containment buildings are potentially exposed to leakage from the borated water systems. The applicant further stated that a review of the condition report and metallurgical report databases (1992 through 2000) did not identify any instance of bolting degradation due to boric acid corrosion in this system.

On the basis of the information provided, the staff finds that this program is appropriate and acceptable for managing the aging effects associated with these components. The staff's detailed evaluation of the boric acid wastage surveillance program is provided in Section 3.9.3 of this SER.

3.4.5.3 Conclusion

The staff has reviewed the information in Section 2.3.3.5 and Section 3.4 of the LRA and the applicant's responses to the staff's RAIs. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the primary water makeup system will be adequately managed so that there is reasonable assurance that these systems will perform its intended functions in accordance with the CLB throughout the period of extended operation.

3.4.6 Sample Systems

3.4.6.1 Summary of Technical Information in the Application

The applicant described its AMR of the sample systems in Section 2.3.3.6, "Sample Systems," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the sample systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

Turkey Point Unit 3 and 4 sample systems each consist of two subsystems, namely the sample system-nuclear steam supply system and sample system-secondary. Both subsystems are designed to operate manually, on an intermittent basis. Samples can be obtained under conditions ranging from full power to cold shutdown.

The sample system-nuclear steam supply system permits remote sampling of fluids of the primary plant systems. The subsystem is used to evaluate fluid chemistry in the reactor coolant, emergency core cooling, and chemical and volume control systems.

The sample system-secondary permits remote sampling of fluids of the secondary systems. The subsystem is used to evaluate fluid chemistry in the feedwater, condensate/condenser hotwell, steam generator blowdown, main steam, and heater drain systems.

The flow diagrams listed in Table 2.3-5 of the LRA show the evaluation boundaries for the portions of the sample systems that are within the scope of license renewal.

Sample systems components subject to an AMR include: valves and coolers (pressure boundary only), piping, tubing, and fittings. The intended functions for sample system components that are subject to an AMR include pressure boundary integrity and throttling. A complete list of sample systems components that require an AMR and the component intended functions appears in Table 3.4-6 of the LRA.

3.4.6.2 Staff Evaluation

The aging effects requiring management in the sample systems are loss of material for carbon steel and stainless steel components, and cracking for certain stainless steel components. The aging effect requiring management for carbon steel mechanical closure bolting is loss of mechanical closure integrity.

The applicant supplied references pertaining to Turkey Point plant-specific as well as industry-wide experience to support its identification of applicable aging effects for all auxiliary systems identified above. The aging effects were identified based upon the description of internal and external environments and material of construction of the system components. The applicant has included all aging effects that are consistent with published literature and industry experience and, thus, the applicable aging effects for sample systems have been properly identified.

3.4.6.2.1 Aging Management Programs

The applicant also identified three AMPs for controlling the effects of aging on the sample system: chemistry control program, system and structures monitoring program, and the boric acid wastage surveillance program. The programs were developed from industry-wide data, industry-developed methodologies, NRC documents, and the applicant's own experience. The applicant concluded that these programs would manage the aging effects in such a way that the intended function of the components in the sample systems will be maintained throughout the period of extended operation, consistent with the CLB, under all design conditions. The staff's detailed evaluations of the programs are found in Sections 3.1.1, 3.1.3 and 3.9.3 of this SER.

3.4.6.3 Conclusion

The staff reviewed the information in Sections 2.3.3.6, "Sample Systems," and 3.4 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that aging effects associated with the sample systems will be adequately managed so that there is a reasonable assurance that the system will perform the intended functions in accordance with the CLB throughout the period of extended operation.

3.4.7 Waste Disposal

3.4.7.1 Summary of Technical Information in the Application

The applicant described its AMR of the waste disposal systems for license renewal in Section 2.3.3.7, "Waste Disposal," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the waste disposal systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

Waste disposal collects and processes potentially radioactive reactor plant wastes prior to release or removal from the plant site. The system is common to Units 3 and 4, except for the components associated with each containment. Waste disposal consists of three subsystems, including the liquid, solid, and gaseous waste disposal systems.

The flow diagrams listed in Table 2.3-5 of the LRA show the evaluation boundaries for the portions of waste disposal that are within the scope of license renewal.

Waste disposal components subject to an AMR include pumps, valves and heat exchangers (pressure boundary only), piping, tubing, and fittings. The intended function for waste disposal components subject to an AMR is pressure boundary integrity. A complete list of waste disposal components that require an AMR and the component intended functions appears in Table 3.4-7 of the LRA.

3.4.7.2 Staff Evaluation

The aging effects requiring management in the waste disposal systems are loss of material for carbon steel and stainless steel components and admiralty brass heat exchanger tubing, and fouling for stainless steel drain piping. The aging effect requiring management for carbon steel mechanical closure bolting is loss of mechanical closure integrity.

The applicant supplied references pertaining to Turkey Point plant-specific as well as industry-wide experience to support its identification of applicable aging effects for all auxiliary systems identified above. The aging effects were identified based upon the description of internal and external environments and material of construction of the system components. The applicant has included all aging effects that are consistent with published literature and industry experience and, thus, the applicable aging effects for waste disposal systems have been properly identified.

3.4.7.2.1 Aging Management Programs

The applicant also identified five AMPs for controlling the effects of aging on the waste disposal systems: chemistry control program, system and structures monitoring program, galvanic corrosion susceptibility inspection program, periodic surveillance and preventive maintenance program and the boric acid wastage surveillance program. The programs were developed from industry-wide data, industry-developed methodologies, NRC documents, and the applicant's own experience. The applicant concluded that these programs will manage the aging effects in such a way that the intended function(s) of the components in the waste disposal systems will be maintained during the period of extended operation, consistent with the CLB, under all design conditions. The staff's detailed evaluations of the programs are found in Sections 3.1.1, 3.1.3, 3.8.5, 3.9.3, and 3.9.11 of this SER.

3.4.7.3 Conclusion

The staff reviewed the information in Sections 2.3.3.7 and 3.4 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that aging effects associated with the waste disposal system will be adequately managed so that there is a reasonable assurance that the system will perform their intended functions in accordance with the CLB throughout the period of extended operation.

3.4.8 Instrument Air

3.4.8.1 Summary of Technical Information in the Application

The applicant described its AMR of the instrument air for license renewal in Section 2.3.3.8, "Instrument Air," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the instrument air systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

Instrument air provides a reliable source of dry, oil-free air for instrumentation and controls and pneumatic valves. Instrument air provides motive power and control air to safety-related and non-safety-related components. Instrument air contains both electric driven and diesel driven air compressors.

Safety-related air-operated valves, normally supplied by instrument air, which are required to operate following design-basis events are provided with backup sources of either air or nitrogen. These backup sources are considered safety-related and were screened with the particular valves they serve.

The flow diagrams listed in Table 2.3-5 of the LRA show the evaluation boundaries for the portions of instrument air that are within the scope of license renewal. Instrument air components that are subject to an AMR include valves (pressure boundary only), flasks/tanks, filters, strainers, heat exchangers, orifices, piping, tubing, and fittings. The intended functions for instrument air components subject to an AMR include pressure boundary integrity, heat transfer, filtration, and throttling. A complete list of instrument air components that require an AMR and the component intended functions appears in Table 3.4-8 of the LRA.

3.4.8.2 Staff Evaluation

The aging effects requiring management in the instrument air system are loss of material for carbon steel, stainless steel, and copper alloy components, as well as fouling for aluminum heat exchanger fins. The aging effect requiring management for carbon steel mechanical closure bolting is loss of mechanical closure integrity.

The applicant supplied references pertaining to Turkey Point plant-specific as well as industry-wide experience to support its identification of applicable aging effects for all auxiliary systems identified above. The aging effects were identified based upon the description of internal and external environments and material of construction of the system components. The applicant has included all aging effects that are consistent with published literature and industry experience and, thus, the applicable aging effects for instrument air systems have been properly identified.

3.4.8.2.1 Aging Management Programs

The applicant also identified four AMPs for controlling the effects of aging on the instrument air system: galvanic corrosion susceptibility inspection program, periodic surveillance and preventive maintenance program, system and structures monitoring program, and the boric acid wastage surveillance program. The programs were developed from industry-wide data, industry-developed methodologies, NRC documents, and the applicant's own experience. The applicant concluded that these programs will manage the aging effects in such a way that the intended function(s) of the components in the instrument air systems will be maintained during the period of extended operation, consistent with the CLB, under all design conditions. The staff's detailed evaluations of the programs are found in Sections 3.1.3, 3.8.5, 3.9.3, and 3.9.11 of this SER.

3.4.8.3 Conclusion

The staff reviewed the information in Sections 2.3.3.8 and 3.4 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that aging effects associated with the instrument air system will be adequately managed so that there is a reasonable assurance that the system will perform its intended functions in accordance with the CLB throughout the period of extended operation.

3.4.9 Normal Containment and Control Rod Drive Mechanism Cooling

3.4.9.1 Summary of Technical Information in the Application

The applicant described its AMR of the normal containment and control rod drive mechanism cooling for license renewal in Section 2.3.3.11, "Normal Containment and Control Rod Drive Mechanism Cooling," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the normal containment and control rod drive mechanism (CRDM) cooling systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

Normal containment and control rod drive mechanism cooling provides air circulation and cooling to maintain containment bulk ambient temperature below design limits and to remove heat from the CRDM.

The flow diagrams listed in Table 2.3-5 of the LRA show the evaluation boundaries for the portions of normal containment and CRDM cooling that are within the scope of license renewal.

Normal containment and CRDM cooling components subject to an AMR include heat exchangers, coolers, ductwork, tubing, and fittings. The intended functions for normal containment and CRDM cooling components that are subject to an AMR include pressure boundary integrity, heat transfer, and structural support. A complete list of normal containment and CRDM cooling components that require an AMR and the component intended functions appears in Table 3.4-9 of the LRA.

3.4.9.2 Staff Evaluation

The aging effects requiring management in the normal containment and CRDM cooling are loss of material for carbon steel components; cracking for neoprene and coated canvas flexible connectors; and loss of material and fouling for admiralty brass, stainless steel, and aluminum heat exchanger tubing and fins. The aging effect requiring management for carbon steel mechanical closure bolting is loss of mechanical closure integrity.

The applicant supplied references pertaining to Turkey Point plant-specific as well as industry-wide experience to support its identification of applicable aging effects for all auxiliary systems identified above. The aging effects were identified based upon the description of internal and external environments and material of construction of the system components. The applicant has included all aging effects that are consistent with published literature and industry experience and, thus, the applicable aging effects for normal containment and CRDM cooling systems have been properly identified.

3.4.9.2.1 Aging Management Programs

The applicant also identified five AMPs for controlling the effects of aging on the normal containment and CRDM cooling systems: chemistry control program, system and structures monitoring program, galvanic corrosion susceptibility inspection program, periodic surveillance and preventive maintenance program and the boric acid wastage surveillance program. The programs were developed from industry-wide data, industry-developed methodologies, NRC documents, and the applicant's own experience. The applicant concluded that these programs would manage the aging effects in such a way that the intended function of the components in the normal containment and CRDM cooling systems will be maintained during the period of extended operation, consistent with the CLB, under all design conditions. The staff's detailed evaluations of the programs are found in Sections 3.1, 3.8 and 3.9 of this SER.

3.4.9.3 Conclusion

The staff reviewed the information in Sections 2.3.3.9, "Normal Containment and CRDM Cooling," and 3.4 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that aging effects associated with the normal containment and CRDM cooling will be adequately managed so that there is reasonable assurance that the system will perform the intended functions in accordance with the CLB during the period of extended operation.

3.4.10 Auxiliary Building Ventilation and Electrical Equipment Room Ventilation

3.4.10.1 Summary of Technical Information in the Application

The applicant described its AMR of the auxiliary building ventilation and electrical equipment ventilation systems for license renewal in Section 2.3.3.10, "Auxiliary Building Ventilation," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the auxiliary building ventilation systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

Auxiliary building ventilation provides adequate heat removal to ensure proper operation of safety-related equipment in the auxiliary building. Auxiliary building ventilation includes electrical equipment room ventilation.

Auxiliary building ventilation is common to both units. The system provides clean air to the operating areas of the auxiliary building and exhausts air from the equipment rooms and open areas of the auxiliary building. Electrical equipment room ventilation is the same for Turkey Point, Units 3 and 4. Electrical equipment room ventilation provides cooling for the electrical equipment room under normal and emergency conditions. During normal operations, non-safety-related chillers maintain the desired room temperature. In the event of a failure of the non-safety-related system or a loss of offsite power, safety-related air conditioners will perform the same function. The flow diagrams listed in Table 2.3-5 of the LRA show the evaluation boundaries for the portions of auxiliary building ventilation and electrical equipment room ventilation that are within the scope of license renewal. Auxiliary building ventilation and electrical equipment room ventilation components subject to an AMR include air handlers (pressure boundary only), damper housings, supply and exhaust fan housings filters, ductwork, tubing, and fitting. The intended function for auxiliary building ventilation and electrical equipment room ventilation components subject to an AMR is pressure boundary integrity. A complete list of auxiliary building ventilation and electrical equipment room ventilation components that require AMR and the component intended functions appears in Table 3.4-10 of the LRA.

3.4.10.2 Staff Evaluation

The aging effects requiring management in the auxiliary building ventilation system are loss of material for carbon steel components and cracking for coated canvas flexible connectors. The aging effect requiring management for carbon steel mechanical closure bolting is loss of mechanical closure integrity.

The applicant supplied references pertaining to Turkey Point plant-specific as well as industry-wide experience to support its identification of applicable aging effects for all auxiliary systems identified above. The aging effects were identified based upon the description of internal and external environments and material of construction of the system components. The applicant has included all aging effects that are consistent with published literature and industry experience and, thus, the applicable aging effects for auxiliary building and electrical equipment room ventilation have been properly identified.

3.4.10.2.1 Aging Management Programs

The applicant also identified two AMPs for controlling the effects of aging on the auxiliary building and electrical equipment room ventilation: system and structures monitoring program and the boric acid wastage surveillance program. The programs were developed from industry-wide data, industry-developed methodologies, NRC documents, and the applicant's own experience. The applicant concluded that these programs will manage the aging effects in such a way that the intended function(s) of the components in the auxiliary building and electrical equipment room ventilation will be maintained throughout the period of extended operation, consistent with the CLB, under all design conditions. The staff's detailed evaluations of the programs are found in Sections 3.1.3, and 3.9.3 of this SER.

3.4.10.3 Conclusion

The staff reviewed the information in Sections 2.3.3.10 and 3.4 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that aging effects associated with the auxiliary building ventilation system will be adequately managed so that there is a reasonable assurance that the system will perform its intended functions in accordance with the CLB throughout the period of extended operation.

3.4.11 Control Building Ventilation

3.4.11.1 Summary of Technical Information in the Application

The applicant described its AMR of the control building ventilation systems for license renewal in Section 2.3.3.11 and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the control building ventilation systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

Control building ventilation provides a temperature controlled environment to ensure proper operation of equipment in the control building. Control building ventilation is composed of three subsystems: control room ventilation; computer/cable spreading room ventilation; and DC equipment/inverter room ventilation. These subsystems are common for Turkey Point, Units 3 and 4.

Control room ventilation circulates air from the control room and the control room offices through roughing filters to the air handling units. Conditioned air is returned and distributed throughout the control room. Control room ventilation maintains the habitability of the control room following design-basis events. Control room ventilation is described in UFSAR Section 9.9.1.

Computer/cable spreading room ventilation maintains the temperature and humidity requirements of the vital electrical equipment installed in the computer and cable spreading rooms. It also provides sufficient ventilation for intermittent occupancy by operations and maintenance personnel. Computer/cable spreading room ventilation is described in UFSAR Section 9.9.3.

DC equipment/inverter room ventilation provides cooling to the rooms that house the safety-related battery banks, battery chargers, inverters, and DC load centers. DC equipment/inverter room ventilation is described in UFSAR Section 9.9.2.

Control building ventilation components subject to an AMR include air handling units and valves (pressure boundary only), heat exchangers, ductwork, piping, tubing, and fittings. The intended functions for control building ventilation components subject to an AMR include pressure boundary integrity, throttling, and heat transfer. A complete list of control building ventilation components that require an AMR and the component intended functions appears in Table 3.4-11 of the LRA. The AMR for control building ventilation is discussed in Section 3.4 of the LRA.

The control building ventilation system contains various components (e.g., cable spreading room and computer room chilled water surge tanks, cable spreading room and computer room chilled water pumps, cable spreading room and computer room chilled water boxes, wye strainers, thermowells, valves, piping/fittings, level gauges, flow elements, air separators, valves, tubing/fittings, cable spreading room and computer room air handling unit headers, and cable spreading room and computer room air handling unit tubes) fabricated from carbon steel, stainless steel, and/or copper and exposed to treated water. The applicant evaluated the aging effects for carbon steel, stainless steel, and/or copper exposed to treated water in Sections 5 and 6 of Appendices C.5 and C.6 to the LRA and identified several forms of corrosion that may result in loss of material (e.g., general corrosion, pitting, galvanic corrosion, erosion/corrosion, and MIC).

The control building ventilation system contains various components (e.g., cable spreading room and computer room chilled water surge tanks, valves, piping/fittings, level gauges, air separators, cable spreading room and computer room air handling unit air boxes in air handlers, ductwork, and ductwork flexible connectors) fabricated from carbon steel, and/or coated canvas exposed to an air/gas environment. The applicant identified loss of material as the aging effect requiring management for carbon steel, and cracking for coated canvas. The applicant evaluated the aging effects for carbon steel exposed to an air/gas environment in Sections 4, 5, and 6 of Appendix C to the LRA.

3.4.11.2 Staff Evaluation

3.4.11.2.1 Effects of Aging

The control building ventilation system contains various components (e.g., cable spreading room and computer room chilled water surge tanks, cable spreading room and computer room chilled water pumps, cable spreading room and computer room chilled water boxes, wye strainers, thermowells, flow elements, air separators, valves, and tubing/fittings) that are fabricated from carbon steel and exposed to outdoor air environment. The applicant identified loss of material as an aging effect requiring management in an external environment and evaluated the aging effects for carbon steel exposed to an outdoor air environment in Section 7 of the application. The applicant identified several forms of corrosion that may result in loss of material (e.g., general corrosion, pitting, galvanic corrosion, crevice corrosion, and MIC) in Sections 5 and 7 of Appendix C to the LRA.

The control building ventilation system contains ductwork fabricated from galvanized steel exposed to an air/gas environment. The applicant concluded that there are no aging effects requiring management for this material in this environment. The staff agrees there are no aging effects for galvanized steel exposed to an air/gas environment.

The control room ventilation system contains ductwork flexible connectors constructed of coated canvas exposed to an air/gas environment. The applicant identified cracking as the aging effect requiring management for this material in this environment as discussed in Section 6 of Appendix C to the LRA.

The control room ventilation system contains various components (e.g., valves, piping/fittings, thermowells, flow elements, control room ventilation air handling unit housings, control room ventilation recirculation filter housing, inverter room and battery room air handling unit housing, cable room and computer room air handling unit housings, and bolting) fabricated from carbon steel, carbon steel-galvanized and stainless steel exposed to air conditioned air. The applicant did not identify any aging effects requiring management for these components in this environment. The staff agrees that there are no aging effects required for these components in an air conditioned air environment.

The control room ventilation system contains various components (e.g., cable spreading room and room air handling unit headers, cable spreading room and room air handling unit tubes, cable spreading room and room air handling unit air boxes in air handlers, cable spreading room and room air handling unit tube fins) constructed from stainless steel, copper, carbon steel, and aluminum exposed to air conditioned air wetted with condensation. The applicant identified loss of material as the aging effect requiring management for these components in this environment as discussed in Sections 5 and 7 of Appendix C to the LRA.

3.4.11.2.2 Aging Management Programs

To manage corrosion-induced aging effects for carbon steel, stainless steel, and copper exposed to a treated water environment, the applicant relies on the following AMPs:

- chemistry control program
- galvanic corrosion susceptibility program

The chemistry control program manages loss of material, cracking, and fouling aging effects for primary and secondary systems, structures, and components. The aging effects are minimized or prevented by controlling the chemical species that cause the underlying mechanism(s) that results in these aging effects. Alternatively, chemical agents, such as corrosion inhibitors and biocides, are introduced to prevent certain aging mechanisms. The program includes sampling activities and analysis. The program provides assurance that an elevated level of contaminants and oxygen does not exist in the systems, structures, and components covered by the program, and thus prevents and minimizes the occurrences of aging effects. The staff's detailed review of this program is described in Section 3.1.1, "Chemistry Control Program," of this SER.

The galvanic corrosion susceptibility inspection program manages the aging effect of loss of material due to galvanic corrosion on the internal surfaces of susceptible piping and components. The program involves selected, one-time inspections on the internal surfaces of piping and components with the greatest susceptibility to galvanic corrosion. Loss of material is expected mainly in carbon steel components directly coupled to stainless steel components in raw water systems, however, baseline examinations in select systems will be performed and evaluated to establish if the corrosion mechanism is active.

On the basis of the results of these inspections, the need for followup examinations or programmatic corrective actions will be established. The program will be implemented prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4. The staff's detailed review of this program is described in Section 3.8.5 of this SER.

To manage corrosion-induced aging effects for carbon steel exposed to an air/gas environment, the applicant relies on the following AMP:

- systems and structures monitoring program

The systems and structures monitoring program manages the aging effects of loss of material, cracking, fouling, loss of seal, and change in material properties. The program provides for periodic visual inspection and examination for degradation of accessible surfaces of specific systems, structures, and components, and corrective actions as required based on these inspections.

This program will be enhanced by restructuring it to address inspection requirements to manage certain aging effects in accordance with 10 CFR 54, modifying the scope of specific inspections, and improving documentation requirements prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4. The staff's detailed review of this program is described in Section 3.1.3 of this SER.

To manage corrosion-induced aging effects for carbon steel exposed to an outdoor environment, the applicant relies on the following AMP:

- systems and structures monitoring program
- galvanic corrosion susceptibility inspection program

These programs have been previously discussed.

To manage corrosion-induced aging effects for stainless steel, copper, carbon steel, and aluminum exposed to an air/gas environment wetted with condensation, the applicant relies on the following AMP:

- periodic surveillance and preventive maintenance program

The periodic surveillance and preventive maintenance program manages the aging effects of loss of material, cracking, fouling buildup, loss of seal, and embrittlement for systems, structures, and components. The scope of the program provides for visual inspection and examination of selected surfaces of specific components and structural components. The program also includes leak inspection of limited portions of the chemical and volume control systems. Additionally, the program replacement/refurbishment of selected components is on a specified frequency, as appropriate.

Specific enhancements to the scope and documentation of some inspections performed under this program will be implemented prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4. The staff's detailed discussion of this program is found in Section 3.9.11 of this SER.

To manage corrosion-induced aging effects for ductwork flexible connectors exposed to an air/gas environment, the applicant relies on the systems and structures monitoring program. This program is discussed above.

3.4.11.3 Conclusion

The staff has reviewed the information in Section 2.3.3.11, "Control Building Ventilation," and Section 3.4 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the control building ventilation systems will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB throughout the period of extended operation.

3.4.12 Emergency Diesel Generator Building Ventilation

3.4.12.1 Summary of Technical Information in the Application

The applicant described its AMR of the emergency diesel generator building ventilation systems for license renewal in Section 2.3.3.12, "Emergency Diesel Generator Building Ventilation," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the emergency diesel generator building ventilation systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

Emergency diesel generator building ventilation is required to provide cooling functions for the emergency diesel generators and associated equipment. Emergency diesel generator building ventilation is different for Turkey Point, Units 3 and 4. Emergency diesel generator building ventilation is necessary to ensure proper operation of the emergency diesel generators and other safety-related electrical equipment.

Unit 3 emergency diesel generator building ventilation consists of one wall-mounted exhaust fan and associated ductwork for each emergency diesel generator. The fan operates to maintain cooling in the room when its associated emergency diesel generator is running. Unit 4 emergency diesel generator building ventilation includes the following subsystems: emergency diesel generator room ventilation; diesel control room ventilation; and 3d and 4d switchgear room ventilation. Unit 4 emergency diesel generator building ventilation is described in UFSAR Section 8.2.2.1.1.3.

The flow diagrams listed in Table 2.3-5 show the evaluation boundaries for the portions of emergency diesel generator building ventilation that are within the scope of license renewal. Note: there is no flow diagram for Unit 3 emergency diesel generator building ventilation, however, all components associated with this system are in the scope of license renewal. Emergency diesel generator building ventilation is in the scope of license renewal because it contains:

- SCs that are safety-related and are relied upon to remain functional during and following design-basis events
- SCs that are non-safety-related whose failure could prevent satisfactory accomplishment of the safety-related functions
- SCs that are relied on during postulated fires, anticipated transients without scram, and station blackout events

Emergency diesel generator building ventilation components subject to an AMR include filters (pressure boundary only), ductwork, tubing, and fittings. The intended function for emergency diesel generator building ventilation components subject to an AMR is pressure boundary integrity. A complete list of emergency diesel generator building ventilation components that require an AMR and the component intended functions is provided in Table 3.4-12 of the LRA. The AMR for emergency diesel generator building ventilation is discussed in Section 3.4 of the LRA.

3.4.12.2 Staff Evaluation

3.4.12.2.1 Effects of Aging

The emergency diesel generator building ventilation contains components (e.g., ductwork and filter housings) fabricated from galvanized carbon steel exposed to a not air conditioned, indoor environment and an air conditioned, indoor environment. The emergency diesel generator building ventilation contains components (e.g., ductwork and filter housings) fabricated from galvanized carbon steel exposed to an air/gas environment. The applicant did not identify any aging effects requiring management for these components in this environment and the staff agrees with this assessment.

The emergency diesel generator building ventilation contains bolting (mechanical closures) fabricated from carbon steel exposed to a not air conditioned, indoor environment and an air conditioned, indoor environment. The applicant did not identify any aging effects requiring management for these components in this environment and the staff agrees with this assessment.

3.4.12.2.2 Aging Management Programs

There are no AMPs for the emergency diesel generator building ventilation because there are no aging effects requiring aging management and the staff agrees with this assessment.

3.4.12.3 Conclusion

The staff has reviewed the information in Section 2.3.3.12 and Section 3.4 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that there are no aging effects associated with the emergency diesel generator building ventilation systems requiring aging management throughout the period of extended operation.

3.4.13 Turbine Building Ventilation

3.4.13.1 Summary of Technical Information in the Application

The applicant described its AMR of the turbine building ventilation systems for license renewal in Section 2.3.3.13, "Turbine Building Ventilation," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the turbine building ventilation systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

Turbine building ventilation provides a temperature controlled environment to ensure proper operation of equipment in the turbine building. Turbine building ventilation consists of two subsystems, including the load center and switchgear rooms ventilation, and the steam generator feed pump ventilation.

Load center and switchgear rooms ventilation provides a temperature controlled environment for the safety-related 4160V switchgear and 480V load centers, located in the rooms, during normal and emergency conditions. Load center and switchgear rooms ventilation is described in UFSAR Section 9.16. Steam generator feed pump ventilation provides cooling to the steam generator feed pump room. The steam generator feed pump ventilation is non-safety-related, performs no safety-related functions, and is not within the scope of license renewal.

The flow diagrams listed in Table 2.3-5 show the evaluation boundaries for the portions of turbine building ventilation that are within the scope of license renewal. Turbine building ventilation is within the scope of license renewal because it contains the following types of SCs:

- SCs that are non-safety-related whose failure could prevent satisfactory accomplishment of the safety-related functions

- SCs that are relied on during postulated fires and station blackout events in the turbine building

Ventilation components that are subject to an AMR include pumps, valves, and air handling units (pressure boundary only), as well as heat exchangers, piping, tubing, and fittings. The intended functions for turbine building ventilation components that are subject to an AMR include pressure boundary integrity, throttling, and heat transfer. A complete list of turbine building ventilation components that require an AMR and the component intended functions appears in Table 3.4-13 of the LRA. The AMR for turbine building ventilation is discussed in Section 3.4 of the LRA.

3.4.13.2 Staff Evaluation

3.4.13.2.1 Effects of Aging

The turbine building ventilation system contains various components (e.g., chilled water surge tanks, chilled water air separators, chilled water pumps, chiller water boxes, valves, piping/fittings, wye strainers, flexible hoses, flow elements, air handling unit headers, and air handling unit heat exchanger tubes) fabricated from carbon steel, stainless steel, or copper and exposed to treated water. The applicant evaluated the aging effects for these materials and environments in Section 5.1 of Appendix C of the LRA and identified several forms of corrosion that may result in loss of material (e.g., general corrosion, pitting, crevice corrosion, galvanic corrosion, and selective leaching). The applicant also identified fouling as an aging effect for the air handling unit heat exchanger tubes as discussed in Section 5.3 of the LRA.

The turbine building ventilation system contains various components (e.g., valves, piping/fittings, level gauges, air handling unit housings, air handling unit air boxes) fabricated from stainless steel and carbon steel exposed to an air/gas (wetted with condensation) environment. The applicant evaluated the aging effects for these materials and environments in Section 5.1 of Appendix C of the LRA. The applicant identified several forms of corrosion that may result in loss of material (e.g., general corrosion, pitting, crevice corrosion, and galvanic corrosion).

The turbine building ventilation system contains various components (e.g., chilled water surge tanks, chilled water air separator, chilled water pumps, chiller water boxes, valves, piping, wye strainers, thermowells, flexible hoses, level gauges, flow elements, and bolting) fabricated from carbon steel and stainless steel and exposed to outside air. The applicant evaluated the aging effects for these materials and environments in Section 5.1 of Appendix C of the LRA. The applicant identified several forms of corrosion that may result in loss of material (e.g., general corrosion, pitting, crevice corrosion, and galvanic corrosion).

The turbine building ventilation system contains various components (e.g., valves, piping/fittings, test wells, flexible hoses, flow elements, air handling unit housings, and bolting) fabricated from carbon steel, galvanized carbon steel, and stainless steel exposed to air conditioned, indoor air. The applicant evaluated the aging effects for these materials and environment in Section 4.2.3 and 7.3 of Appendix C of the LRA and identified no corrosion-related aging effects because sufficient moisture is not present. The staff agrees that there will be no aging effects requiring management of these materials in this environment.

The turbine building ventilation system contains various components (e.g., air handling unit headers, air handling unit heat exchanger tubes, air handling unit air boxes, and air handling unit heat exchanger fins) fabricated from carbon steel, copper, and aluminum exposed to air conditioned inside air wetted with condensation. The applicant evaluated the aging effects for these materials and environment in Sections 4.2.3 and 7.3 of Appendix C of the LRA and identified several forms of corrosion that may result in loss of material (e.g., general corrosion, pitting, crevice corrosion, and galvanic corrosion.)

3.4.13.2.2 Aging Management Programs

To manage corrosion-induced aging effects for carbon steel, copper, and stainless steel exposed to a treated water environment, the applicant relies on the following AMPs:

- chemistry control program
- galvanic corrosion susceptibility inspection program

The chemistry control program manages loss of material, cracking, and fouling aging effects for primary and secondary systems, structures, and components. The aging effects are minimized or prevented by controlling the chemical species that cause the underlying mechanism(s) that result in these aging effects. Alternatively, chemical agents, such as corrosion inhibitors and biocides, are introduced to prevent certain aging mechanisms. The program includes sampling activities and analysis. The program provides assurance that an elevated level of contaminants and oxygen does not exist in the systems, structures, and components covered by the program and, thus, prevents and minimizes the occurrences of aging effects.

The galvanic corrosion susceptibility inspection program manages the aging effect of loss of material due to galvanic corrosion on the internal surfaces of susceptible piping and components. The program involves selected, one-time inspections on the internal surfaces of piping and components with the greatest susceptibility to galvanic corrosion. Loss of material is expected mainly in carbon steel components directly coupled to stainless steel components in raw water systems, however, baseline examinations in select systems will be performed and evaluated to establish if the corrosion mechanism is active. On the basis of the results of these inspections, the need for followup examinations or programmatic corrective actions will be established. The program will be implemented prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4. The staff's detailed evaluations of the programs are found in Sections 3.1.1, and 3.8.5 of this SER.

To manage corrosion-induced aging effects for carbon steel exposed to an air/gas environment, the applicant relies on the following AMP:

- systems and structures monitoring program

The systems and structures monitoring program manages the aging effects of loss of material, cracking, fouling, loss of seal, and change in material properties. The program provides for periodic visual inspection and examination for degradation of accessible surfaces of specific systems, structures, and components, and corrective actions as required based on these inspections.

This program will be enhanced by restructuring it to address inspection requirements to manage certain aging effects in accordance with 10 CFR Part 54, modifying the scope of specific inspections, and improving documentation requirements prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4. The staff's detailed evaluation of this program is found in Section 3.1.3 this SER.

To manage corrosion-induced aging effects for carbon steel exposed to an outside air environment, the applicant relies on the following AMPs:

- systems and structures monitoring program
- galvanic corrosion susceptibility inspection program

These programs are discussed above.

To manage corrosion-induced aging effects for carbon steel, copper, and aluminum exposed to an air conditioned inside air wetted with condensation environment, the applicant relies on the following AMP:

- periodic surveillance and preventive maintenance program

The periodic surveillance and preventive maintenance program manages the aging effects of loss of material, cracking, fouling buildup, loss of seal, and embrittlement for systems, structures, and components. The scope of the program provides for visual inspection and examination of selected surfaces of specific components and structural components. The program also includes leak inspection of limited portions of the chemical and volume control systems. Additionally, the program provides for replacement/refurbishment of selected components on a specified frequency, as appropriate. Specific enhancements to the scope and documentation of some inspections performed under this program will be implemented prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4. The staff's detailed evaluation of this program is found in Sections 3.9.11 of this SER.

3.4.13.3 Conclusion

The staff has reviewed the information in Section 2.3.3.13 and Section 3.4 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the turbine building ventilation systems will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB throughout the period of extended operation.

3.4.14 Fire Protection

3.4.14.1 Summary of Technical Information in the Application

The applicant described its AMR of the fire protection system for license renewal in Section 2.3.3.14, "Fire Protection" and Section 3.4, "Auxiliary Systems," of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the fire protection systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

Fire protection protects plant equipment in the event of a fire, to ensure safe plant shutdown, and minimizes the risk of a radioactive release to the environment. Fire protection consists of fire water supply including sprinklers, Halon suppression, fire dampers, RCP oil collection, alternate shutdown, safe shutdown, and fire detection and protection. Individual components that constitute alternate shutdown and safe shutdown were screened with their respective systems. Fire detection and protection was screened with electrical and instrumentation and controls (see Section 2.5). Fire protection is described in UFSAR Appendix 9.6A. The majority of fire protection is common to Units 3 and 4.

The flow diagrams listed in Table 2.3-5 show the evaluation boundaries for the portions of fire protection that are within the scope of license renewal. Fire protection is within the scope of license renewal because it contains the following types of SCs:

- SCs that are safety-related and are relied upon to remain functional during and following design-basis events

- SCs that are non-safety-related whose failure could prevent satisfactory accomplishment of the safety-related functions

- SCs that are relied on during postulated fires

Fire protection components subject to an AMR include the raw water tanks, pumps and valves (pressure boundary only), tanks, heat exchangers, hose stations, flame arrestors, sprinklers, strainers, orifices, piping, tubing, and fittings. The intended functions for fire protection components subject to an AMR are pressure boundary integrity, heat transfer, filtration, throttling, fire spread prevention, and spray. A complete list of the fire protection components that require an AMR and the component intended functions appears in Tables 3.4-14 and 3.6-12 of the LRA. The aging management reviews for fire protection are discussed in Sections 3.4 and 3.6.2. Fire extinguishers, fire hoses, and air packs are not subject to an AMR because they are replaced based on conditions in accordance with National Fire Protection Association (NFPA) standards and plant surveillance procedures for fire protection equipment. This position is consistent with the NRC staff's guidance on consumables provided in the NRC's March 10, 2000, letter to NEI.

3.4.14.2 Staff Evaluation

The fire protection system contains various components [e.g., basket strainers (body), basket strainers (elements) orifices, valves, piping/fittings, sprinkler heads, tubing/fittings, flexible hoses, tanks, pumps and flow restriction orifices] that are fabricated from either cast iron, stainless steel, carbon steel, galvanized carbon steel, or copper alloys exposed to raw city water. The applicant evaluated the aging effects for these materials and environment in Sections 5 and 6.2 of Appendix C to the LRA. The applicant identified several forms of corrosion that may result in loss of material. Loss of material due to general corrosion is an aging effect requiring management for cast iron and carbon steel in raw water environments. Loss of material due to pitting corrosion is an aging effect requiring management for aluminum bronze, carbon steel, cast iron, monel, and stainless steel in raw water environments. Loss of material due to galvanic corrosion is an aging effect requiring management for carbon steel and cast iron in raw water environments when coupled with materials having higher electrical potential. Loss of material due to crevice corrosion and MIC are aging effects requiring management for carbon steel, cast iron, copper-nickel, and stainless steel in raw water environments. Loss of material due to selective leaching is an aging effect requiring management for aluminum bronze and gray cast iron in raw water environments.

The fire protection system contains components (e.g., valves, piping/fittings, sprinkler heads, and flame arrestors) fabricated from carbon steel, stainless steel, galvanized carbon steel, cast iron, and copper alloy components exposed to an air/gas environment. The applicant evaluated the aging effects for these materials in Sections 4.1.3 and 6.3 of Appendix C to the LRA. Loss of material due to general corrosion is an aging effect requiring management for carbon steel and cast iron in an atmospheric air/gas environment. The applicant did not identify any aging effects for stainless steel, galvanized steel and copper alloy components.

The fire protection system contains valves, piping/fittings, tubing/fittings, tanks, oil collection enclosures and flexible hoses constructed from carbon steel and stainless steel exposed to lubrication oil or air/gas with an oil film. The applicant evaluated the aging effects for these material in Section 6.5 of Appendix C to the LRA and identified no corrosion-related aging effects because of the presence of the oil film. The staff agrees that there are no aging effects requiring aging management.

The fire protection system contains various components (e.g., raw water tanks, diesel-driven fire pump fuel oil tank, electric fire pump, basket strainer, bodies, valves, piping/fittings, flexible hoses, sprinkler heads, flow restriction orifices, and flame arrestors) fabricated from carbon steel, cast iron, galvanized carbon steel, copper alloy, and stainless steel exposed to an outdoor environment. The applicant evaluated the aging effects for these materials and environment in Section 7.0 of the LRA. Loss of material due to general corrosion is an aging effect requiring management for low alloy steel, carbon steel, and cast iron in outdoor environments. Loss of material due to pitting corrosion is an aging effect requiring management for low alloy steel, carbon steel, and cast iron in outdoor environments.

The fire protection system contains a reactor coolant pump oil collection tank, valve, piping/fittings, tubing/fittings, enclosures and drip pans, and flexible hoses fabricated from carbon steel and stainless steel exposed to containment air. The applicant evaluated the aging effects in Section 7.4.3.1 of Appendix C to the LRA and identified several forms of corrosion that may result in loss of material. Loss of material due to general corrosion is an aging effect requiring management for carbon steel in containment environments when wetted. Loss of material due to pitting corrosion is an aging effect requiring management for carbon steel in containment environments. Corrosion is an aging effect requiring management for carbon steel when wetted in containment environments.

The fire protection system contains a reactor coolant pump oil collection tank, valves, piping/fittings, and bolting fabricated from carbon steel exposed to borated water leaks. The applicant evaluated the aging effects for these components and environment in Section 7.5 of Appendix C of the LRA. The applicant identified severe chemical attack that could lead to loss of material for these components. In addition, severe chemical attack of the bolting in bolted connections could lead to loss of mechanical closure integrity.

The fire protection system contains a diesel fire pump heat exchanger shell and cover (radiator), valves, piping and fittings, expansion joints, tubing/fittings, and flexible hoses fabricated using carbon steel, cast iron, copper alloy, stainless steel, and rubber exposed to not air conditioned indoor air. The applicant evaluated the aging effects for these materials and environment in Section 7.2 of Appendix C to the LRA. Loss of material due to general corrosion is an aging effect requiring management for carbon steel and cast iron in non-air conditioned indoor environments. Loss of material due to pitting corrosion is an aging effect requiring management for carbon steel and cast iron in non-air conditioned indoor environments. The applicant identified cracking as the aging effect for rubber in this environment. The applicant did not identify any aging effects for stainless steel and copper alloys.

The fire protection system contains valves, piping, and fittings fabricated from cast iron and carbon steel and exposed to a buried environment. The applicant evaluated the aging effects for these materials and this environment in Section 7 of Appendix C of the LRA. Loss of material due to general corrosion is an aging effect requiring management for carbon steel and cast iron in buried environments. Loss of material due to crevice and pitting corrosion, MIC and selective leaching is an aging effect requiring management for carbon steel and cast iron in buried environments.

In RAI 2.3.3.14, the staff identified that neither the Halon suppression system components nor the Halon suppression system as a whole appeared to be included in Tables 3.4-14 or 3.6-12 of the LRA. The components which appeared to be missing from the table include, but are not limited to, Halon cylinders, Halon nozzles, nitrogen cylinders, Halon piping, pilot heads, pilot lines, pilot valve bodies, and auxiliaries. The staff requested that these components be included in the scope of license renewal. The staff also requested that the applicant provide a discussion if these components should be subject to an AMR and justification for those components that are not subject to an AMR.

The applicant responded that Halon Suppression is included as part of Fire Protection in Subsection 2.3.3.14 of the LRA. All Halon Suppression components, as depicted on drawing 0-FP-08, were determined to perform or support license renewal system intended functions and are within the scope of license renewal. Except for nitrogen and Halon cylinders, Halon nozzles, and flexible hoses, all components of Halon Suppression were included in an aging management review.

Nitrogen cylinders are monitored routinely and replaced based on condition replacement criteria, therefore, nitrogen cylinders are considered short-lived and do not require an aging management review.

Halon cylinders and flexible hoses are also monitored and/or inspected on a specified frequency, however, the Halon cylinders and flexible hoses are not normally replaced. Therefore, the Halon cylinders and flexible hoses are not short-lived and should have been included in an aging management review. Additionally, the Halon nozzles were inadvertently omitted from Table 3.4-14 of the LRA.

In the response to RAI 2.3.314-14, the applicant identified that the fire protection system contains additional component (e.g., Halon cylinders, flexible hoses and Halon nozzles) fabricated of carbon steel, wire reinforced rubber and aluminum, exposed to an internal air/gas environment. The applicable external environments for these components are outdoor air for the Halon cylinders and flexible hoses and indoor-air conditioned air for the Halon nozzles. The applicant evaluated the aging effects of these materials and concluded that cracking due to embrittlement is an aging effect requiring management for wire reinforced rubber in an internal atmospheric air/gas environment. The applicant did not identify any aging effects for carbon steel and aluminum components exposed to an internal air/gas environment. The applicant concluded that loss of material due to general and pitting corrosion is an aging effect requiring management for carbon steel Halon cylinders exposed externally to an outdoor air environment. Cracking due to embrittlement is an aging effect requiring management for wire reinforced rubber exposed externally to an outdoor air environment. The applicant did not identify any aging effects for aluminum Halon nozzles exposed to an external indoor-air conditioned environment.

Additionally, in the response to RAI 2.3.3.14-4, the applicant identified that Table 3.4-14 of the LRA should have included the aging management review results for valves and piping/fittings exposed to an external environment of "indoor-air conditioned." These components are fabricated of copper alloys and galvanized carbon steel. The applicant did not identify any aging effects for these components.

In RAI 2.3.3.14-6, the staff indicated that Fire Protection License Renewal Boundary Drawing 0-FP-03, showed the fire water jockey pumps in the scope of license renewal. The pump casings were not included in the list of components identified in the scope of license renewal (Table 3.4-14). The staff requested that the applicant clarify this apparent discrepancy between the drawings and the LRA.

The applicant responded that the fire water jockey pumps were screened within the scope of LR and require and AMR. These pumps were inadvertently omitted from LRA Table 3.4-14. The response to RAI 2.3.3.14-6 indicated that the jockey pumps are fabricated of cast iron and are exposed internally to raw water - city water and externally to an outdoor air environment. The applicant concluded that loss of material due to general corrosion, crevice corrosion, pitting corrosion, MIC, selective leaching and galvanic corrosion is an aging effect requiring management for cast iron exposed to an internal environment of raw water - city water. Additionally loss of material due to general and pitting corrosion in an aging effect requiring aging management for cast iron exposed to an external outdoor air environment.

3.4.14.2.1 Aging Management Programs

To manage corrosion-induced aging effects for cast iron, stainless steel, carbon steel, galvanized steel, and copper alloys exposed to raw city water, the applicant relies on the following AMPs:

- fire protection program
- galvanic corrosion susceptibility inspection program

The fire protection program manages the aging effects of loss of material, cracking, and fouling for the components/piping of the fire protection system and fire rated assemblies. Additionally, this program manages the aging effects of loss of material, loss of seal, cracking, and erosion for structures and structural components associated with fire protection. UFSAR Appendix 9.6A contains a detailed discussion of the fire protection program. The scope of the fire protection program will be enhanced to include inspection of additional components prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4. The staff's detailed evaluations of these programs are found in Sections 3.9.8 of this SER.

The galvanic corrosion susceptibility inspection program manages the aging effects of loss of material due to galvanic corrosion on the internal surfaces of susceptible piping and components. The program involves selected, one-time inspections of the internal surfaces of piping and components with the greatest susceptibility to galvanic corrosion. Loss of material is expected mainly in carbon steel components directly coupled to stainless steel components in raw water systems, however, baseline examinations in select systems will be performed and evaluated to establish if the corrosion mechanism is active. On the basis of the results of these inspections, the need for followup examinations or programmatic corrective actions will be established. The program will be implemented prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4. The staff's detailed review of this program is described in Section 3.8.5 of this SER.

To manage corrosion-induced aging effects for cast iron and carbon steel exposed to air/gas environment, the applicant relies on the AMP for the fire protection program. The fire protection program is described above and in Section 3.9.8 of this SER.

To manage corrosion-induced aging effects for cast iron and carbon steel exposed to outdoor environment, the applicant relies on the AMP for the fire protection program. The fire protection program is described above and in Section 3.9.8 of this SER.

To manage corrosion-induced aging effects for carbon steel exposed to a containment air environment, the applicant relies on the following AMP:

- periodic surveillance and preventive maintenance program

The periodic surveillance and preventive maintenance program manages the aging effects of loss of material, cracking, fouling buildup, loss of seal, and embrittlement for systems, structures, and components. The scope of the program provides for visual inspection and examination of selected surfaces of specific components and structural components.

Additionally, the program provides for replacement/refurbishment of selected components on a specified frequency, as appropriate.

Specific enhancements to the scope and documentation of some inspections performed under this program will be implemented prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4. The staff's detailed evaluation of this program is found in Section 3.9.11 of this SER.

To manage corrosion-induced aging effects for carbon steel exposed to borated water leaks, the applicant relies on the following AMP:

- boric acid wastage surveillance program

The boric acid wastage surveillance program manages the aging effects of loss of material and mechanical closure integrity due to aggressive chemical attack resulting from borated water leaks. The program addresses the reactor coolant system and structures and components containing, or exposed to, borated water. This program utilizes systematic inspections, leakage evaluations, and corrective actions to ensure that boric acid corrosion does not lead to degradation of pressure boundary or structural integrity of components, supports, or structures, including electrical equipment in proximity to borated water systems. This program includes commitments to NRC Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants."

Some systems outside containment (i.e., SFP cooling and portions of waste disposal associated with containment integrity) are currently inspected under other existing programs. The scope of the boric acid wastage surveillance program will be enhanced to include these systems and components prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4. The staff's detailed evaluation of this program is found in Section 3.9.3 of this SER.

To manage corrosion-induced aging effects for carbon steel and cast iron exposed to not-air conditioned indoor air environment, the applicant relies on the following AMP:

- fire protection program

The fire protection program is described above.

To manage corrosion-induced aging effects for carbon steel and cast iron exposed to a buried environment, the applicant relies on the following AMP:

- fire protection program

The fire protection program is described above.

3.4.14.3 Conclusion

The staff has reviewed the information in Sections 2.3.3.14 and 3.4 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the fire protection systems will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB throughout the period of extended operation.

3.4.15 Emergency Diesel Generators and Support Systems

3.4.15.1 Summary of Technical Information in the Application

The applicant described its AMR of the emergency diesel generators and support systems for license renewal in Section 2.3.3.15, "Emergency Diesel Generators and Support Systems," and Section 3.4 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant has demonstrated that the effects of aging on the emergency diesel generators and support systems will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The emergency diesel generators provide AC power to the onsite electrical distribution system to ensure the capability for a safe and orderly shutdown. The following emergency diesel generators support systems are necessary to ensure proper operation of the emergency diesel generators:

- air intake and exhaust
- air start
- fuel oil
- cooling water
- lube oil

The emergency diesel generators are described in UFSAR Section 8.2.2.1.1.1 and the emergency diesel generators support systems are described in Section 9.15. The Unit 3 emergency diesel generator fuel oil storage tank is a free-standing steel tank. The Unit 4 emergency diesel generator fuel oil storage tank is a concrete structure with a steel liner that is an integral part of the Unit 4 emergency diesel generator building. The flow diagrams listed in Table 2.3-5 show the evaluation boundaries for the portions of emergency diesel generators and support systems (EDGASS) that are within the scope of license renewal. Emergency diesel generators and support systems are in the scope of license renewal because they contain the following types of SCs:

- SCs that are safety-related and are relied upon to remain functional during and following design-basis events

- SCs that are non-safety-related whose failure could prevent satisfactory accomplishment of the safety-related functions

- SCs that are relied on during postulated fires, anticipated transients without scram, and station blackout events

Emergency diesel generators and support systems components subject to an AMR include two diesel oil storage tanks, pumps and valves (pressure boundary only), tanks, heat exchangers, flame arrestors, filters, strainers, piping, tubing, and fittings. The intended functions for emergency diesel generators and support systems components subject to an AMR include pressure boundary integrity, filtration, heat transfer, throttling, and fire spread prevention. A complete list of the emergency diesel generators and support systems components that require an AMR and component intended functions appears in Table 3.4-15 of the LRA. The AMR for the emergency diesel generators and support systems are discussed in Section 3.4 of the LRA.

3.4.15.2 Staff Evaluation

The emergency diesel generators and support systems contain various components (e.g., exhaust piping/fittings, silencers, air filter assemblies, expansion joints, tubes/fittings, air start accumulators, air start motors, air start system lubricators, valves, governor bypasses, filters, flexible hose, Unit 4 diesel oil storage tank liner, emergency diesel generator fuel oil pumps, diesel oil skid tanks, sight glasses, flexible couplings, air start piping/fittings, day tanks, Unit 3 diesel oil storage tanks and flame arrestors) fabricated either from carbon steel, galvanized steel, stainless steel, copper alloy, cast iron, aluminum, rubber, or rubber braided hoses that are exposed to an air/gas environment. The applicant evaluated the aging effects for these materials and environments in Sections 5 and 6 of Appendix C to the LRA and identified several forms of corrosion that may result in loss of material or cracking.

The EDGASS contains various components (e.g., exhaust piping/fittings, bolting, Unit 3 diesel oil storage tank, Unit 3 emergency diesel generator fuel oil pumps, various valves, piping/fittings silencers, tubing/fittings, and flame arrestors) that are fabricated from carbon steel, cast iron, and stainless steel exposed to outside air. The applicant evaluated the aging effects for these materials and environments in Sections 5 and 6 of Appendix C to the LRA, and identified several forms of corrosion that may result in loss of material.

The EDGASS contains various components (e.g., exhaust piping/fittings, silencers, air filter assemblies, expansion joints, flexible couplings, tubing/fittings, bolting, air start accumulators, air start motors, air start system lubricators, governor bypasses, flexible hoses, diesel oil day tanks, diesel oil skid tanks, Unit 3 emergency diesel generator fuel oil pumps, sight glasses, filters, diesel generator cooling water expansion tanks, diesel generator cooling water pumps, diesel generator cooling water immersion heaters, radiator water boxes, radiator tubes, orifices, diesel lube oil pumps, heat exchanger shells, and heat exchanger channel heads) that are fabricated from carbon steel, galvanized steel, cast iron, stainless steel, aluminum alloy, copper, copper alloy, and rubber exposed to not-air conditioned indoor air. The applicant evaluated the aging effects for these materials and environment in Sections 5 and 6 of Appendix C to the LRA and identified loss of material for carbon steel, copper alloys, and cast iron and cracking for stainless steel and rubber as the aging effects. No aging effects were identified for galvanized steel, copper alloy or aluminum alloy components. In several cases, the applicant identified no aging effects for carbon steel and stainless steel components when exposed to not-air conditioned indoor air. In addition, in Table 3.4-15 (page 3.4-87) of the LRA, the applicant shows that stainless steel exposed to not-air conditioned indoor air has the aging effect of loss of material. These aging effects are not consistent and needed to be explained. The applicant provided an explanation for these inconsistencies in letter L-2001-50, dated March 22, 2001. Carbon steel exposed to exhaust air/gas has the potential aging effect of loss of material due to general corrosion, crevice corrosion, and pitting because exhaust gases contain moisture and other potential contaminates the staff found the explanation adequate. Stainless steel exposed to ambient air/gas has no aging effect. Stainless steel, carbon steel, galvanized carbon steel, aluminum, and copper alloys exposed to a compressed air/gas environment has no aging effect. Carbon steel exposed to an air/gas environment in an enclosed area with diesel fuel oil vapor has no aging effect since the fuel oil vapor will prevent corrosion. Stainless steel expansion joints exposed to exhaust gas/air are subject to cracking due to fatigue. The cracking is minor and is managed by periodic inspection. The carbon steel in the diesel oil storage tank is subject to temperature fluctuations that may result in condensation on the inside of the tank. However, due to the size of the tank, the oil vapor may not provide protection against corrosion. Therefore, the applicant listed loss of material as a potential aging effect for the Unit 3 diesel oil storage tank.

The EDGASS contains various components (e.g., Unit 3 diesel oil storage tank, Unit 4 diesel oil storage tank liner, Unit 3 emergency diesel generator fuel oil pumps, diesel oil day tanks, diesel oil skid tanks, valves, piping/fittings, sight glasses, flex hoses, filters, and tubing) that are fabricated from carbon steel, cast iron, copper, and stainless steel exposed to fuel oil. The applicant evaluated the aging effects for these materials and environment in Sections 5 and 6 of Appendix C to the LRA and identified MIC that may lead to loss of material.

The EDGASS contains various components (e.g., diesel generator cooling water expansion tanks, diesel generator cooling water pumps, diesel generator cooling water immersion heaters, radiator water boxes, radiator tubes, valves, piping/fittings, tubing/fittings, flexible hoses, orifices, sight glasses, and heat exchanger channel heads) that are fabricated from carbon steel, cast iron, stainless steel, red brass, and copper alloy exposed to a treated water environment. The applicant evaluated the aging effects for these materials and environment in Sections 5 and 6 of Appendix C to the LRA, and identified several forms of corrosion that could lead to loss of material (e.g., general corrosion, pitting, and MIC for carbon steel and cast iron, and pitting for copper alloy and stainless steel).

The EDGASS contains the Unit 4 diesel oil storage tank liner constructed of carbon steel exposed to an embedded/encased environment. The applicant evaluated the aging effects for carbon steel in an embedded/encased environment in Section 7.7 of Appendix C to the LRA, and did not identify any aging effects.

The EDGASS contains various components (e.g., diesel generator lube oil pumps, heat exchanger shells, heat exchanger tubing, valves, piping/fittings, flexible hoses, sight glasses, filters, tubing/fittings, and orifices) that are constructed from carbon steel, cast iron, red brass, and stainless steel exposed to lubricating oil. The applicant evaluated the aging effects for these materials exposed to lubricating oil in Section 6.5 of Appendix C of the application and did not identify any aging effects requiring management.

3.4.15.2.2 Aging Management Programs

Emergency Diesel Generators and Support Systems

To manage corrosion-induced aging effects for carbon steel, stainless steel, and rubber exposed to an air/gas environment, the applicant relies on the following AMP:

- periodic surveillance and preventive maintenance program

The periodic surveillance and preventive maintenance program is credited for managing the aging effects of loss of material, cracking, fouling, loss of seal, and embrittlement for structures, systems, and components within the scope of license renewal. This program provides for visual inspection of selected surfaces of specific components and structural components, or alternatively their replacement/ refurbishment during the performance of periodic surveillance and preventive maintenance activities. The program also includes leak inspections of limited portions of the chemical and volume control systems. The staff's detailed evaluation of this program is found in Section 3.9.11 of this SER.

To manage corrosion-induced aging effects for carbon steel exposed to outdoor air, the applicant relies on the following AMP:

- periodic surveillance and preventive maintenance program
- systems and structures monitoring program

This program is described above.

To manage corrosion-induced aging effects for carbon steel, cast iron, stainless steel, and rubber exposed to not-air conditioned indoor air, the applicant relies on the following AMPs:

- periodic surveillance and preventive maintenance program
- systems and structures monitoring program

The periodic surveillance and preventive maintenance program has been previously discussed.

The systems and structures monitoring program manages the aging effects of loss of material, cracking, fouling, loss of seal, and change in material properties for selected systems, structures, and components within the scope of license renewal. The program provides for visual inspection and examination of accessible surfaces of specific systems, structures, and components, including welds and bolting. Aging management of structural components that are inaccessible for inspection is accomplished by inspecting accessible structural components with similar materials and environments for aging effects that may be indicative of aging effects for inaccessible structural components. For example, rust bleeding on an accessible surface of a concrete structure may be indicative of corrosion of inaccessible reinforcing steel embedded in the concrete.

This program will be enhanced by restructuring it to address inspection requirements to manage certain aging effects in accordance with 10 CFR Part 54, modifying the scope of specific inspections, and improving documentation requirements. The staff's detailed evaluation of this program is found in Section 3.1.3 of this SER.

To manage corrosion-induced aging effects for carbon steel, cast iron, stainless steel, and copper and exposed to fuel oil, the applicant relies on the following AMPs:

- chemistry control program
- periodic surveillance and preventive maintenance program

The chemistry control program is credited for managing the aging effects of loss of material, cracking, and fouling buildup for the internal surfaces of primary and secondary systems and structures. The program includes sampling activities and analysis for treated water—primary, treated water—borated, treated water—secondary, treated water, and fuel oil.

The periodic surveillance and preventive maintenance program has been previously described.

To manage corrosion-induced aging effects for carbon steel, cast iron, stainless steel, and copper alloy exposed to treated water, the applicant relies on the following AMPs:

- chemistry control program
- Unit 3 - periodic surveillance and preventive maintenance program
- Unit 4 - galvanic corrosion susceptibility inspection program

The chemistry control program and the periodic surveillance and preventive maintenance program have already been described. The staff's detailed evaluations of these programs are found in Sections 3.1.1 and 3.8.5 of this SER.

The galvanic corrosion susceptibility inspection program will manage the potential effects of loss of material due to galvanic corrosion on the internal surfaces of susceptible piping and components. Carbon steel components directly coupled to stainless steel components in raw water systems at Turkey Point are the most susceptible to galvanic corrosion. However, baseline examinations in select systems will be performed and evaluated to establish if the corrosion mechanism is active. The program will involve selected one-time inspections, the results of which will be utilized to determine the need for additional actions. The staff's detailed evaluation of this program is found in Section 3.8.5 of this SER.

3.4.15.3 Conclusion

The staff has reviewed the information in Sections 2.3.3.15 and 3.4 of the LRA and applicant's responses to the staff's RAIs. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the emergency diesel generators and support systems will be adequately managed so that there is reasonable assurance that these systems will perform their intended functions in accordance with the CLB throughout the period of extended operation.

3.4.16 General

3.4.16.1 Thermal Fatigue

The applicant did not identify cracking due to thermal fatigue as an aging effect requiring management in Section 3.4.2 for the auxiliary system components. However, the applicant identified thermal fatigue for piping systems designed to the requirements of ANSI B31.1 as a time limited aging analysis (TLAA) in Section 4.3.4 of the LRA. The staff's evaluation of that TLAA is in Section 4.3 of this SER, and aging effect due to thermal fatigue, as it applies to auxiliary system components, will not be discussed further in this section of the SER.

3.4.16.2 Mechanical Closure Integrity

In Section 5.4 of Appendix C of the LRA, the applicant stated that the loss of mechanical closure integrity is an aging effect associated with bolted mechanical closures that can result from the loss of preload due to cyclic loading, gasket creep, thermal or other effects, cracking, or loss of bolting material. The applicant further stated that the effects of the mechanisms associated with loss of preload are the same as that of a degraded gasket; that is, the potential for external leakage of the internal fluid at the mechanical joint. However, the applicant stated that with the exception of the situation where a gasket/seal is utilized to provide a radiological boundary/barrier, the aging mechanisms associated with loss of preload are not considered to require management for non-Class 1 components during the period of extended operation. Furthermore, the applicant stated that it utilizes the proper bolt torquing procedures to prevent loss of preload. Furthermore, leakage of auxiliary systems mechanical joints due to loss of preload has not been a significant issue at Turkey Point. The applicant concluded that there are no aging effects associated with loss of preload resulting from settling, relaxation after cyclic loading, gasket creep, and temperature effects in the auxiliary systems during the period of extended operation. On the basis of the information provided by the applicant, the staff agrees that loss of preload is not a significant issue at Turkey Point for mechanical joints in the auxiliary systems.

Loss of bolting material can result in a loss of components pressure boundary integrity. Most carbon steel bolting is in a dry environment and coated with a lubricant; thus, general corrosion of bolting has not been a major concern in the industry. Corrosion of fasteners has only been a concern, when leakage of a joint occurs, specifically, when bolting is exposed to boric acid. Loss of mechanical closure integrity due to boric acid corrosion was considered a potential aging effect for components in proximity, to borated water systems.

Susceptibility to cracking due to SCC of bolting material is controlled by yield strength and minimizing contaminants. Therefore, no AMP was required for cracking of bolting.

3.4.16.3 Ventilation Systems Flexible Connectors

Several ventilation systems included in Section 3.4 of the LRA contain flexible connectors (rubber, neoprene, or coated canvas materials). The ductwork in the heating, ventilation, and air conditioning (HVAC) system typically includes isolators (such as flexible connectors between ducts and fans) to prevent transmission of vibration and dynamic loading to the rest of the system. Those isolators may degrade (e.g., hardening and cracking) because of relative motion between vibrating equipment, warm moist air, temperature changes, oxygen, and radiation. In Section 5.2 of Appendix A to the LRA, the applicant stated that embrittlement is an aging mechanism that could cause cracking of rubber, neoprene, or coated canvas materials. To manage that aging effect, the applicant relies on the visual inspection included in two AMPs, periodic surveillance and preventive maintenance program, and systems and structures monitoring program described in LRA Appendix B, Sections 3.2.11 and 3.2.15, respectively. Both programs do not provide a description of the inspection schedule (frequency). In a letter dated February 2, 2001, the staff requested the applicant to describe the frequency of the subject visual inspection. Also, the applicant is requested to demonstrate the adequacy of that inspection frequency and method to ensure that aging degradation will be detected before there is loss of intended functions. The applicant responded to this RAI in a letter dated March 22,

2001. The applicant stated that the ductwork flexible connectors for HVAC system within the scope of license renewal are visually inspected on a 5-year frequency, except for the flexible connectors for the normal containment coolers. The visual inspection of the flexible connectors for the normal containment coolers is included as part of an 18-month preventive maintenance task for these coolers. The applicant further stated that these inspection frequencies are appropriate, based on the environment (ambient air) that the connectors are exposed to and the operating history of these components at Turkey Point. The applicant also stated that the frequency of these inspections may be adjusted as necessary, based on future inspection results and industry experience. The staff concurs with this response. The staff's detailed evaluations of periodic surveillance and preventive maintenance program and systems and structures monitoring program are discussed separately in Sections 3.9.11 and 3.1.3 of this SER.

3.4.16.4 Scoping Issues Related to Aging Management Programs for Auxiliary Systems

The scoping requirements of 10 CFR 54.4(a)(2) include all non-safety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1)(i), (ii), or (iii). In Section 2.1.1.3 of the LRA, the applicant stated that Turkey Point, Units 3 and 4, were not originally licensed for "seismic II over I." However, "seismic II over I" was considered for license renewal scoping. In a letter dated February 2, 2001, the staff requested that the applicant clarify whether the scope of the auxiliary systems discussed in Section 3.4 of the LRA includes any seismic II over I piping. In addition, the applicant requested to clarify how the AMPs for those piping systems including their supports have been addressed. Specifically, the staff asked whether the same AMPs discussed in tables included in LRA Section 3.4 also apply to those seismic II over I piping components. The applicant responded to this RAI in letters dated March 22, and May 3, 2001. The applicant stated those piping supports for non-safety-related systems with the potential of "seismic II over I" interactions with safety-related components were identified as within the scope of license renewal. Piping for these non-safety-related systems, however, was not identified as within the scope of license renewal. The applicant also stated that the Turkey Point CLB does not require the assumption of collapse and/or deformation of non-safety-related piping under seismic loading. However, non-safety-related piping system and their supports were designed, manufactured, and installed in accordance with recognized conventional practice. The applicable codes and standards were established based on conservative criteria resulting in design stresses well within the yield strength of the materials during maximum postulated loading conditions. In addition, non-safety-related piping systems are maintained in good, essentially leak tight, operating condition, especially in the areas where safety-related components are located. System engineer walkdowns and operator rounds are performed in accordance with plant administrative, engineering, operation, and Maintenance Rule procedures. Current procedures require system engineers to perform walkdowns at least quarterly (and in some cases monthly) of their assigned systems. Operator rounds are performed at least daily, and are specifically designed to route operators through most areas of the plant to observe system operating conditions. Although not anticipated, significant degradation of non-safety-related piping would be promptly identified and resolved through FPL's 10 CFR Part 50, Appendix B corrective action program. Furthermore, the applicant stated that safety-related systems are protected from water spray, jet impingement, and pipe whip effects (due to postulated failures of non-safety-related piping) by the use of pipe whip restraints and internal barriers, as described in Turkey Point UFSAR Section 5.4.

The staff reviewed the information described above and disagreed with the applicant's scoping criteria for seismic II over I piping systems. The staff's position is that the seismic II over I piping systems whose failure could prevent safety-related systems and structures from accomplishing their intended functions should be within the scope of license renewal in accordance with the scoping requirements of 10 CFR 54.4(a)(2). The staff considers the seismic II over I piping segments to be within the scope of license renewal. For these seismic II/I piping systems, the applicant should perform an AMR to determine if there are any plausible aging effects, and identify appropriate aging management programs. Furthermore, the applicant needs to clarify the scope of its seismic II over I piping systems (i.e., whether it includes non-safety-related piping systems that are connected to safety related piping systems as well as non-safety-related piping systems that are not connected to safety-related piping systems). The applicant also needs to address the criteria used to postulate breaks and cracks in non-safety-related piping systems that are within the seismic II over I scope, if it wishes to take credit for protection of safety-related systems. The applicant must demonstrate that plant mitigative features which are provided to protect safety-related SSCs from a failure of non-safety-related piping segments are within the scope of license renewal. This issue is also discussed in Section 2.1 of this SER and is identified as open item 2.1.2-1.

By letter dated November 1, 2001, the applicant provided additional information to supplement the March 22, 2001, and May 2, 2001, responses. The applicant reiterated those SSCs, including mitigative design features, included within the scope of license renewal as a result of their initial evaluation. The applicant also addressed staff's concerns regarding the potential for age-related degradation of non-safety-related piping segments which could affect safety-related SSCs by performing a supplemental review to establish what additional non-safety-related piping should be included in the scope of license renewal. As a result of this supplemental review, the applicant brought additional non-safety-related piping segments into the scope of license renewal. On the basis of the additional information provided by the applicant, the staff concludes that all SSCs that meet the 54.4(a)(2) Scoping criteria, have been included within the scope of license renewal. The staff's evaluation of the applicant's Scoping criteria and results is discussed in Section 2.1.2.1 of this SER.

In the letter dated November 1, 2001, the applicant also provided information regarding the management of aging effects associated with those additional non-safety-related piping segments that are brought into the scope of license renewal. These contain carbon seel piping, fittings and valves in auxiliary steam, in the condensate downstream of the #4 feedwater heaters to the main feedwater pump suction line, and the #6 to #5 feedwater heater drains. The inside of these carbon steel components are exposed to treated, secondary side water and the effects of aging is loss of material. The applicant is using the chemistry control program and the flow-accelerated corrosion program to manage the effects of aging. The chemistry control program is reviewed in Section 3.2.4 and the flow-accelerated corrosion program is reviewed in Section 3.2.9 of this SER. The staff agrees that these programs are the applicable programs for managing loss of material since both of these programs follow EPRI Guidelines that have been endorsed by the staff. The applicant did not identify any effects of aging for the outside surface of these components, and the staff agrees with this conclusion.

On the basis of the additional information provided by the applicant in response to Open Item 2.1.2-1, the staff concludes that the aging management of seismic II/I piping systems is adequate and provides reasonable assurance that safety-related structures, systems, and components will be adequately protected from the consequences of a failure in the seismic II/I piping systems. Therefore, the Open Item 2.1.2-1 is closed.

3.5 Steam and Power Conversion Systems

The applicant has described its AMR of the steam and power conversion systems (SPCSs) for license renewal in Sections 2.3.4, "Steam and Power Conversion Systems," and 3.5, "Steam and Power Conversion Systems," of its LRA. The staff has reviewed these sections of the application to determine whether the applicant has provided adequate information to meet the requirements of 10 CFR 54.21(a)(3) for managing the aging effects of the SPCSs for license renewal.

3.5.1 Summary of Technical Information in the Application

The LRA has identified three systems that will require aging management to meet the requirements of 10 CFR 54.21(a)(3) for management of aging effects. The three systems are main steam and turbine generators, feedwater and blowdown, and auxiliary feedwater and condensate storage. A brief description of the systems is provided in the LRA and is given below.

3.5.1.1 Main Steam and Turbine Generators

Main steam transports saturated steam from the steam generators to the main turbine and other secondary steam system components. Main steam provides the principal heat sink for the reactor coolant system protecting the reactor coolant system and the steam generators from overpressurization, provides isolation of the steam generators during a postulated steam line break, and provides steam supply to the auxiliary feedwater pump turbines.

Turbine generators convert the steam input from main steam to the plants' electrical output, provide first-stage pressure input to the reactor protection system, and provide isolation under certain postulated steam line break scenarios. Main steam and turbine generators are described in UFSAR Section 10.2.2.

The flow diagrams listed in the LRA, Table 2.3-6 show the evaluation boundaries for the mechanical portions of main steam and turbine generators that are within the scope of license renewal. As described in the LRA, the initial scoping was performed on the basis of functions.

Main steam and turbine generators components that are subject to an AMR include valves (pressure boundary only), steam traps, flow elements, piping, tubing, and fittings. The intended functions for main steam and turbine generators components that are subject to an AMR are pressure boundary integrity and throttling. A complete list of main steam and turbine generators components that require an AMR and the component intended functions appears in Table 3.5-1. The AMR for main steam and turbine generators is discussed in Section 3.5 of LRA.

3.5.1.2 Feedwater and Blowdown

Feedwater and blowdown provide sufficient water flow to the steam generators to maintain an adequate heat sink for the reactor coolant system, provide for feedwater and blowdown isolation following a postulated loss-of-coolant accident or steam line break event, and assist in maintaining steam generator water chemistry. Feedwater and blowdown consists of three subsystems, including main feedwater, steam generator blowdown, and standby steam generator feedwater. Main feedwater supplies preheated, high-pressure feedwater to the steam generators at a rate equal to main steam and the steam generator blowdown flows. The feedwater flow rate is controlled by the steam generator level control system, which determines the desired feedwater flow by comparing the feed flow, steam flow, and the steam generator level. Main feedwater system is described in UFSAR Section 10.2.2.

Steam generator blowdown assists in maintaining required steam generator chemistry by providing a means for removal of foreign matter that concentrates in the evaporator section of the steam generator. Steam generator blowdown is fed by three independent blowdown lines (one per steam generator), which tie to a common blowdown flask. Steam generator blowdown is continuously monitored for radioactivity during plant operation. Steam generator blowdown is described in UFSAR Section 10.2.4.3.

Standby steam generator feedwater is common to Turkey Point, Units 3 and 4. Standby steam generator feedwater supplies steam generator feedwater during normal startup, shutdown, and hot standby conditions. Standby steam generator feedwater delivers sufficient feedwater to maintain one unit at hot standby, while providing makeup for maximum blowdown. The standby steam generator feedwater pumps take suction from the demineralized water storage tank and discharge to a common header upstream of the feedwater regulating valves. Standby steam generator feedwater is described in UFSAR Section 9.11. The flow diagrams listed in Table 2.3-6 show the evaluation boundaries for the portions of feedwater and blowdown that are within the scope of license renewal.

Feedwater and blowdown components that are subject to an AMR include the demineralized water storage tank, pumps and valves (pressure boundary only), orifices, piping, tubing, and fittings. The intended functions for the feedwater and blowdown system components that are subject to an AMR are pressure boundary integrity and throttling. A complete list of feedwater and blowdown components that require AMR and the component intended functions, is provided in Table 3.5-2. The aging management review for feedwater and blowdown is discussed in Section 3.5 of the LRA.

3.5.1.3 Auxiliary Feedwater and Condensate Storage

The auxiliary feedwater system supplies feedwater to the steam generators when normal feedwater sources are not available, provides for auxiliary feedwater steam and feedwater isolation during a postulated steam generator tube rupture event, and provides for auxiliary feedwater isolation to the faulted steam generator and limits feedwater flow to the steam generators to limit positive reactivity insertion during a postulated steam line break event. The auxiliary feedwater system is a shared system between Turkey Point, Units 3 and 4.

The auxiliary feedwater system contains three steam turbine-driven pumps. The pumps can be supplied steam from the steam generators in either unit. The pumps take suction from either condensate storage tank and discharge to one of two redundant headers. Each header can supply each steam generator. The auxiliary feedwater system is normally maintained in standby with one pump aligned to one discharge header and two pumps aligned to the other header. Upon initiation, all three pumps start to supply the affected steam generator with feedwater. The auxiliary feedwater system is described in UFSAR Section 9.11.

The condensate storage tank stores water for use by the auxiliary feedwater system to support safe shutdown of the plant. The condensate storage tank on each unit supplies water using three auxiliary feedwater pumps. The tank outlet piping is cross-connected between the units so that either tank can supply auxiliary feedwater to the steam generators. The condensate storage system is described in UFSAR Section 9.11.3.

The flow diagrams listed in Table 2.3-6 show the evaluation boundaries for the portions of the auxiliary feedwater system and the condensate storage system that are within the scope of license renewal.

3.5.1.4 Aging Management Programs

The LRA has identified eight aging management programs that will manage the aging effects associated with the steam and power conversion systems. These programs are auxiliary feedwater pump oil coolers inspection, auxiliary feedwater steam piping inspection program, boric acid wastage surveillance program, chemistry control program, field-erected tanks internal inspection, flow-accelerated corrosion program, galvanic corrosion susceptibility inspection program, and systems and structures monitoring program. A detailed description concerning each of the above listed programs is included in Appendix B to the LRA.

The steam and power conversion systems (SPCSs) are exposed to internal environments of treated water, lubricating oil, and air/gas, as well as external environments of outdoor, containment air, underground, and potential borated water leaks. The only parts of the SPCS components that are considered to be inaccessible for inspection are those that are buried underground. On February 8, 2001, in response to a staff RAI dated January 10, 2001, the applicant indicated that sections of the standby steam generator feedpumps suction and recirculation piping are buried underground as shown on drawing 0-FW-01. The underground sections of this piping are made of stainless steel and externally coated and wrapped in plastic to protect the coating against backfill damage. Although the pipe is buried, it is above the ground water level and therefore not exposed to ground water chemicals. Additionally, the area where the pipe is buried is paved or covered by a concrete slab, making it unlikely that the surface of the pipe will be exposed to a water environment. As part of the AMR process, the applicant reviewed the plant's operating experience, and confirmed that there has been no external corrosion of buried stainless steel piping at Turkey Point. The applicant concluded that this piping is adequately protected against potential external aging mechanisms, and that there are no external aging effects requiring management. The staff concurs with the applicant's conclusion that the AMR program is adequate to protect these buried piping sections at Turkey Point against potential aging effects.

3.5.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff has reviewed the information included in Sections 2.3.4 and 3.5 of the LRA. The purpose of the review was to ascertain whether the applicant has adequately demonstrated that the effects of aging will be adequately managed so that the intended function of the systems will be maintained consistent with the CLB throughout the period of extended operation.

3.5.2.1 Effects of Aging

The components of the SPCSs are constructed from carbon steel low alloy steel, cast iron, brass, and stainless steel. They are exposed to an external environment of outdoor, containment air, buried, and potential borated water leaks. Internally, the components in the SPCSs are exposed to environments of treated water, steam, lubricating oil, and air/gas. Section 5 of Appendix C to the LRA provides a discussion of the potential aging effects based on materials and environments. Aging effects are considered to require management if the effects could cause a component to lose its ability to perform an intended function during the period of extended operation.

The following aging effects were identified in the systems carrying treated water and steam: loss of material, cracking and loss of mechanical enclosure integrity. Tables 3.5-1, 3.5-2, and 3.5-3 of the LRA list the components, component function, material, environment, applicable aging effects and applicable aging management programs. In Tables 3.5-1 and 3.5-2 for carbon steel bolting, the effect of humidity in the external environment is not considered to cause aging that leads to loss of material due to general corrosion and loss of preload. The applicant relies on the boric acid wastage surveillance program to manage the aging effects of mechanical bolting in piping connections and closures to ensure that boric acid corrosion does not lead to degradation of the pressure boundary. When external leakage involves borated water, the aging effect of concern is loss of carbon or low alloy steel bolting material due to aggressive chemical attack (i.e., boric acid corrosion).

Therefore, the LRA addresses loss of mechanical closure integrity resulting from the external environment of "borated water leaks" and credits the boric acid wastage surveillance program for management of this effect on carbon and low alloy steel bolting. This is acceptable to the staff.

The applicant has provided references to Turkey Point plant-specific as well as industry-wide experience to support its identification of applicable aging effects for steam and power conversion systems. The staff concludes that, on the basis of the description of the internal and external environments and material of fabrication for these systems, the applicant has included aging effects that are consistent with published literature and industry experience and, thus, are acceptable to the staff.

3.5.2.2 Aging Management Programs

The applicant has identified the following eight aging management programs for controlling the effects of aging in the SPCSs:

- auxiliary feedwater pump oil coolers inspection
- auxiliary feedwater steam piping inspection program
- boric acid wastage surveillance program
- chemistry control program
- field-erected tanks internal inspection
- flow-accelerated corrosion program
- galvanic corrosion susceptibility inspection program
- systems and structures monitoring program

The programs were developed from industry-wide data, industry-developed methodologies, NRC documents, and the applicant's own experience. The applicant concluded that these programs would manage the aging effects in such a way that the intended function of the components in the SPCSs will be maintained during the period of extended operation, consistent with the current licensing basis (CLB), under all design conditions.

The staff has evaluated the FPL aging management programs in order to determine if they contain the essential elements needed to provide adequate aging management of the components in the SPCSs so that the components will perform their intended functions in accordance with the CLB during the period of extended operation. In Appendix B to the LRA, the applicant discusses the attributes that each aging management program is required to address. Those attributes are (1) scope of program including the specific structure, component or commodity for the identified aging effect, (2) preventive actions to mitigate or prevent aging degradation, (3) parameters monitored or inspected which are linked to the degradation of the particular intended function, (4) method of detection of the aging effects, (5) monitoring and trending for timely corrective actions, (6) acceptance criteria, (7) corrective actions including root cause determination and prevention of recurrence, (8) confirmation process, (9) administrative controls, and, (10) operating experience including past corrective actions resulting in program enhancements or additional programs. The application indicated that the corrective actions, confirmation process, and administrative controls for license renewal are in accordance with the site-controlled corrective actions program pursuant to 10 CFR Part 50, Appendix B, and covers all structures and components that are subject to an aging management review. The staff's evaluation of the applicant's corrective actions program is provided separately in Section 3.1.2 of this SER. The QA program satisfies the elements of corrective actions, confirmation process, and administrative controls.

On the basis of the information provided, the staff finds that the following 8 AMPs are appropriate and acceptable for managing the aging effects associated with these components:

- auxiliary feedwater pump oil coolers inspection
- auxiliary feedwater steam piping inspection program

- boric acid wastage surveillance program
- chemistry control program

- field-erected tanks internal inspection
- flow-accelerated corrosion program
- galvanic corrosion susceptibility inspection program
- systems and structures monitoring program

The eight AMPs are discussed in Sections 3.1.1, 3.1.3, 3.8.1, 3.8.2, 3.8.4, 3.8.5, 3.9.3, and 3.9.9 of this SER.

3.5.3 Conclusion

The staff has reviewed the information in LRA Sections 2.3.4, "Steam and Power Conversion Systems," and 3.5, "Steam and Power Conversion Systems," as well as applicant's responses to the staff's RAIs. On the basis of this review, the staff concludes that the applicant has demonstrated that aging effects associated with the subject systems will be adequately managed so that there is a reasonable assurance that the subject systems will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6 Structures and Structural Components

3.6.1 Containments

3.6.1.1 Containment Structure Concrete Components

3.6.1.1.1 Summary of Technical Information in the Application

Containment structure concrete components are described in Section 3.6.1.1 of the LRA. The containment structure provides radiation shielding, protects the reactor vessel and other safety-related systems, equipment, and components against missiles and environmental conditions, and serves as the last engineered barrier to the release of radioactivity. The containment structure concrete components identified by the licensee are the dome, cylinder wall, floor, and foundation mat. These components are made of concrete and reinforced by steel bars. The dome and cylinder wall were further reinforced with a post-tensioning steel system. The containment structure concrete components were designed and constructed in accordance with the American Concrete Institute (ACI) and the American Society for Testing and Materials (ASTM) standards.

Containment structure concrete components are exposed to several different environments depending on their location. Below-grade containment structure concrete components can be either above or below the groundwater elevation. Containment structure concrete components that are below grade and above the groundwater elevation are exposed to a soil/fill environment. Containment structure concrete components that are below the groundwater elevation are exposed to a soil/fill and groundwater environment. Above-grade external surfaces of the containment structure are exposed to both indoor (without air conditioned) and outdoor environments. Internal components of the containment structure are exposed to the containment air environment.

The aging effects identified by the applicant that could cause loss of intended function(s) for containment structure concrete components are loss of material, cracking, and change in material properties. The aging management program used by the applicant to manage these aging effects is the systems and structures monitoring program.

3.6.1.1.2 Staff Evaluation

In addition to Section 3.6.1.1 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results — Structures" and the applicable aging management program descriptions provided in Appendix B to the LRA to determine whether the aging effects for the containment structure concrete components have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.1.1.2.1 Effects of Aging

The aging effects identified by the applicant that could cause loss of intended function(s) for containment structure concrete components are loss of material, cracking, and change in material properties. Loss of material is manifested in containment structure concrete components as scaling, spalling, pitting and erosion. Cracking is manifested in containment structure concrete components as complete or incomplete separation of the concrete into two or more parts. Change in material properties is manifested in concrete as increased permeability, increased porosity, reduction in pH value, reduction in tensile strength, reduction in compressive strength, reduction in modulus of elasticity, and reduction in bond strength.

For the loss of material aging effect, the applicant identified the following plausible aging mechanisms: (1) freeze-thaw, (2) abrasion and cavitation, (3) elevated temperature, (4) aggressive chemical attack, and (5) corrosion of reinforcing and embedded steel. Of these aging mechanisms, the applicant stated that only aggressive chemical attack and corrosion of reinforcing and embedded steel are applicable for containment structure concrete components exposed to groundwater. As such, the applicant committed to manage loss of material only for reinforced containment concrete walls below groundwater elevation.

For the cracking aging effect, the applicant identified the following plausible aging mechanisms: (1) freeze-thaw, (2) reaction with aggregates, (3) shrinkage, (4) settlement, (5) fatigue, and (6) elevated temperature. The applicant stated that none of these aging mechanisms are applicable for containment structure concrete components at Turkey Point that are located either above or below groundwater elevation, and therefore, listed no aging management program to manage cracking in Table 3.6-2 of the LRA.

For the change in material properties aging effect, the applicant identified the following plausible aging mechanisms: (1) leaching, (2) creep, (3) elevated temperature, (4) irradiation embrittlement, and (5) aggressive chemical attack. Of these aging mechanisms, the applicant stated that only aggressive chemical attack is applicable for containment structure concrete components exposed to groundwater. As such, the applicant committed to manage change in material properties only for reinforced containment concrete walls below groundwater elevation.

The staff considers each of the above aging effects (loss of material, cracking, and change in material properties) to be both plausible and applicable for containment structure concrete components located above groundwater elevation. As such, in RAI 3.9.1.4-1 the staff requested that the applicant identify the aging management program that will be used to manage the aging effects for containment structure concrete components that are located above groundwater elevation. In its response, the applicant argued that there are no aging effects that could cause a loss of intended function for containment concrete above groundwater. At the same time, the applicant recognized the existence of the concrete degradations depicted in Appendix A to NUREG-1522. The applicant proposed to modify its ASME Section XI, Subsection IWL aging management program to include aging management of containment reinforced concrete above groundwater elevation. FPL also committed to use ACI 201.1R, "Guide for Making a Condition Survey of Concrete in Service," to establish degradation type and IWL-3211 for the acceptance criteria. Once incorporated, as committed in this response, the staff considers this issue to be resolved.

3.6.1.1.2.2 Aging Management Program

The aging management program used by the applicant to manage loss of material and cracking for containment structure concrete components located below groundwater elevation is the systems and structures monitoring program. The structural monitoring program provides condition monitoring and appraisal of containment structure concrete components through periodic visual inspections. In its description of the systems and structures monitoring program, the applicant stated that external surfaces of concrete are monitored through visual examination for exposed rebar, extensive rust bleeding, cracks that exhibit rust bleeding, and cracking of block walls and building roof seals. The results of the visual inspection for systems, structures and components are documented and the frequency for the inspection may be adjusted, as necessary, based on the inspection results and industry experience. In RAI 3.6.1.1-1, the staff requested that the applicant specifically identify how the systems and structures monitoring program manages the two aging effects, loss of material and change in material properties caused by aggressive chemical attack for containment structure concrete components that are exposed to groundwater. In its response the applicant stated that, for the containment building concrete below groundwater, which is inaccessible, visual inspection of the tendon access gallery concrete below groundwater will be required to provide early indication of potential aging effects for the containment concrete and the visual inspection will look for signs of degradation (e.g., concrete cracking, spalling, scaling, leaching, discoloration, groundwater leakage, and rust stains). The staff finds the applicant's response acceptable because the walls of the tendon access gallery are much thinner than the containment base mat or the reactor pit and, thus, any aging effects on concrete will show up sooner on the tendon access gallery than containment base mat or the reactor pit. The systems and structures monitoring program is discussed in greater detail in Section 3.1.3 of this SER.

Since the applicant did not identify any plausible and applicable aging effects for containment structure concrete components located above groundwater elevation, there are no aging management programs listed in Table 3.6-2 of the LRA to manage loss of material, cracking, and change in material properties. However, in response to the staff's position that each of these aging effects are both plausible and applicable for containment structure concrete components located above groundwater elevation, the applicant committed in its response RAI 3.9.1.4-1 to modify its ASME Section XI, Subsection IWL aging management program to include aging management of containment reinforced concrete above groundwater elevation. The ASME Section XI, Subsection IWL inservice inspection program is discussed in greater detail in Section 3.9.1.4 of this SER.

On the basis of the information discussed above, the staff concludes that the applicant has demonstrated that the aging effects for containment structure concrete components will be adequately managed by the systems and structures monitoring program for the period of extended operation.

3.6.1.1.3 Conclusion

The staff has reviewed the information in Sections 3.6.1.1, "Containment Structure Concrete Components," and Section 2.4, "Scoping and Screening Results – Structures," as well as the applicable aging management program descriptions provided in Appendix B to the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the containment structure concrete components will be adequately managed so that there is reasonable assurance that these structural components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.1.2 Containment Structure Steel Components

3.6.1.2.1 Summary of Technical Information in the Application

Containment structure steel components are described in Section 3.6.1.2 of the LRA. The purpose of the containment structure steel components is to provide several safety-related functions including serving as a pressure boundary or a fission-product retention barrier, providing structural and/or functional support to safety and non-safety-related equipment, and serving as missile and flood protection barriers. The following containment structure steel components are identified by the applicant:

- liners (including the liner plate, anchors/embedments/attachments, leak chase channels, and moisture barriers)
- penetrations [including mechanical piping, mechanical ventilation, and steel portions (pressure boundary) of the electrical penetration assemblies]
- airlocks and hatches (personnel hatch, equipment hatch, escape hatch, including seals and gaskets)
- fuel transfer tube blind flanges

The containment structure steel components were designed and constructed in accordance with ASME Section III - 1965 for the pressure boundary, and the American Institute of Steel Construction (AISC) "Manual of Steel Construction" for structural steel. The gaskets, seals, and moisture barriers that protect the containment structure steel components are elastomers.

Containment structure steel components are exposed to containment air, both indoor (not air conditioned) and outdoor air, and embedded/encased environments. Borated water is also a potential environment for containment structure steel components.

The aging effects identified by the applicant that could cause loss of intended function(s) for containment structure steel components are loss of material, cracking, and change in material properties. The aging management programs used by the applicant to manage these aging effects are the ASME Section XI, Subsection IWE inservice inspection program and the boric acid wastage surveillance program.

3.6.1.2.2 Staff Evaluation

In addition to Section 3.6.1.2 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results — Structures," and the applicable aging management program descriptions provided in Appendix B to the LRA to determine whether the aging effects for the containment structure steel components have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.1.2.2.1 Effects of Aging

The aging effects identified by the applicant that could cause loss of intended function(s) for containment structure steel components are loss of material, cracking, and change in material properties.

For the loss of material aging effect, applicant identified the following plausible aging mechanisms: (1) material compatibility, (2) mechanical wear, (3) corrosion, and (4) aggressive chemical attack. Of these aging mechanisms, the applicant stated that corrosion and aggressive chemical attack (due to boric acid) are applicable for containment structure steel components exposed to containment air or borated water leaks. As such, the applicant committed to manage loss of material using their ASME Section XI, Subsection IWE inservice inspection program for containment steel exposed to air and their boric acid wastage surveillance program for containment steel exposed to borated water leaks. The staff agrees with the applicant's findings.

For the cracking aging effect, the applicant identified the following plausible aging mechanisms: (1) stress corrosion and (2) fatigue. The applicant stated that neither of these aging mechanisms are applicable for containment structure steel components at Turkey Point that are exposed to any environment, and therefore, listed no aging management program to manage cracking in Table 3.6-2 of the LRA. In RAI 3.6.1.2-2 the staff requested that the applicant evaluate the potential for cracking of the radiant energy shields and reactor vessel supports due to stress corrosion cracking and thermal fatigue. These items along with the fuel transfer blind flanges, and non-safety-related pipe segments are made of stainless steel and listed in Table 3.6-2 of the LRA. Section 3.6.1.5 of the LRA provides only a brief explanation for concluding that these items do not require aging management. In its response, the applicant responded that, as stated in Section 5.2 of Appendix C to the LRA, cracking is a non-ductile failure of a component due to stress corrosion, fatigue, or embrittlement. Stress corrosion cracking (SCC) requires a combination of a susceptible material and tensile stress. Cracking due to thermal fatigue requires cyclic thermal stresses beyond the material endurance limit. The environment for the stainless steel components discussed in the RAI is containment air, which is dry. These components are not exposed to the corrosive environment necessary to cause SCC. Consequently, SCC is not an aging effect requiring management for these components. The applicant further stated that, by design, the components discussed in the RAI are not exposed to cyclic thermal stresses of the quantity or magnitude necessary to cause thermal fatigue. Consequently, thermal fatigue is not an aging mechanism that can lead to cracking for these components. The staff finds this response adequate to resolve RAI 3.6.1.2-2.

For the change in material properties aging effect, the applicant identified the following plausible aging mechanisms: (1) elevated temperature, (2) irradiation embrittlement, and (3) embrittlement and permanent set of elastomers. Of these aging mechanisms, the applicant stated that only embrittlement and permanent set of elastomers is applicable for elastomers associated with containment structure steel components. As such, the applicant committed to manage change in material properties using their ASME Section XI, Subsection IWE inservice inspection program for elastomers associated with containment steel exposed to air. In RAI 3.6.1.2-3, the staff asked the applicant to evaluate the potential for material changes for the steam generator support material (Lubrite), and to justify its exclusion for items requiring aging management. The applicant indicated in its response that Lubrite is the trade name for a low-friction lubricant material used in applications where relative motion (sliding) is desired. At Turkey Point, the intended function of the Lubrite plates is to facilitate relative motion (sliding) during RCS heatup and cooldown. As described in an engineering brief supplied by the applicant's Lubrite vendor, Lubrite resists deformation, has a low coefficient of friction, resists softening at elevated temperatures, absorbs grit and abrasive particles, is not susceptible to corrosion, withstands high intensities of radiation, and will not score or mar. In addition, the applicant stated that Lubrite products are solid, permanent, completely self lubricating, and require no maintenance. Also, the Lubrite lubricants used in nuclear applications are designed for the environments to which they are exposed. The applicant also performed an extensive search of industry and plant-specific operating experience and found no reported instances of Lubrite plate degradation or failure to perform their intended function. Based on the above information, the applicant determined that there are no known aging effects for the Lubrite material that would lead to a loss of intended function. The staff agrees with the applicant's determination, and considers RAI 3.6.1.2-3 resolved.

The staff finds that the applicant's approach for evaluating the applicable aging effects for containment structure steel components to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for containment structure steel components.

3.6.1.2.2.2 Aging Management Programs

The aging management programs used by the applicant to manage the above aging effects are the ASME Section XI, Subsection IWE inservice inspection program and the boric acid wastage surveillance program.

The ASME Section XI, Subsection IWE inservice inspection program is credited with managing the effects of loss of material for containment steel components and change in material properties for elastomers associated with containment steel components. The program provides inspection and examination of accessible surface areas, including surfaces of welds, pressure-retaining bolting, and moisture barriers intended to prevent intrusion of moisture against inaccessible containment metallic surfaces. In its description of the ASME Section XI, Subsection IWE inservice inspection program, the applicant stated that visual inspections of steel components are performed to detect loss of material due to general corrosion and visual inspections of elastomers are performed to detect change in material properties. The results of the visual inspections are documented and the examinations performed during any inspection interval that reveal flaws or areas of degradation exceeding the acceptance criteria are expanded to include additional examinations within the same category. In RAI 3.6.1.2-4, the staff asked the applicant to provide a discussion of any plant-specific program content for inspection of Class CC metallic liners and pressure retention components, which is part of the ASME Section XI, Subsection IWE inservice inspection program. Specifically, the staff requested that the applicant provide a discussion of how the visual inspection of the internal and external surfaces and fasteners is to be implemented, thereby providing assurance that the containment shell and internal structures have not degraded due to corrosion. In its response, the applicant stated that the Turkey Point ASME Section XI, Subsection IWE inservice inspection program includes a visual examination of all accessible interior and exterior surfaces of the metallic shell and penetrations, thereby providing assurance that the containment shell and internal structures have not degraded due to corrosion. The program also requires visual examination of moisture barriers intended to prevent intrusion of moisture against inaccessible areas of the pressure retaining liner at concrete-to-metal interfaces and at metal-to-metal interfaces that are not seal welded (Category E-D), thereby providing assurance that the moisture barriers are not degraded. The staff finds the applicant's response to be acceptable. The ASME Section XI, Subsection IWE inservice inspection program is discussed in greater detail in Section 3.9.1.2 of this SER.

The boric acid wastage surveillance program is credited for aging management of carbon steel and low alloy steel components for the containment structure. The boric acid wastage surveillance program manages the effects of loss of material due to aggressive chemical attack of steel components through the detection of leakage of coolant containing boric acid. Conditions leading to boric acid corrosion are detected by visual inspections on external surfaces in accordance with plant procedures. The boric acid wastage surveillance program is discussed in greater detail in Section 3.9.3 of this SER.

On the basis of the information discussed above, the staff concludes that the applicant has demonstrated that the aging effects for containment structure steel components will be adequately managed by the Turkey Point ASME Section XI, Subsection IWE inservice inspection program and the boric acid wastage surveillance program for the period of extended operation.

3.6.1.2.3 Conclusion

The staff has reviewed the information in Sections 3.6.1.2, "Containment Structure Steel Components," and Section 2.4, "Scoping and Screening Results — Structures," as well as the applicable aging management program descriptions provided in Appendix B to the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the containment structure steel components will be adequately managed so that there is reasonable assurance that these structural components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.1.3 Containment Structure Post-Tensioning System

3.6.1.3.1 Summary of Technical Information in the Application

Containment structure post-tensioning system components are described in Section 3.6.1.3 of the LRA. The post-tensioning system provides pre-compression for the containment structure. The containment structure post-tensioning system components identified by the licensee are the tendon wires and tendon anchorage.

Each tendon of the containment structure post-tensioning system is housed in spirally wrapped, corrugated, thin wall sheathing and capped at each end with a sheathing filler cap. After fabrication, the tendon is shop dipped in grease. The tendon sheathing provides the channel in the concrete through which the tendon is pulled, and contains the tendon sheathing filler material, which is grease. The tendon anchorages and tendon wires are contained in the sheathing filler material.

The aging effects identified by the applicant that could cause loss of intended function(s) for the containment structure post-tensioning system are loss of material and loss of prestress. The aging management program used by the applicant to manage these aging effects is the ASME Section XI, Subsection IWL inservice inspection program.

3.6.1.3.2 Staff Evaluation

In addition to Section 3.6.1.3 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results — Structures," and the applicable aging management program descriptions provided in Appendix B to the LRA to determine whether the aging effects for the containment structure post-tensioning system have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.1.3.2.1 Effects of Aging

The aging effects identified by the applicant that could cause loss of intended function(s) for the containment structure post-tensioning system are loss of material and loss of prestress. The applicant identified corrosion as an aging mechanism that can lead to the loss of material aging effect for the containment structure post-tensioning system. Corrosion can affect both the tendon wires within the grease-filled conduits and the anchorages providing the tendon terminations.

The applicant identified elevated temperatures, irradiation, stress relaxation of the prestressing wire, shrinkage, creep or elastic deformation of the concrete, anchorage seating losses, and tendon friction as aging mechanisms that can lead to the loss of prestress aging effect for the containment structure post-tensioning system. The loss of prestress aging effect is monitored by the applicant through a time-limited aging analysis and is discussed in greater detail in Section 4.5 of this SER.

The staff finds that the applicant's approach for evaluating the applicable aging effects for the containment structure post-tensioning system to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for the containment structure post-tensioning system.

3.6.1.3.2.2 Aging Management Programs

The aging management program used by the applicant to manage the loss of material aging effect for the containment structure post-tensioning system is the ASME Section XI, Subsection IWL inservice inspection program. The program provides for inspection of tendon wires and tendon anchorage hardware surfaces for loss of material, as well as a confirmatory program for measurement of tendons for loss of prestress. In its description of the ASME Section XI, Subsection IWL inservice inspection program, the applicant stated that unbonded post-tensioning system components are examined. These components consist of tendons, wires or strand, anchorage hardware and surrounding concrete, corrosion protection medium, and free water. Surface conditions are monitored through visual examinations to determine the extent of corrosion or concrete degradation around anchorage locations. The results of the visual inspections are documented in accordance with the corrective action program and areas of degradation are evaluated to determine if repair or replacement is required. The ASME Section XI, Subsection IWL inservice inspection program is discussed in greater detail in Section 3.9.1.4 of this SER.

On the basis of the information discussed above, the staff concludes that the applicant has demonstrated that the loss of material aging effect for the containment structure post-tensioning system will be adequately managed by the ASME Section XI, Subsection IWL inservice inspection program for the period of extended operation.

3.6.1.3.3 Conclusion

The staff has reviewed the information in Sections 3.6.1.3, "Containment Structure Post-Tensioning System," and 2.4, "Scoping and Screening Results — Structures," as well as the applicable aging management program descriptions provided in Appendix B to the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the containment structure post-tensioning system will be adequately managed so that there is reasonable assurance that these structural components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.1.4 Containment Internal Structural Concrete Components

3.6.1.4.1 Summary of Technical Information in the Application

Containment internal structural concrete components are described in Section 3.6.1.4 of the LRA. The containment structure provides radiation shielding, protects the reactor vessel and other safety-related systems, equipment, and components against missiles and environmental conditions, and serves as the last engineered barrier to the release of radioactivity. The following containment internal structural concrete components are identified by the applicant:

- reinforced concrete primary shield walls

- reinforce concrete secondary shield walls
- reinforced concrete upper secondary compartment walls (steam generator and pressurizer cubicles)
- reinforced concrete refueling cavity walls
- reinforced concrete containment sumps
- reinforced concrete equipment pads
- reinforced concrete missile shields

- reinforced concrete beams, floors, mats, and walls
- reinforce concrete curbs

These components were designed and constructed in accordance with ACI and ASTM standards. Containment internal structural concrete components are exposed to the containment air environment.

The aging effects identified by the applicant that could cause loss of intended function(s) for containment internal structural concrete components are loss of material, cracking, and change in material properties. However, the applicant determined for the containment internal structural concrete components that none of these aging effects required aging management for the period of extended operation and as such there is no aging management program used by the applicant to manage these aging effects.

3.6.1.4.2 Staff Evaluation

In addition to Section 3.6.1.4 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results – Structures" and the applicable aging management program descriptions provided in Appendix B to the LRA to determine whether the aging effects for the containment internal structural concrete components have been completely identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.1.4.2.1 Effects of Aging

The aging effects identified by the applicant that could cause loss of intended function(s) for the containment internal structural concrete components are loss of material, cracking, and change in material properties. Loss of material is manifested in containment internal structural concrete components as scaling, spalling, pitting, and erosion. Cracking is manifested in containment internal structural concrete components as complete or incomplete separation of the concrete into two or more parts. Change in material properties is manifested in containment internal structural concrete components as increased permeability, increased porosity, reduction in pH, reduction in tensile strength, reduction in compressive strength, reduction in modulus of elasticity, and reduction in bond strength.

For the loss of material aging effect, the applicant identified the following plausible aging mechanisms: (1) freeze-thaw, (2) abrasion and cavitation, (3) aggressive chemical attack, (4) corrosion of reinforcing and embedded steel, and (5) elevated temperature. The applicant stated that none of these aging mechanisms are applicable for containment internal structural concrete components at Turkey Point and therefore, listed no aging management program to manage loss of material in Table 3.6-2 of the LRA.

For the cracking aging effect, the applicant identified the following plausible aging mechanisms: (1) freeze-thaw, (2) reactions with aggregates, (3) shrinkage, (4) settlement, (5) fatigue, and (6) elevated temperature. The applicant stated that none of these aging mechanisms are applicable for containment internal structural concrete components at Turkey Point and therefore, listed no aging management program to manage cracking in Table 3.6-2 of the LRA.

For the change in material properties aging effect, the applicant identified the following plausible aging mechanisms: (1) leaching, (2) creep, (3) aggressive chemical attack, (4) irradiation embrittlement, and (5) elevated temperature. The applicant stated that none of these aging mechanisms are applicable for containment internal structural concrete components at Turkey Point and therefore, listed no aging management program to manage change in material properties in Table 3.6-2 of the LRA.

The staff considers that each of the above aging effects (loss of material, cracking, change in material properties) are both plausible and applicable for containment internal structural concrete components at Turkey Point. As such, in RAI 3.6.2.1-2 the staff requested that the applicant provide an aging management program to manage the aging of reinforced concrete structures. In its initial response, the applicant reasserted its position that aging management reviews performed on above groundwater reinforced concrete did not identify any aging effects requiring management. However, FPL proposed to use its inspections of containment structure concrete components through the ASME Section XI, IWL inservice inspection program as an indicator for the condition of other reinforced concrete structures. Subsequent communication between the staff and FPL culminated in a staff letter, dated October 30, 2001, in which the staff asserted its position that all concrete structures within the scope of license renewal require aging management via a dedicated aging management program. In its response to the staff's position (see supplemental response to RAI 3.6.2.1-2 dated November 1, 2001), the applicant committed to manage the aging of containment internal structural concrete components for loss of material, cracking, and change in material properties through inspections performed by its systems and structural monitoring aging management program. Once incorporate, as committed in this response, the staff considers this issue to be resolved.

3.6.1.4.2.2 Aging Management Programs

Since the applicant did not identify any plausible and applicable aging effects for containment internal structural concrete components, there are no aging management programs listed in Table 3.6-2 of the LRA to manage loss of material, cracking, and change in material properties. However, in response to the staff's position that each of these aging effects are both plausible and applicable for containment internal structural concrete components, the applicant committed in its supplemental response to RAI 3.6.2.1-2 to manage the aging of containment internal structural concrete components for loss of material, cracking, and change in material properties through inspections performed by its systems and structural monitoring aging management program. The systems and structures monitoring program is discussed in greater detail in Section 3.1.3 of this SER.

3.6.1.4.3 Conclusion

The staff has reviewed the information in Sections 3.6.1.2, "Containment Internal Structural Concrete Components," and 2.4, "Scoping and Screening Results — Structures," as well as the applicable aging management program descriptions provided in Appendix B to the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the containment internal structural concrete components will be adequately managed so that there is reasonable assurance that these structural components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.1.5 Containment Internal Structural Steel Components

3.6.1.5.1 Summary of Technical Information in the Application

Containment internal structure steel components are described in Section 3.6.1.5 of the LRA. The purpose of the containment internal structural steel components is to provide several safety-related functions including serving as a pressure boundary or a fission-product retention barrier, providing structural and/or functional support to safety-and non-safety-related equipment, and serving as missile and flood protection barriers. The following containment internal structural steel components are identified by the applicant:

- equipment component supports
- heating, ventilation, and air-conditioning (HVAC) ductwork supports
- piping supports
- pipe whip restraints
- cable trays, conduits, and supports
- electrical and instrument panels and enclosures
- anchorages/embedments exposed surfaces
- instrument line supports
- instrument racks and frames
- structural steel beams and columns
- stairs, platforms, and grating
- sump screens
- Lubrite plates
- radiant energy shields
- polar crane
- reactor coolant system supports (including reactor vessel supports, steam generator supports, reactor coolant pump supports, pressurizer supports, and the surge line support)
- non-safety-related piping between class break and anchor

The containment internal structural steel components were designed in accordance with the AISC "Manual of Steel Construction." The materials of construction for the reactor coolant system supports include structural steel, low alloy steel, and carbon steel pipe. The primary bolting material is carbon steel. Pipe segments beyond the safety-related/non-safety-related boundaries are constructed of carbon and stainless steel and consist of piping and inline components.

Containment internal structural steel components are exposed to containment air and treated water. Borated water is also a potential environment for containment internal structural steel components.

The aging effects identified by the applicant that could cause loss of intended function(s) for containment structure steel components are loss of material, cracking, and change in material properties. The aging management programs used by the applicant to manage these aging effects are the ASME Section XI, Subsection IWF inservice inspection program, the boric acid wastage surveillance program, and the systems and structures monitoring program.

3.6.1.5.2 Staff Evaluation

In addition to Section 3.6.1.5 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results – Structures," and the applicable aging management program descriptions provided in Appendix B of the LRA to determine whether the aging effects for the containment internal structural steel components have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.1.5.2.1 Effects of Aging

The aging effects identified by the applicant that could cause loss of intended function(s) for containment internal structural steel components are loss of material, cracking, and change in material properties.

For the loss of material aging effect, applicant identified the following plausible aging mechanisms: (1) material compatibility, (2) mechanical wear, (3) corrosion, and (4) aggressive chemical attack. Of these aging mechanisms, the applicant stated that corrosion and aggressive chemical attack (due to boric acid) are applicable for containment internal structural steel components at Turkey Point that are exposed to containment air or borated water leaks. As such, the applicant committed to manage loss of material using their ASME Section XI, Subsection IWF inservice inspection program or the systems and structures monitoring program for containment internal structural steel exposed to air and their boric acid wastage surveillance program for containment steel exposed to borated water leaks.

For the cracking aging effect, the applicant identified the following plausible aging mechanisms: (1) stress corrosion and (2) fatigue. The applicant stated that neither of these aging mechanisms are applicable for containment internal structural steel components at Turkey Point that are exposed to any environment, and therefore, listed no aging management program to manage cracking in Table 3.6-2 of the LRA.

For the change in material properties aging effect, the applicant identified the following plausible aging mechanisms: (1) elevated temperature, (2) irradiation embrittlement, and (3) creep and stress relaxation. The applicant stated that neither of these aging mechanisms are applicable for containment internal structural steel components at Turkey Point that are exposed to any environment, and therefore, listed no aging management program to manage change in material properties in Table 3.6-2 of the LRA.

In addition to the three aging effects listed above, the staff requested in RAI 3.6.1.5-3 that the applicant provide the technical justification for not including loss of preload as an aging effect for expansion and undercut anchors due to the effects of vibration on the surrounding concrete. In its response, the applicant stated that the FPL design specification for expansion and undercut anchors specifically prohibits the use of these anchors in vibratory service conditions. In addition, the applicant stated that any degradation due to vibratory loading would occur relatively early in plant life and such an occurrence would be detected and corrective actions implemented to preclude recurrence. Therefore, degradation due to vibration is not an aging effect requiring management for Turkey Point. The staff finds this response acceptable.

The staff finds that the applicant's approach for evaluating the applicable aging effects for containment internal structural steel components to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for containment internal structural steel components.

3.6.1.5.2.2 Aging Management Programs

The aging management programs used by the applicant to manage the above aging effects are the ASME Section XI, Subsection IWF inservice inspection program, the boric acid wastage surveillance program, and systems and structures monitoring program.

The ASME Section XI, Subsection IWF inservice inspection program is credited with managing the effects of loss of material for Class 1, 2, and 3 component supports in the containment. The program provides for a visual inspection of the surfaces of component supports for evidence of surface irregularities such as flaking, blistering, peeling or discoloration. The results of the visual examinations are documented and the component supports that are subjected to corrective measures are reexamined during the next inspection period. The ASME Section XI, Subsection IWF inservice inspection program is discussed in greater detail in Section 3.9.1.3 of this SER.

The boric acid wastage surveillance program is credited for aging management of carbon steel and low alloy steel components for the containment structure. The boric acid wastage surveillance program manages the effects of loss of material due to aggressive chemical attack of steel components through the detection of leakage of coolant containing boric acid. Conditions leading to boric acid corrosion are detected by visual inspections on external surfaces in accordance with plant procedures. In RAI 3.6.1.5-5, the staff requested that FPL provide the basis for omitting the boric acid waste surveillance program as the aging management program for containment anchorages/embedments that are located above the groundwater table or in an air conditioned environment. In its response, the applicant stated that Table 3.6-2 of the LRA lists two types of containment anchorages/embedments, which are located above groundwater. Specifically, these anchorages/embedments are those encased in concrete and those exposed to containment air. For anchorages and embedments that are encased in concrete, the applicant maintains that the surrounding concrete protects the anchorages/embedments; thus, aging management is not required. However, the applicant confirmed that the anchorages/embedments that are exposed to containment air and borated water leaks are subject to the loss of material aging effect, and are managed by the boric acid wastage surveillance program. The boric acid wastage surveillance program is discussed in greater detail in Section 3.9.3 of this SER.

The systems and structures monitoring program is credited with managing the loss of material aging effect due to corrosion for containment internal structural steel components other than component supports. The structural monitoring program provides condition monitoring and appraisal of containment internal structural steel components through periodic visual inspections. In its description of the systems and structures monitoring program, the applicant stated that external surfaces of steel components are examined for evidence of corrosion such as flaking, blistering, peeling or discoloration. The results of the visual inspections are documented and the frequency of the inspection may be adjusted based on the inspection results and industry experience. In RAI 3.6.1.5-1 the staff requested that the applicant explain the omission of the systems and structures monitoring program as an aging management program for the galvanized carbon steel components such as electrical, instrument panels and enclosures, miscellaneous steel (stairs, platforms, and grating). In its response, the applicant stated that galvanized carbon is steel that is not considered to be susceptible to general corrosion except where buried, submerged in fluid, or subject to wetting. Hence, the boric acid wastage surveillance program is the only aging management program for these galvanized carbon steel components. The systems and structures monitoring program is discussed in greater detail in Section 3.1.3 of this SER.

On the basis of the information discussed above, the staff concludes that the applicant has demonstrated that the aging effects for containment internal structural steel components will be adequately managed by the Turkey Point ASME Section XI, Subsection IWF inservice inspection program, the boric acid wastage surveillance program, and the systems and structures monitoring program for the period of extended operation.

3.6.1.5.3 Conclusion

The staff has reviewed the information in Sections 3.6.1.5, "Containment Internal Structural Steel Components," and 2.4, "Scoping and Screening Results — Structures," as well as the applicable aging management program descriptions provided in Appendix B to the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the containment internal structural steel components will be adequately managed so that there is reasonable assurance that these structural components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.2 Other Structures

3.6.2.1 Steel-in-Air Structural Components

3.6.2.1.1 Summary of Technical Information in the Application

The following steel-in-air structural components are described in Section 3.6.2.1 of the LRA:

- framing, bracing, and connections
- decking, grating, and checkered plate
- stairs and ladders
- exposed anchors and embedments
- piping, duct, and component supports
- non-safety-related piping between class break and anchor
- crane rails and girders

- cable trays, conduits, and electrical enclosures
- instrumentation supports
- instrument racks and frames

The in-scope steel-in-air structural components listed above are found in the auxiliary building, control building, intake structure, turbine building, yard structures, and other smaller, miscellaneous enclosures listed in Tables 3.6-3 through 3.6-20.

The applicant stated that the steel-in-air structural components were designed and constructed in accordance with AISC standards. Turkey Point steel-in-air structural components are constructed of painted or galvanized carbon steel and stainless steel. The applicant stated that pipe segments beyond the safety-related/non-safety-related boundaries are constructed of carbon and stainless steel and consist of piping and inline components. The steel-in-air structural components are exposed to containment air, outdoor, indoor (both air and non-air conditioned), and potential borated water leak environments.

The aging effects identified by the applicant that could cause loss of intended function(s) for steel-in-air structural components are loss of material, cracking, and change in material properties. The aging management programs used by the applicant to manage these aging effects are the systems and structures monitoring program, ASME Section XI, Subsection IWF inservice inspection program, and boric acid wastage surveillance program.

3.6.2.1.2 Staff Evaluation

In addition to Section 3.6.2.1 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results – Structures" and the applicable aging management program descriptions provided in Appendix B to the LRA to determine whether the aging effects for the steel-in-air structural components have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.2.1.2.1 Effects of Aging

The aging effects identified by the applicant that could cause loss of intended function(s) for the steel-in-air structural components are loss of material, cracking, and change in material properties.

For the loss of material aging effect, the applicant identified the following plausible aging mechanisms: (1) mechanical wear, (2) corrosion, (3) and aggressive chemical attack. Of these aging mechanisms the applicant identified corrosion of carbon steel in an air environment and aggressive chemical attack due to boric acid as applicable to steel structural components. As such, the applicant committed to manage loss of material for steel-in-air structural components.

For the cracking aging effect, the applicant identified the following plausible aging mechanisms: (1) stress corrosion and (2) fatigue. The applicant stated that neither of these aging mechanisms is applicable for steel-in-air structural components at Turkey Point, and therefore, listed no aging management program to manage cracking for these components in Tables 3.6-3 through 3.6-20 in the LRA.

For the change in material properties aging effect, the applicant identified thermal and irradiation embrittlement as a plausible aging mechanism. The applicant determined that since none of the steel-in-air structural components outside the containment are exposed to elevated temperatures or fluences that would cause reduction in fracture toughness, that change in material properties is not an aging effect requiring management for steel-in-air structural components.

The staff finds the applicant's approach for evaluating the applicable aging effects for steel-in-air structural components to be reasonable and acceptable. The staff concludes that the applicable aging effects for steel-in-air structural components have been properly identified.

3.6.2.1.2.2 Aging Management Programs

The aging management programs used by the applicant to manage the above aging effects are the ASME Section XI, Subsection IWF inservice inspection program, the boric acid wastage surveillance program, and systems and structures monitoring program.

The ASME Section XI, Subsection IWF inservice inspection program is credited with managing the effects of loss of material for Class 1, 2, and 3 component supports in the auxiliary building, containment, emergency diesel generator buildings, and yard structures. The program provides for a visual inspection of the surfaces of component supports for evidence of surface irregularities such as flaking, blistering, peeling or discoloration. The results of the visual examinations are documented and the component supports that are subjected to corrective measures are reexamined during the next inspection period. The ASME Section XI, Subsection IWF inservice inspection program is discussed in greater detail in Section 3.9.1.3 of this SER.

The boric acid wastage surveillance program is credited for aging management of carbon steel and low alloy steel components for several different systems and structures. The boric acid wastage surveillance program manages the effects of loss of material due to aggressive chemical attack of steel components through the detection of leakage of coolant containing boric acid. Conditions leading to boric acid corrosion are detected by visual inspections on external surfaces in accordance with plant procedures. The boric acid wastage surveillance program is discussed in greater detail in Section 3.9.3 of this SER.

The systems and structures monitoring program is credited with managing the loss of material aging effect due to corrosion for steel-in-air structural components other than component supports. The structural monitoring program provides condition monitoring and appraisal of structural steel components through periodic visual inspections. In its description of the systems and structures monitoring program, the applicant stated that external surfaces of steel components are examined for evidence of corrosion such as flaking, blistering, peeling or discoloration. The results of the visual inspections are documented and the frequency of the inspection may be adjusted based on the inspection results and industry experience. In Tables 3.6-3 and 3.6-13 of the LRA, the applicant credited the systems and structures monitoring program with managing the loss of material aging effect for anchorages/embedments located below groundwater elevation. In RAI 3.6.2.1-1 the staff questioned the effectiveness of the systems and structures monitoring program for managing the loss of material aging effect for the normally inaccessible steel components that are enclosed in concrete below groundwater elevation. In its response, the applicant stated that the systems and structures monitoring program will manage aging of concrete below the groundwater elevation by direct visual inspections of exposed surfaces of the concrete structures (i.e., intake structure and auxiliary building). Visual inspections of exposed surfaces of concrete below groundwater elevation will identify signs of degradation (e.g., concrete cracking, spalling, scaling, leaching, discoloration, groundwater in-leakage, or rust stains). Satisfactory inspection of the concrete surfaces will ensure adequate aging management for the steel anchorages/embedments below groundwater elevation. The applicant's response is acceptable to the staff. The systems and structures monitoring program is discussed in greater detail in Section 3.1.3 of this SER.

On the basis of the information discussed above, the staff concludes that the applicant has demonstrated that the aging effects for steel-in-air structural components will be adequately managed by the Turkey Point ASME Section XI, Subsection IWF inservice inspection program, the boric acid wastage surveillance program, and the systems and structures monitoring program for the period of extended operation.

3.6.2.1.3 Conclusion

The staff has reviewed the information in Sections 3.6.2.1, "Steel-In-Air Structural Components," and 2.4, "Scoping and Screening Results — Structures," as well as the applicable aging management program descriptions provided in Appendix B to the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the steel-in-air structural components will be adequately managed so that there is reasonable assurance that these structural components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.2.2 Steel-in-Fluid Structural Components

3.6.2.2.1 Summary of Technical Information in the Application

The following steel-in-fluid structural components are described in Section 3.6.2.2 of the LRA:

- refueling pool cavity liner plates
- spent fuel pool liner plates
- spent fuel handling equipment and tools
- spent fuel pool keyway gates
- fuel transfer tubes, penetration sleeves, and gate valves
- reactor cavity seal rings
- spent fuel pool anchorages and embedments
- intake structure traveling screens

The in-scope steel-in-fluid structural components listed above are found primarily in the intake structure, spent fuel storage and handling, and yard structures listed in Tables 3.6-13, 3.6-16, and 3.6-20.

The applicant stated that the steel-in-fluid structural components were designed and constructed in accordance with AISC standards. Turkey Point steel-in-fluid structural components are constructed of painted or galvanized carbon steel and stainless steel. In addition, the spent fuel storage racks contain Boraflex panels. The steel-in-fluid structural components are exposed to fluid environments of raw water, borated water, and indoor, outdoor and containment air environments.

The aging effects identified by the applicant that could cause loss of intended function(s) for steel-in-fluid structural components are loss of material, cracking, and change in material properties. The aging management programs used by the applicant to manage these aging effects are the systems and structures monitoring program, Boraflex surveillance program, chemistry control program, and periodic surveillance and preventive maintenance program.

3.6.2.2.2 Staff Evaluation

In addition to Section 3.6.2.2 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results – Structures," and the applicable aging management program descriptions provided in Appendix B of the LRA to determine whether the aging effects for the steel-in-fluid structural components have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.2.2.2.1 Effects of Aging

The aging effects identified by the applicant that could cause loss of intended function(s) for the steel-in-fluid structural components are loss of material, cracking, and change in material properties.

For the loss of material aging effect, the applicant identified the following plausible aging mechanisms: (1) leaching, (2) aggressive chemical attack, (3) mechanical wear, and (4) corrosion. In Appendix C of the LRA, the applicant stated that leaching, aggressive chemical attack, and mechanical wear are not aging mechanisms that can lead to the loss of material aging effect for steel-in-fluid structural components. Loss of material due to selective leaching is an aging effect requiring management for admiralty brass, brass, and gray cast iron in treated water environments and is not applicable to structural steel components. Aggressive chemical attack due to boric acid is an applicable aging mechanism for steel-in-air structural components, since steel-in-air may be exposed to highly concentrated boric acid solutions resulting from borated water leaks. However, steel-in-fluid structural components are not exposed to highly concentrated boric acid solutions and therefore the applicant determined that aggressive chemical attack is not an applicable aging mechanism that will lead to the loss of material aging effect. The applicant also determined that there is no mechanical wear for the in-scope steel-in-fluid structural components. Corrosion is identified as an aging mechanism that can lead to the loss of material aging effect for steel-in-fluid structural components.

For the cracking aging effect, the applicant identified the following plausible aging mechanisms: (1) fatigue, (2) hydrogen damage and (3) stress corrosion cracking. In Appendix C of the LRA, the applicant stated that none of these three aging mechanisms can lead to the cracking aging effect for steel-in-fluid structural components at Turkey Point, and therefore, listed no aging management program to manage cracking for these components in Tables 3.6-3 through 3.6-20 in the LRA. The applicant stated that vibration induced fatigue is fast acting and typically detected early in a component's life, at which time corrective actions are initiated to prevent recurrence. These corrective actions typically involve modifications to the plant, such as the addition of supplemental restraints to a piping system, replacement of tubing with flexible hose, etc. Based upon these considerations, the applicant concluded that cracking due to vibration induced fatigue is not an aging effect requiring management. The applicant also concluded, based on its own operating experience and a review of other PWR treated water systems, that cracking due to hydrogen damage is not an aging effect requiring management for stainless steel components. The applicant also stated that for carbon steels, stress corrosion cracking occurs most commonly in the presence of aqueous chlorides. Industry data do not indicate a significant problem of stress corrosion cracking of low strength carbon steels. Therefore, the applicant concluded that stress corrosion cracking of carbon steels is not an aging effect requiring management. Based on the above, the applicant concluded that cracking is not an aging effect requiring management for steel-in-fluid structural components.

For the change in material properties aging effect, the applicant identified the following plausible aging mechanisms: (1) creep and stress relaxation and (2) thermal and irradiation embrittlement. Regarding creep and stress relaxation, the applicant stated that this aging mechanism can lead to change in material properties for steel components if the component operating temperature approaches or exceeds the crystallization temperature for the metal. Austenitic stainless steel with temperatures less than 800 °F and carbon steel and low alloy steels with temperatures less than 700 °F are not susceptible to creep and stress relaxation. All Turkey Point plant systems operate at temperatures below 700 °F and, thus, are not susceptible to creep and stress relaxation. Therefore, the applicant concluded that creep and stress relaxation would not lead to change in material properties for steel-in-fluid structural components at Turkey Point. Regarding thermal and irradiation embrittlement, the applicant stated that steel-in-fluid structural components outside containment are not exposed to the elevated temperatures or fluences that would cause reduction in fracture toughness. However, the applicant stated that Boraflex panels, which are neutron absorbers inserted between the fuel storage cells in high-density fuel storage racks, are susceptible to change in material properties resulting from irradiation embrittlement.

The staff finds the applicant's approach for evaluating the applicable aging effects for steel-in-fluid structural components to be reasonable and acceptable. The staff concludes that the applicable aging effects for steel-in-fluid structural components have been properly identified.

3.6.2.2.2.2 Aging Management Programs

The aging management programs used by the applicant to manage the above aging effects are the Boraflex surveillance program, the chemistry control program, and the systems and structures monitoring program.

The Boraflex surveillance program is credited with managing the change in material properties aging effect for the Boraflex panels that are inserted between the fuel storage cells in the fuel storage racks. The Boraflex surveillance program seeks to determine the amount of degradation of the Boraflex material through blackness testing and tracking of the spent fuel pool silica levels. The results of the Boraflex surveillance testing are evaluated to determine the schedule for subsequent testing. The Boraflex surveillance program is discussed in greater detail in Section 3.9.2 of this SER.

The chemistry control program is credited with managing the loss of material aging effect for spent fuel storage and handling stainless steel components in a treated water-borated environment. The chemistry control program includes sampling activities and analysis for treated water-borated that determine the amount of corrosion inhibitors that is introduced to prevent loss of material. The acceptance criteria for the chemistry control program are in accordance with the Nuclear Chemistry Parameters Manual, Technical Specifications, and appropriate plant procedures. The chemistry control program is discussed in greater detail in Section 3.1.1 of this SER.

The systems and structures monitoring program is credited with managing the loss of material aging effect for most of the steel-in-fluid structural components. The structural monitoring program provides condition monitoring and appraisal of components through periodic visual inspections. In its description of the systems and structures monitoring program, the applicant stated that external surfaces of steel components are examined for evidence of corrosion such as flaking, blistering, peeling or discoloration. The results of the visual inspections are documented and the frequency of the inspection may be adjusted based on the inspection results and industry experience. The systems and structures monitoring program is discussed in greater detail in Section 3.1.3 of this SER.

On the basis of the information discussed above, the staff concludes that the applicant has demonstrated that the aging effects for steel-in-fluid structural components will be adequately managed by the Boraflex surveillance program, the chemistry control program, and the systems and structures monitoring program for the period of extended operation.

3.6.2.2.3 Conclusion

The staff has reviewed the information in Sections 3.6.2.2, "Steel-In-Fluid Structural Components," and 2.4, "Scoping and Screening Results — Structures," as well as the applicable aging management program descriptions provided in Appendix B to the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the steel-in-fluid structural components will be adequately managed so that there is reasonable assurance that these structural components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.2.3 Concrete Structural Components

3.6.2.3.1 Summary of Technical Information in the Application

The concrete structural components are described in Section 3.6.2.3 of the LRA. Concrete structural components include foundations, columns, walls, floors, roofs, equipment pads, electric duct banks, manholes, trenches, masonry block walls, embedded steel, embedded anchors, and concrete piping. The in-scope concrete structural components listed above are found in the auxiliary building, cold chemistry lab, control building, diesel driven fire pump enclosure, discharge structure, electrical penetration rooms, emergency diesel generator buildings, intake structure, main steam and feedwater platforms, plant vent stack, spent fuel storage and handling room, turbine building, chimneys, and yard structures, listed in Tables 3.6-3 through 3.6-20.

The applicant stated that the concrete structural components were designed and constructed in accordance with ACI and ASTM standards. Turkey Point concrete structural components are exposed to environments of outdoor, indoor-not air-conditioned, indoor-air conditioned, buried, raw water cooling canals, and embedded/encased.

The aging effects identified by the applicant that could cause loss of intended function(s) for concrete structural components are loss of material, cracking, and change in material properties. The aging management program used by the applicant to manage these aging effects is the systems and structures monitoring program.

3.6.2.3.2 Staff Evaluation

In addition to Section 3.6.2.3 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results – Structures," and the applicable aging management program descriptions provided in Appendix B of the LRA to determine whether the aging effects for the containment structure concrete components have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.2.3.2.1 Effects of Aging

The aging effects identified by the applicant that could cause loss of intended function(s) for concrete structural components are loss of material, cracking, and change in material properties. Loss of material is manifested in concrete structural components as scaling, spalling, pitting and erosion. Cracking is manifested in concrete structural components as complete or incomplete separation of the concrete into two or more parts. Change in material properties is manifested in concrete structural components as increased permeability, increased porosity, reduction in pH value, reduction in tensile strength, reduction in compressive strength, reduction in modulus of elasticity, and reduction in bond strength.

For the loss of material aging effect, the applicant identified the following plausible aging mechanisms: (1) freeze-thaw, (2) abrasion and cavitation, (3) elevated temperature, (4) aggressive chemical attack, and (5) corrosion of reinforcing and embedded/encased steel. Of these aging mechanisms, the applicant stated that only aggressive chemical attack and corrosion of reinforcing and embedded steel are applicable for concrete structural components exposed to groundwater or saltwater. As such, the applicant committed to manage loss of material only for reinforced concrete structures that are below groundwater elevation or exposed to saltwater.

For the cracking aging effect, the applicant identified the following plausible aging effects: (1) freeze-thaw, (2) reactions with aggregates, (3) fatigue, (4) shrinkage, (5) settlement, and (6) elevated temperature. Of these aging mechanisms, the applicant stated that only shrinkage and settlement are applicable for unreinforced masonry block walls at Turkey Point. For all other concrete structural components, the applicant stated that none of the above aging mechanisms are applicable and therefore, listed no aging management program to manage cracking for these components in Tables 3.6-3 through 3.6-20 of the LRA. For unreinforced masonry block walls, the applicant committed to using the systems and structures monitoring aging management program to manage cracking.

For the change in material properties aging effect, the applicant identified the following plausible aging effects: (1) leaching, (2) creep, (3) elevated temperature, (4) irradiation embrittlement, and (5) aggressive chemical attack. Of these aging mechanisms, the applicant stated that only aggressive chemical attack is applicable for concrete structural components exposed to groundwater or saltwater. As such, the applicant committed to manage change in material properties only for concrete structural components that are below groundwater elevation or exposed to saltwater.

The staff considers that each of the above aging effects (loss of material, cracking, change in material properties) are both plausible and applicable for containment internal structural concrete components. As such, in RAI 3.6.2.1-2 the staff requested that the applicant provide an aging management program to manage the aging of concrete structural components. In its initial response, the applicant reasserted its position that aging management reviews performed on above groundwater reinforced concrete did not identify any aging effects requiring management. However, FPL proposed to use its inspections of containment structure concrete components through the ASME Section XI, IWL inservice inspection program as an indicator for the condition of other reinforced concrete structures. Subsequent communication between the staff and FPL culminated in a staff letter, dated October 30, 2001, in which the staff asserted its position that all concrete structures within the scope of license renewal require aging management. In its response to the staff's position (see supplemental response to RAI 3.6.2.1-2 dated November 1, 2001), the applicant committed to manage the aging of concrete structural components for loss of material, cracking, and change in material properties through inspections performed by its systems and structural monitoring aging management program. Once incorporated, as committed in this response, the staff considers this issue to be resolved.

3.6.2.3.2.2 Aging Management Programs

The aging management program used by the applicant to manage the above aging effects is the systems and structures monitoring program. The structural monitoring program provides condition monitoring and appraisal of concrete structural components through periodic visual inspections. In its supplemental response to RAI 3.6.2.1-2 (dated November 1, 2001), the applicant stated that the "Parameters Monitored or Inspected" section of the systems and structural monitoring program has been revised to include the monitoring for change in material properties, cracking, and loss of material of all reinforced concrete components and not just those concrete components located below groundwater elevation or exposed to saltwater. The results of the visual inspection for systems, structures and components will be documented and the frequency for the inspection may be adjusted, as necessary, based on the inspection results and industry experience. In RAI 3.6.2.3-1, the staff requested that the applicant identify the specific inspection procedure used by the systems and structures monitoring program for monitoring the condition of masonry block walls. In its response, the applicant stated that the inspection procedures require visual inspection of masonry walls for signs of degradation, including cracks, missing or degraded mortar, missing or degraded masonry units, and degradation at bracing connections. When cracks are identified, they are evaluated under the Corrective Action Program to ensure the extent of cracking does not invalidate the evaluation basis established either in response to IEB 80-11 or established for implementation of USI A-46. The response is acceptable to the staff because all the components of the masonry block walls are inspected and the safety of the masonry block walls is evaluated against the acceptable criteria to the staff. The systems and structures monitoring program is discussed in more detail in Section 3.1.3 of this SER.

On the basis of the information discussed above, the staff concludes that the applicant has demonstrated that the aging effects for concrete structural components and masonry block walls will be adequately managed by the systems and structures monitoring program for the period of extended operation.

3.6.2.3.3 Conclusion

The staff has reviewed the information in Sections 3.6.2.3, "Concrete Structural Components," 2.4, "Scoping and Screening Results — Structures," as well as the applicable aging management program descriptions provided in Appendix B to the LRA and responses to the staff's RAIs. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the concrete structural components will be adequately managed so that there is reasonable assurance that these structural components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.6.2.4 Miscellaneous Structural Components

3.6.2.4.1 Summary of Technical Information in the Application

Miscellaneous structural components are described in Section 3.6.2.4 of the LRA. Miscellaneous structural components include fire rate assemblies, cooling water canals, weatherproofing, flood protection seals and stop logs, and control room ceiling and raised floor. The in-scope miscellaneous structural components listed above are found in the control building, cooling water canals, electrical penetration rooms, emergency diesel generator buildings, fire protection monitoring station, fire rated assemblies, spent fuel storage and handling, and turbine building listed in Tables 3.6-3 through 3.6-20.

The applicant stated that the miscellaneous structural components consist of a variety of materials including painted and galvanized carbon steel, aluminum, earth/rock, wood, gypsum board, acoustical panels, weatherproofing materials, and fire protection materials. Turkey Point miscellaneous structural components are exposed to environments of outdoor and indoor air (both air and non-air conditioned).

The aging effects identified by the applicant that could cause loss of intended function(s) for miscellaneous structural components are loss of material and loss of seal. The aging management programs used by the applicant to manage these aging effects are the systems and structures monitoring program, fire protection program, and periodic surveillance and preventive maintenance program.

3.6.2.4.2 Staff Evaluation

In addition to Section 3.6.2.3 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results – Structures," and the applicable aging management program descriptions provided in Appendix B of the LRA to determine whether the aging effects for the miscellaneous structural components have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.6.2.4.2.1 Effects of Aging

The aging effects identified by the applicant that could cause loss of intended function(s) for the miscellaneous structural components are loss of material and loss of seal.

Aging mechanisms, identified by the applicant, that can lead to the loss of material aging effect for miscellaneous structural components are wear, weathering, corrosion, and organic decomposition. The applicant evaluated each of these aging mechanisms for loss of material of the fire rated assemblies, cooling water canals, weatherproofing (structures and sealants), control room ceiling and raised floor, and the fire protection monitoring station miscellaneous structural components. In particular, the applicant determined that loss of material due to (1) weathering is an aging effect requiring management for Thermo-Lag insulation materials, (2) corrosion is an aging effect requiring management for certain fire doors since these doors are constructed of carbon steel, and (3) organic decomposition is an aging effect requiring management for wooden stop logs, which provide flood protection. However, the applicant determined that loss of material is not an applicable aging effect for (1) the control room ceiling and raised floor and the fire protection monitoring station since these are indoor - air conditioned environments that are occupied 24 hours per day, (2) fire penetration seals, as concluded in SECY 96-146, (3) the cooling water canals and (4) aluminum stop logs. In response to RAI 3.6.2.4-1, the applicant stated that based on its plant operating experience and the findings of SECY 96-146, fire penetration seals are not subject to aging effects. The applicant further clarified that, as part of the plants' existing fire protection program mandated by Appendix R to 10 CFR Part 50 and Branch Technical Position (BTP) 9.5-1, visual inspections of the fire penetrations will continue to be performed. In response to RAI 3.6.2.4-3, the applicant stated that since aluminum is highly resistant to corrosion, there are no aging effects that would cause a loss of intended function for aluminum stop logs and pipe trench penetration seals. Based on the above, the applicant concluded that loss of material due to weathering, corrosion, and organic decomposition is an aging effect requiring management for miscellaneous structural components. The staff concurs with the applicant's conclusions.

The aging mechanism, identified by the applicant, that can lead to loss of seal for miscellaneous structural components is weathering. The applicant determined that loss of seal due to weathering is an aging effect requiring management for manholes and associated sealants, weatherproofing components, and pipe trench penetration seals. Regarding the flood protection provided by wooden and aluminum stop logs, the applicant stated, in response to RAI 3.6.2.4-4, that the purpose of the wooden and aluminum stop logs is to provide a flood protection barrier against wave run-up and that the stop logs are not intended to be leak-tight barriers. The staff agrees with the applicant's response.

The staff finds the applicant's approach for evaluating the applicable aging effects for miscellaneous structural components to be reasonable and acceptable. The staff concludes that the applicable aging effects for miscellaneous structural components have been identified.

3.6.2.4.2.2 Aging Management Programs

The aging management programs used by the applicant to manage the above aging effects are the systems and structures monitoring program, fire protection program, and periodic surveillance and preventive maintenance program.

The systems and structures monitoring program is credited with managing the loss of material and loss of seal aging effects for many of the miscellaneous structural components. The structural monitoring program provides condition monitoring and appraisal of components through periodic visual inspections. In its description of the systems and structures monitoring program, the applicant stated that external surfaces of steel components are examined for evidence of corrosion such as flaking, blistering, peeling or discoloration and inspection of weatherproofing material for deterioration is performed. The results of the visual inspections are documented and the frequency of the inspection may be adjusted based on the inspection results and industry experience. The systems and structures monitoring program is discussed in greater detail in Section 3.1.3 of this SER.

The fire protection program is credited for aging management of specific components associated with fire protection and fire rated assemblies. The fire protection program manages the loss of material and loss of seal aging effects for the miscellaneous structural components associated with fire protection. The fire protection program provides condition monitoring and appraisal of components through periodic visual inspections. In its description of the fire protection program, the applicant stated that component surface conditions are monitored visually to determine the extent of external material degradation such as loss of material due to general, crevice, and pitting corrosion; and loss of seal or cracking due to embrittlement. The results of the visual inspections are documented and the frequency of the inspection may be adjusted based on the inspection results and industry experience. The fire protection program is discussed in greater detail in Section 3.9.8 of this SER.

The periodic surveillance and preventive maintenance program is credited for aging management of weatherproofing, pipe trench penetrations, and wooden stop logs. The periodic surveillance and preventive maintenance program manages the loss of material and loss of seal aging effects for these miscellaneous structural components. The periodic surveillance and preventive maintenance program provides condition monitoring and appraisal of components through periodic visual inspections. In its description of the periodic surveillance and preventive maintenance program, the applicant stated that component surface conditions are monitored visually to determine the extent of material degradation, such as loss of material due to organic decomposition and loss of seal due to weathering. The results of the visual inspections are documented, and the frequency of the inspection may be adjusted based on the inspection results and industry experience. The periodic surveillance and preventive maintenance program is discussed in greater detail in Section 3.9.11 of this SER.

3.6.2.4.3 Conclusion

The staff has reviewed the information in Sections 3.6.2.4, "Miscellaneous Structural Components," and 2.4, "Scoping and Screening Results — Structures," as well as the applicable aging management program descriptions provided in Appendix B to the LRA and responses to the staff's RAIs. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the miscellaneous structural components will be adequately managed so that there is reasonable assurance that these structural components will perform their intended functions in accordance with the CLB during the period of extended operation.

3.7 Electrical and Instrumentation and Controls

The applicant described its AMR results of electrical/I&C components requiring AMR at Turkey Point, Units 3 and 4, in Section 3.7 of the LRA. The staff reviewed this section of the application to determine whether the applicant has demonstrated that the effect of aging on the electrical/I&C components will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

On the basis of this review, the staff requested additional information in a letter to the applicant, dated January 17, 2001. The applicant responded to this request for additional information (RAI) in a letter to the staff, dated March 30, 2001. The applicant provided supplemental responses to the staff's RAI 3.7.1-1 on May 11 and May 29, 2001.

3.7.1 Summary of Technical Information in the Application

3.7.1.1 Non-Environmentally Qualified Insulated Cables and Connections, and Electrical/I&C Penetrations

In Section 3.7.1.1 of the LRA, the applicant described the process used to identify the applicable aging effects of the electrical/I&C components. The process is based on the Department of Energy (DOE) aging management guide (AMG). This AMG provides a comprehensive compilation and evaluation of information on the insulated cables and connections, spliced connections, and terminal blocks. The electrical/I&C non-metallic materials are also evaluated with the cable and connector materials in this AMG. The DOE Cable AMG evaluated the stressors acting on cable and connection components, industry data on aging and failures of these components, and the maintenance activities performed on cable systems. Also evaluated were the main subsystem within cables, including the conductors, insulation, shielding, tape wraps, and jacketing, as well as all subcomponents associated with each type of connection.

The applicant also identified, evaluated, and correlated the principal aging mechanisms and anticipated effects resulting from environmental and operating stresses with plant experience to determine whether the predicted effects are consistent with field experience. As such, the information, evaluations, and conclusions contained in the DOE Cable AMG are used for the evaluation of aging effects.

The most significant and observed aging mechanisms for insulated cable and connections are listed in the DOE Cable AMG, Table 4-18. The applicant used the aging mechanisms from that table as the starting point for identifying aging effects for insulated cables and connections. The applicant presents the potential aging effects along with the applicable stressors that are evaluated for insulated cables and connections in Table 3.7-1 of the LRA.

In its response to the NRC letter dated March 30, 2001, the applicant also states that in order to provide reasonable assurance that the intended functions of non-environmentally qualified (EQ) cables, connections, and penetration exposed to postulated adverse localized equipment environments caused by heat or radiation will be maintained consistent with the CLB throughout the period of extended operation, the applicant proposes an AMP for non-EQ cables, connections, and penetration in the containment at Turkey Point. The non-EQ cables, connections, and penetrations managed by this program include those used for power and instrumentation and control that are within the scope of license renewal.

The applicant stated that this program is an acceptable aging management program for non-EQ cables, connections and penetration within the scope of license renewal exposed to adverse localized equipment environments due to heat and radiation in the Turkey Point Containment. This program will be added to the Turkey Point LRA.

3.7.1.1.1 Low-Voltage Metal Connector Contact Surfaces — Moisture and Oxygen

The applicant stated that the DOE AMG states that 3% of all low-voltage metal connector failures were identified as being caused by moisture intrusion. In each case, the source of moisture was precipitation. Based on the total number of reported connector failures in the DOE Cable AMG, moisture intrusion accounted for only 10 failures in all of the operating plants in the United States.

The applicant indicates structures where electrical/I&C components may be exposed to moisture in Table 3.7-2 of the LRA. The potential moisture sources from Table 3.7-2 that are applicable to connectors at Turkey Point are precipitation and potential boric acid leaks. The applicant also indicated that all metal connectors are located in enclosures or protected from the environment with Raychem splices. Thus, aging related to moisture and oxygen do not require an AMP for low-voltage connectors at Turkey Point. The applicant also noted that electrical enclosures are treated as structural components and are discussed with each structure, as applicable, in Section 3.6 of the LRA.

3.7.1.1.2 Low-Voltage Metal Compression Fittings – Vibration and Tensile Stress

The applicant states that the aging mechanism of mechanical stress will not result in aging effects requiring AMP for the following reasons:

- Damage to cables during installation at Turkey Point is unlikely due to standard installation practices, which include limitations on cable pulling tension and bend radius. Even though installation damage is unlikely, most (including all safety-related) cables are tested after installation and before operation. Failures induced by installation damage generally occur within a short time after the damaged cable is energized.

- NRC resolution of License Renewal Issue No. 98-0013, which states, "Based on the above evaluation, the staff concludes that the issue of degradation induced by human activities need not be considered as a separate aging effect and should be excluded from an AMR."

- Mechanical stress due to forces associated with electrical faults is mitigated by the fast action of circuit protective devices at high currents. However, mechanical stress due to electrical faults is not considered an aging mechanism since such faults are infrequent and random in nature.

- Vibration is generally induced in cables and connections by the operation of external equipment, such as compressors, fans, and pumps. Vibration can affect cable connections at a running motor by producing fatigue damage of the metallic cable or termination components in the immediate vicinity of the connection point. Normally, there has to be some physical damage as well to have an effect (e.g., a nicked connector). Terminations at equipment are part of the equipment and are inspected and maintained along with the equipment. These terminations are not within the evaluation boundary for insulated cable and connections and are not included in the insulated cable and connection review.

- Manipulation of cables is not considered an aging mechanism since such manipulation occurs during maintenance activities. Such activities require post-maintenance testing to detect any deficiency in the cables. Any evidence of cable abnormalities would result in condition being addressed under the corrective program.

3.7.1.1.3 Medium-Voltage Cable and Connections and Electrical/I&C Penetration Insulation – Moisture and Voltage Stress

The applicant stated that electrical/I&C penetrations are not located in structures exposed to outside ambient conditions and therefore, not subject to moisture.

In Table 3.7-2 of the LRA, the applicant indicates structures where electrical/I&C cable and connectors may be exposed to moisture. The effects of moisture-produced water trees on medium-voltage cable were examined in Section 4.1.2.5 of the DOE Cable AMG. Water trees occur when the insulating materials are exposed to long-term, continuous electrical stress and moisture. These trees eventually result in breakdown of the dielectric materials and ultimate failure. The growth and propagation of water trees is somewhat unpredictable and few occurrences have been noted for cables operated below 15 kV. Water treeing is a long-term degradation and failure phenomenon that is documented only for medium-voltage electrical cable with cross-linked polyethylene (XLPE) or high molecular weight polyethylene (HMWPE) insulation. However, some cables are located in structures exposed to outside ambient conditions and are evaluated for the potential of moisture-produced water trees.

The applicant also indicates that Turkey Point Unit 3 and 4 medium-voltage applications, defined as 2 kV to 15 kV, use lead sheath cable to prevent effects of moisture on the cables. In addition, the applicant indicated Turkey Point does not use XLPE or HMWPE insulated cable in medium-voltage applications. Therefore, aging effects related to cable exposed to moisture and voltage stress do not require AMP at Turkey Point.

3.7.1.1.4 Medium-and Low-Voltage Cable and Connections and Electrical/I&C Penetration Insulation — Radiation and Oxygen

The applicant states that DOE Cable AMG, Section 4.1.4, Table 4-7, provides a threshold value and a moderate dose for various insulating materials. The threshold value is the amount of radiation that causes incipient to mild insulation damage. Once this threshold is exceeded, damage to the insulation increases from mild to moderate to severe as the total dose increases. The moderate damage value indicates the value at which the insulating material has been damaged but is still functional. Turkey Point evaluations use the moderate damage dose from the DOE Cable AMG as the limiting radiation value. The maximum operating dose and moderate damage dose of insulation material is shown in Table 3.7-3 of the LRA. The maximum operating dose shown in Table 3.7-3 includes the maximum 60-year normal exposure for inside containment.

The applicant compares the maximum operating dose and the moderate damage doses in Table 3.7-3 and indicates that all of the insulation materials included in this AMR will not exceed the moderate damage doses and concludes that aging effects caused by radiation exposure will not adversely affect the intended function of insulated cables and connections and electrical/I&C penetration during the extended period of operation. Therefore, the applicant concludes that aging effects related to radiation do not require an AMP for cables and connections and electrical/I&C penetrations.

3.7.1.1.5 Medium- and Low-Voltage Cable and Connections and Electrical/I&C Penetration Insulation – Heat and Oxygen

The applicant states that a maximum operating temperature was developed for each insulation type based on cable application at Turkey Point, Units 3 and 4. The maximum operating temperature indicated in Table 3.7-4 in the LRA incorporates a value for self-heating for power applications combined with the maximum design ambient temperature.

The applicant used Arrhenius method, as described in EPRI NP-1558, "A Review of Equipment Aging Theory and Technology," to determine the maximum continuous temperature to which the insulation material can be exposed so that the material has an indicated "endpoint of 60 years." These limiting temperatures for 60 years of service are provided in Table 3.7-4.

The applicant then compared the maximum operating temperature to the maximum 60-year continuous use temperature for the various insulation materials and indicated that except for polyethylene (PE) and Butyl used in power application, all of the insulation materials used in low- and medium-voltage power cables and connections can withstand the maximum operating temperature for at least 60 years.

For PE and Butyl cable insulation, the applicant states that the maximum operating temperatures, including self-heating, for PE and Butyl are 138.7 °F and 132.6 °F, respectively. The maximum temperatures for a 60-year life are 131 °F for PE and 125.1 °F for Butyl, which are 7.7 °F and 7.5 °F, respectively, less than the maximum operating temperature. The applicant states that the difference is small and is considered to be within the conservatism incorporated in the maximum operating temperatures and the maximum 60-year continuous use temperature.

The applicant also states that Butyl and PE insulated cables and connections are not used in containment and are not subject to an accident environment. Therefore, the endpoints chosen for this aging management review are extremely conservative and the 60-year endpoint values can be reduced without a loss of function, thus resulting in higher maximum 60-year continuous use temperatures.

The applicant states that maximum operating temperature in the application Table 3.7-4 includes a calculated self-heating temperature rise that assumes normal operation 100% of the time since receipt of the original operating licenses. In addition, the actual daily and seasonal temperature vary from 30 °F to 95 °F, which is less than the 104 °F limit assumed in the calculation of 60-year lifetime for Butyl and PE. The Turkey Point units have historically operated less than the 90% of the time since receipt of the original operating licenses. This amount of shutdown time lessens the amount of aging actually occurring and thus extends the lives of the materials.

Given these conservatisms, the applicant states that there is reasonable assurance that PE and Butyl insulated cables will not thermally age to the point at which they will not be able to perform their intended function during the period of extended operation. The applicant states that aging effects related to heat and oxygen do not require management for cables and electrical/I&C penetration included in the aging management review.

3.7.1.2 Uninsulated Ground Conductors

The applicant states that the ground cable material used at Turkey Point, Units 3 and 4, is copper. Copper is a good choice for this application because of its high electrical conductivity, high fusing temperature, and high corrosion resistance. Copper is also relatively strong, and it is easy to join by welding, compression, or clamping. Ground connections are commonly made with welds or mechanical type connectors, which include compression-, bolted-, and wedge-type devices.

The applicant also states that a review of available technical information regarding material aging revealed that there are no aging effects requiring management for copper grounding materials. In addition, a review of industry and plant operating experiences did not identify any failures of copper grounding systems due to aging effects. Also, several underground portions of the Turkey Point grounding system were inspected during plant modification to add two additional emergency diesel generators in 1990 and 1991 and no aging-related effects were identified. The system was approximately 20 years old at the time of that inspection. The portion of the grounding system inspected is buried in the same type of soil as other underground portions of the grounding system. Therefore, based on industry and plant-specific experiences, no aging effects requiring management were identified for the plant grounding system.

The applicant also reviewed industry and plant operating experience to ensure that no unique aging effects exist beyond those discussed in Section 3.7 for cables and connections.

3.7.2 Staff Evaluation

The staff evaluated the information on aging management presented in the LRA, Section 3.7 and in the applicant's response to the staff RAIs, dated March 30, May 11, and May 29, 2001, to determine if there is a reasonable assurance that the applicant has demonstrated that the effects of aging will be adequately managed, consistent with its CLB throughout the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.7.2.1 Aging Management Program

The staff evaluation of the applicant's AMPs focused on the program element rather than details of specific plant procedures. The staff's approach to evaluating each program and activity used to manage the applicable aging effects is described in Section 3.1 of this SER.

[Program Scope] The scope of inspection includes accessible non-EQ cables, connections and penetrations within the scope of license renewal in the containment structures at Turkey Point that are installed in adverse localized environments caused by heat or radiation in the presence of oxygen. The staff found the scope of the program acceptable because it includes cables, connections and penetrations that are subject to potentially adverse localized environments that can result in applicable aging effects on these insulated cables, connections and penetrations.

[Preventive/Mitigative Actions] There are no preventive or mitigative actions taken as part of this program, and the staff did not identify the need for such actions.

[Parameter Inspected/Monitored] Accessible non-EQ cables, connections and penetrations within the scope of license renewal in the containment structures installed in adverse localized environments are visually inspected for cable and connection jacket surface anomalies such as embrittlement, discoloration, of cracking of surfaces. The staff found this approach acceptable because it provides means for monitoring the applicable aging effects for accessible in-scope cables, connections, and penetrations.

[Detection of Aging Effects] Cable and connection jacket surface anomalies are precursor indication of conductor insulation aging degradation from heat or radiation in the presence of oxygen and may indicate existence of an adverse localized equipment environment. An adverse localized environment is a condition in a limited plant area that is significant more severe than the specified service condition for the electrical cable, connection, or penetration. Accessible non-EQ cables, connections, or penetrations that are within the scope of license renewal in the containment structures installed in adverse localized environment are visually inspected at least every 10 years, which is an adequate period to preclude failures of the conductor insulation. The first inspection will be performed before the end of the initial 40-year licence term. EPRI TR-109619, "Guideline for the Management of Adverse Localized Equipment Environments," will be used as guidance in performing inspections. The staff found the inspection scope and inspection technique for accessible non-EQ cables, connections, and penetrations acceptable on the basis that the AMP is focused on detecting change in material properties of the conductor insulation, which is the applicable aging effect when cables and connections are exposed to an adverse, localized environment.

[Monitoring and Trending] Trending actions are not included as part of this program because the ability to trend inspection results is limited. The staff found the absence of a trending program acceptable.

[Acceptance Criteria] No unacceptable visual indications of cables and connection jacket surface anomalies, which suggest that conductor insulation degradation exists, as determined by engineering evaluation. An unacceptable indication is defined as a noted condition or situation that, if left unmanaged, could lead to a loss of the intended function. The staff found these acceptance criteria acceptable because it should ensure that the cables and connections intended functions are maintained under all CLB design condition during the period of extended operation.

[Corrective Actions] Further investigation is performed through the corrective action program on non-EQ cables, connections and penetrations when the acceptance criteria are not met in order to ensure that the intended function will be maintained consistent with the current licensing basis. Corrective action may include, but are not limited to, testing, shielding or

otherwise changing the environment, relocation or replacement of the affected cable, connection, or penetration. Corrective actions implemented as part of the corrective action program are performed in accordance with FPL's 10 CFR Part 50, Appendix B, Quality Assurance Program. As indicated above, if an unacceptable condition or situation is identified for a cable, connections, penetration in the inspection, the applicant will perform further investigation through the corrective action program. However, the applicant did not specifically include a determination of whether the same condition or situation is applicable to other accessible or inaccessible cables, connections and penetration. In this regard, the staff requested the applicant address the aging management associated with inaccessible cables, connections, or penetrations. In response to the staff's request, the applicant specifically requires that when an adverse localized environment is identified for a cable, connection, or penetration, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables, connections, or penetrations. The staff found the applicant response acceptable because selected cables, connections, and penetrations from accessible areas (the inspection sample) are inspected and represent, with reasonable assurance, all cables, connections, and penetrations in the adverse localized environments. It also found that as discussed in Section 3.1.2 of this report, the requirement of 10 CFR Part 50, Appendix B, acceptable to address corrective actions.

[Confirmation Process] The confirmation process implemented as part of the corrective program is performed in accordance with FPL's 10 CFR Part 50, Appendix B, Quality Assurance Program. As discussed in Section 3.1.2 of this report, the staff found the requirements of 10 CFR Part 50, Appendix B, acceptable to address the confirmation process.

[Administrative Controls] Administrative controls associated with this program will be performed in accordance with FPL's 10 CFR Part 50, Appendix B, Quality Assurance Program. The staff found the requirements of 10 CFR Part 50, Appendix B, acceptable to address administrative controls.

[Operating Experience] The licensee did not identify the presence of adverse localized heat and radiation environments in the containment at Turkey Point. However, operating experience identified by the staff in the draft GALL Report has shown that adverse localized environments caused by heat or radiation for electrical cables and connections may exist next to or above (within three feet of) steam generators, pressurizers or hot process pipes such as feedwater lines. The staff found that the proposed inspection program will detect the adverse localized environment caused by heat or radiation of electrical cables and connections.

3.7.2.2 Non-Environmentally Qualified Insulated Cables and connections, and Electrical/I&C Penetrations

The NRC staff has evaluated the information presented in Sections 3.7.1.1.1, 3.7.1.1.2, 3.7.1.1.3, 3.7.1.1.4, 3.7.1.1.5, and 3.7.1.2 of the LRA to determine if there is a reasonable assurance that the applicant has identified the applicable aging effects and the bounding conditions for electrical/I&C components. The process to determine the applicable effect on these components is based on industry literature defining the operating environment and operating stresses for each of the components that are subject to an AMR. The NRC staff reviewed each of the environments and resulting mechanisms and effects as they apply to the electrical/I&C component commodities.

3.7.2.2.1 Low-Voltage Metal Connector Contact Surfaces — Moisture and Oxygen

3.7.2.2.1.1 Effects of Aging

The potential aging mechanisms considered for low-voltage metal connector surfaces is corrosion due to moisture intrusion. Structures where electrical/I&C components may be exposed to moisture are indicated in the LRA Table 3.7-2. The potential moisture sources from this table that are applicable to connectors at Turkey Point are precipitation and potential boric acid leaks. All metal connectors at Turkey Point are located in enclosures or protected from the environment with Raychem splices. Thus, aging effects related to moisture and oxygen do not require management for low-voltage connectors at Turkey Point.

3.7.2.2.1.2 Aging Management Program

The NRC staff has evaluated the information on low-voltage metal connectors as presented in Section 3.7.1.1.1 of the LRA to determine if there is a reasonable assurance that the applicant has demonstrated that the aging affects for low-voltage connectors will be adequately managed, consistent with the applicant's CLB throughout the period of extended operation.

The staff agrees with the applicant's assessment and the conclusion that low-voltage connectors are located in enclosure or protected from the environment with Raychem splices and aging effects related to moisture and oxygen do not require an AMP for low-voltage connectors at Turkey Point.

3.7.2.2.2 Low-Voltage Metal Compression Fitting - Vibration and Tensile Stress

3.7.2.2.2.1 Effects of Aging

The aging mechanism of mechanical stress will not result in effects requiring management for the following reasons (1) damage to cables during installation at Turkey Point is unlikely due to standard installation practice, which include limitation on cable pulling tension and bend radius. (2) NRC resolution of License Renewal Issue No. 98-0013 states that the issue of degradation induced by human activities need not be considered as a separate aging affect and should be excluded from an AMR. (3) Mechanical stress due to forces associated with electrical faults is mitigated by the fast action of circuit protective devices at high currents. However, the mechanical stress due to electrical faults is not considered an aging mechanism since such faults are infrequent and random in nature. (4) Vibration is generally induced in cables and connections by the operation of external equipment, such as compressor, fans, and pumps. Vibration can affect cable connections at a running motor by producing fatigue damage of the metallic cable or termination components in the immediate vicinity of the connection point. Normally, there has to be some physical damage as well to have an effect (e.g., a nicked connector). Terminations at equipment are part of the equipment and are inspected and maintained along with the equipment. These terminations are not within the evaluation boundary for insulated cable and connections and are not included in the insulated cable and connection review. (5) Manipulation of cables is not considered an aging mechanism since such manipulation occurs during maintenance activities. Such activities require post-maintenance testing to detect any deficiencies in the cables. Any evidence of cable abnormalities would result in the condition being addressed under the corrective action program.

3.7.2.2.2.2 Aging Management Programs

The staff has evaluated the information on low-voltage metal compression fittings as presented in Section 3.7.1.1.2 of the LRA to determine if there is a reasonable assurance that the applicant has demonstrated that the aging affects for low-voltage metal compression fittings will be adequately managed, consistent with the applicant's CLB throughout the period of extended operation.

The staff agrees with the applicant's assessment and conclusion that aging mechanism of mechanical stress will not result in aging effects requiring an AMP for low-voltage metal compression fittings.

3.7.2.2.3 Medium-Voltage Cable and Connections and Electrical/I&C Penetration Insulation — Moisture and Voltage Stress

3.7.2.2.3.1 Effects of Aging

Electrical/I&C penetrations are not located in structures exposed to outside ambient conditions and, therefore, not subject to moisture.

Structures where electrical/I&C cable and connectors may be exposed to moisture are indicated in Table 3.7-2. Water trees occur when the insulating materials are exposed to long-term, continuous electrical stress and moisture. These trees eventually result in breakdown of the dielectric materials and ultimately failure. The growth and propagation of water trees is somewhat unpredictable, and occurrences have been noted for cable operated below 15 kV. Water treeing is a long-term degradation and failure phenomenon that is documented only for medium-voltage electrical cable with conductor insulation made of various organic polymers (e.g., EPR, SR, EPDM, XLPE).

3.7.2.2.3.2 Aging Management Program

The staff has evaluated the information on medium-voltage cable and connections and electrical/I&C penetration insulation as presented in Section 3.7.1.1.3 of the LRA to determine if there is a reasonable assurance that the applicant has demonstrated that the aging affects for medium-voltage cable, connections, and electrical/I&C penetration insulation will be adequately managed, consistent with the applicant's CLB throughout the period of extended operation.

The applicant states that Turkey Point Unit 3 and 4 medium-voltage applications use lead sheath to prevent effects of moisture on the cables. In addition, the applicant states that Turkey Point does not use XLPE or HMWPE insulated cables in medium-voltage applications and, therefore, the aging effects related to cable exposed to moisture and voltage stress do not require an AMP at Turkey Point.

Most electrical cables in nuclear power plant are located in dry environments. However, some cables may be exposed to condensation and wetting in some locations (such as conduits, cable trenches, cable troughs, duct banks, underground vaults, or direct buried installations). When an energized cable that is not specifically designed for submergence is exposed to these conditions, water treeing or a decrease in the dielectric strength of the conductor insulation can occur. This can potentially lead to electrical failure. The purpose of the aging management program is to provide a reasonable assurance that the intended functions of medium-voltage cables exposed to adverse localized environments caused by moisture while energized will be maintained consistent with the current licensing basis through the period of operation. It was not clear to the staff that the lead sheath would prevent moisture ingress if the cable was subjected to significant moisture simultaneously with significant voltage. Water treeing is a long-term degradation and failure phenomenon with conductor insulation made of various organic polymers. In the letter to the applicant dated January 17, 2001 (RAI Number 3.7.1-1), the staff requested the applicant to provide an aging management program for accessible and inaccessible electrical cable operated below 15 kV exposed to an adverse localized environment caused by moisture-produced water trees.

In response to the staff's request, the applicant stated that Turkey Point medium voltage application use lead sheath cable to prevent effects of moisture on cables. This cable is designed with a thick layer of lead over the cable insulation with an overall jacket over the lead and insulation. This differs from the typical medium voltage cable design of insulation with an overall jacket. The applicant uses lead sheath cable as a standard for medium voltage applications because of its good characteristics in moisture environments. The applicant's cable specification states that lead sheath cables are designed to be installed in wet environments for extended periods. In addition, the cable manufacturer's specification for lead sheath cable states that "...EPR/lead sheath cable is designed for application in which liquid contamination is present and reliability is paramount. The sheath combined with the overall jacket provided a virtually impenetrable barrier against hostile environments — liquids, fire hydrocarbons, acids, caustic, sewage, etc." As an added level of protection, Turkey Point underground medium-voltage cables are only routed in concrete-encased duct banks. Industry experience shows no failures of the medium-voltage lead sheath cable under various environments, including moisture. In addition, the applicant performed an extensive review of Turkey Point's plant-specific operating experience and found no cases of medium-voltage cable failures due to adverse localized environments.

Based on the review of the LRA and the applicant's response to the staff's RAIs, the staff concludes that since the applicant uses lead sheath in medium voltage cables, an aging management program for accessible and inaccessible medium-voltage cable to address adverse localized environments caused by moisture-produced water trees and voltage stress is not required.

3.7.2.2.4 Medium- and Low-Voltage Cable and Connections and Electrical/I&C Penetration Insulation — Radiation and Oxygen

3.7.2.2.4.1 Effects of Aging

Radiation-induced degradation in cable jacket and insulated material produces change in organic material properties, including reduced elongation and changes in tensile strength. Visible of indication of radiative aging may include embrittlement, cracking, discoloration, and swelling of the jacket and insulation. Table 3.7-3 of the LRA lists both the maximum operating doses and the moderate damage doses.

3.7.2.2.4.2 Aging Management Program

The staff has evaluated the information on medium-voltage cable and connections/I&C penetration insulation as presented in Section 3.7.1.1.4 of the LRA to determine if there is a reasonable assurance that the applicant has demonstrated that the aging affects for medium- and low-voltage cable and connections and electrical/I&C penetration insulation will be adequately managed, consistent with the applicant's CLB throughout the period of extended operation.

The applicant compares the maximum operating dose and the moderate damage doses in Table 3.7-3 and shows that all of the insulation materials included in this AMR will not exceed the moderate damage doses and concludes that aging effects caused by radiation exposure will not adversely affect the intended function of insulated cables and connections and electrical/I&C penetrations during the extended period of operation. The applicant concludes that aging effects related to radiation do not require an AMP for cables and connections and electrical/I&C penetrations.

Conductor insulation material used in cables and connections and electrical/I&C penetrations may degrade more rapidly than expected in the adverse localized environments due to radiation. The radiation levels most equipment experience during normal service have little degrading effect on most materials. The evaluations or calculations that determine or bound the expected radiation doses usually account for doses seen in all plant areas. However, some localized areas may experience higher-than-expected radiation conditions. Typical areas prone to elevated radiation levels include areas near primary reactor-coolant-system piping or the reactor-pressure-vessel; areas near waste processing system and equipment (e.g., gaseous-waste system, reactor-purification system, reactor-water-cleanup system, and spent-fuel-pool cooling and cleanup system); and areas subject to radiation streaming. The applicant's conclusion is not consistent with the aging management program and activities for electrical cables and connections exposed to localized environments caused by radiation as described in the previous LRAs that have been approved by the staff. In a letter to the applicant dated January 17, 2001 (RAI Number 3.7.1-1), the staff requested the applicant to provide an aging management program for accessible and inaccessible electrical cable and connections and electrical/I&C penetrations exposed to an adverse localized environment caused by radiation.

In response to the staff's request, in a letter dated March 30, 2001, the applicant stated that the intake structure, main steam and feedwater platforms, and yard structures are outdoor areas where cable, connections, and penetrations are not subject to adverse localized radiation effects. The turbine building is an outdoor area with no external walls or roof. The only buildings with any appreciable radiation levels are the containment and the auxiliary buildings. In order to provide reasonable assurance that the intended functions of non-EQ cables, connection, and penetration exposed to adverse localized equipment environments cause by radiation will be maintained consistent with the current licensing basis through the period of extended operation, the applicant proposes an aging management program for non-EQ cables, connections, and penetrations in the containment at Turkey Point. The non-EQ cables, connections and penetrations managed by this program include those used for power and instrumentation and control that are within the scope of license renewal. The acceptability of the AMP is evaluated in section 3.7.2.1 of the staff's safety evaluation report.

As indicated above, the applicant states that the only buildings with any appreciable radiation levels are the containment and auxiliary buildings. However, the aging management program that the applicant proposed is only include the non-EQ cables, connections, and penetrations in the containment. It does not include those cables, connections and penetrations in the auxiliary buildings. In a telephone conference, the staff requested the applicant explain why auxiliary building was not included in the scope of electrical inspection program. In response to the staff request, the applicant modified its response to the staff's RAI to state that with regard to radiation, the only buildings with any appreciable radiation levels are the containment building and the auxiliary building. However, non-EQ cables, connections, and penetration in the auxiliary building are not located in the areas which would be subject to adverse localized radiation environments during plant operation. The staff finds the applicant's response to be acceptable because it is consistent with the scope of the proposed aging management program.

Based on the review of the LRA and the applicant's response to the staff's RAIs, the staff concludes that aging effects of radiation on medium- and low-voltage cables, connections, and electrical/I&C penetrations will be managed through an AMP. This program will provide reasonable assurance that the intended functions of electrical cables, connections and electrical/I&C penetration exposed to adverse localized environments caused by radiation will be maintained consistent with the CLB through the period of extended operation.

3.7.2.2.5 Medium- and Low-Voltage Cable and Connections and Electrical/I&C Penetration Insulation — Heat and Oxygen

3.7.2.2.5.1 Effects of Aging

Thermal-induced degradation in cable jacket and insulation materials can result in reduced elongation and changes in tensile strength. Visible indications of thermal aging may include embrittlement, cracking, discoloration, and swelling of the jacket and insulation. Arrhenius methodology with the time period fixed at 60 years was used by the applicant to determine the maximum continuous temperature to which the material can be exposed so the material will not have reached the endpoint at the end of 60 years.

3.7.2.2.5.2 Aging Management Program

The staff has evaluated the information as presented in Section 3.7.1.1.5 of the LRA to determine if there is a reasonable assurance that the applicant has demonstrated that the aging effects for medium- and low-voltage cables, connections, and electrical/I&C penetration insulation will be adequately managed, consistent with the applicant's CLB, for the period of extended operation.

The applicant uses the Arrhenius method to determine the maximum continuous temperature to which the insulation material can be exposed so that the material has an indicated "endpoint of 60 years." It then compares the maximum 60-year continuous use temperature to the maximum operating temperature for the various insulation materials. The applicant concludes that except for polyethylene (PE) and Butyl used in power application, all of the insulation materials used in low- and medium-voltage power cables and connections and electrical/I&C penetration insulation can withstand the maximum operating temperatures for at least 60 years. For Butyl and PE insulated cables and connections, the applicant states that Butyl and PE are not used in containment and are not subject to an accident environment. Therefore, the endpoint chosen for this AMR are extremely conservative, and the 60-year endpoints values can be reduced without a loss of function, thus resulting in higher maximum 60-year continuous use temperature. The applicant concludes that aging effects related to heat do not require management for cables, connections, and electrical/I&C penetrations included in the AMR.

The most common adverse localized equipment conditions are those created by elevated temperature. Elevated temperature can cause equipment to age prematurely, particularly equipment containing organic materials and lubricants. The effect of elevated temperature can be quite dramatic. The types of areas that are prone to high temperature include areas with high-temperature process fluid piping and vessels, areas with equipment that operates at high temperature, and areas with limited ventilation. The staff did not agree with the applicant that the Arrhenius method can be used to extend the qualified life of insulation material that is exposed to elevated temperature to 60 years. In a letter dated January 17, 2001, the staff requested that the applicant provide an aging management program for accessible and inaccessible electrical cables and connections and electrical/I&C penetrations exposed to adverse localized environments caused by heat. In response to the staff's request, in a letter dated March 30, 2001, the applicant stated that the intake structure, main steam and feedwater platforms, and yard structures are outdoor areas where cable, connections, and penetrations are not subject to adverse localized temperature effects. The turbine building is an outdoor area with no external wall or roof. The auxiliary building does not contain any high temperature reactor coolant, main steam, or feedwater and blowdown system piping and components. In order to provide reasonable assurance that the intended functions of non-EQ cables, connections, and penetrations exposed to adverse localized equipment environments caused by heat will be maintained consistent with the CLB basis through the period of extended operation, the applicant proposed an aging management program for non-EQ cables, connections, and penetrations in the containment at Turkey Point. The non-EQ cables, connections, and penetrations managed by this program include those used for power and instrumentation and control that are within the scope of license renewal. The acceptability of this AMP is evaluated in section 3.7.2.1 of the staff's safety evaluation report.

Based on the review of the LRA and the applicant's response to the staff's RAIs, the staff concludes that aging effects of heat on medium-and low-voltage cable and connections and electrical/I&C penetrations should be managed through the AMP. This program will provide reasonable assurance that the intended functions of electrical cables and connections and electrical/I&C penetration exposed to adverse localized environments caused by heat will be maintained consistent with the current licensing basis through the period of extended operation.

3.7.2.3 Uninsulated Ground Conductors

The ground cable material used at Turkey Point, Units 3 and 4, is copper. Copper is a good choice for this application because of its high electrical conductivity, high fusing temperature, and high corrosion resistance. Copper is also relatively strong, and it is easy to join by welding, compression, or clamping. Ground connections are commonly made with welds or mechanical type connectors, which include compression-, bolted-, and wedge-type devices.

The applicant has reviewed the available industry technical information regarding material aging and has determined that there are no aging effects requiring management for copper grounding materials. In addition, the applicant has reviewed of industry and plant operating experience and did not identify any failures of copper ground system due to aging affects. The applicant also inspected several underground portions of the Turkey Point grounding system during plant modification to add two additional emergency diesel generators in 1990 and 1991, and did not identify any aging-related effects. The system was approximately 20 years old at the time of that inspection. The applicant states that portion of the grounding system inspected is buried in the same type of soil as other underground portions of the grounding system. Therefore, based on industry and plant-specific experience, no aging affects requiring management were identified for the plant grounding system. The staff agrees with the applicant's assessment and conclusion that no AMP is required for the plant ground system.

3.7.3 FSAR Supplement

In response to the staff's RAI 3.7.1-1, the applicant proposed an AMP for non-EQ cables, connections, and electrical/I&C penetrations. The acceptability of the AMP is evaluated in Section 3.7.2.1 of this SER. The applicant committed to include the AMP in the UFSAR Supplement. By letter dated November 1, 2001, the applicant provided summary description of the programs in Appendix A, Chapter 16, section 16.1.8, "Containment Cable Inspection Program," of the UFSAR Supplement. The summary description is sufficient, and therefore, confirmatory item 3.0-1 FSAR item 3.7-1 is closed.

3.7.4 Conclusion

On the basis of the staff's evaluation described above, the staff finds that there is reasonable assurance that the effects of aging of cables, connections, and electrical/I&C penetrations at Turkey Point will be adequately managed so that the intended function will be maintained consistent with the applicant's CLB throughout the period of extended operation in accordance with the requirements of 10 CFR 54.21(a)(3).

3.8 New Aging Management Programs

3.8.1 Auxiliary Feedwater Pump Oil Coolers Inspection Program

3.8.1.1 Summary of Technical Information in the Application

The auxiliary feedwater system supplies feedwater to the steam generators when normal feedwater sources are not available. It provides for auxiliary feedwater steam and feedwater isolation during a postulated steam generator tube rupture event and, for auxiliary feedwater isolation to the faulted steam generator. The auxiliary feedwater system also limits feedwater flow to the steam generators to limit positive reactivity insertion during a postulated steam line break. The auxiliary feedwater system contains three steam turbine-driven pumps. Table 3.5.3 of the LRA indicates that the auxiliary feedwater pumps oil coolers inspection and chemistry control programs are credited for the aging management of the auxiliary feedwater pump oil coolers for the pumps in the auxiliary feedwater and condensate storage systems. The condensate storage tank stores water for use by the auxiliary feedwater system to support safe shutdown of the plant. The intended functions for the auxiliary feedwater and condensate storage components subject to an aging management review are pressure boundary integrity, heat transfer, and throttling.

3.8.1.2 Staff Evaluation

In Table 3.5-3 of the LRA, the applicant identified loss of material to be the aging effect requiring management for the cast steel auxiliary feedwater pump lube oil coolers channel and covers exposed to treated water. The lube oil coolers are tube and shell type heat-exchangers, with the lube oil flowing in the tubes and the feedwater on the shell side. The purpose of the coolers is to transfer heat from the lube oil to the feedwater and maintain the lube oil temperature to within acceptable limits. The applicant credited the auxiliary feedwater pump oil coolers inspection program for the aging management of the identified aging effect. This program is described in Appendix B, Section 3.1.1, of the LRA.

The staff evaluation of the auxiliary feedwater pump oil cooler inspection program focused on how the program manages the aging effect through the effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.

The corrective actions, confirmation process and administrative controls for license renewal are in accordance with the site-control quality assurance program pursuant to 10 CFR Part 50, Appendix B, and cover all structures and components subject to an aging management review. The staff evaluation of the applicant's quality assurance program is provided separately in Section 3.1.2 of this safety evaluation. This satisfies the elements of corrective actions, confirmation process, and administrative controls. The remaining seven (7) elements are discussed below.

[Program Scope] The applicant stated that this inspection is intended to be a one-time inspection of an oil cooler of one of the three shared auxiliary feedwater pumps. The auxiliary feedwater pump oil coolers inspection will manage the effects of loss of material due to graphitic corrosion (i.e., selective leaching) and other types of corrosion of the internal surfaces of cast iron parts of the coolers wetted internally by treated secondary water. A visual inspection will be performed to detect loss of material. The inspection will include the cast iron bonnet of one of the auxiliary feedwater pump lube oil coolers and, if necessary, the cast iron parts of an auxiliary feedwater turbine governor controller oil cooler. Commitment dates associated with the implementation of this new program are contained in Appendix A to the LRA.

In RAI 3.8.1-1, dated February 2, 2001, the staff requested that the applicant provide justification for only inspecting the oil cooler of one of the three pumps, and for doing a one-time-only inspection instead of multiple inspections with intervals of 3 or 5 years, as is generally prescribed in ASME Section XI programs for similar components.

In its response (FPL Letter L-2001-75, dated April 19, 2001), the applicant stated that the three auxiliary feedwater pump oil coolers are identical units and are subjected to the same internal environments and operating conditions. Therefore, the condition of one cooler is representative of all three coolers.

The applicant stated that the one-time inspection will provide confirmatory information on the condition of the coolers. Although Turkey Point's operating experience has not identified graphitic corrosion degradation of these coolers, the materials of construction and environment make them potentially susceptible to such degradation. This corrosion mechanism is not anticipated due to the quality of the water in the auxiliary feedwater system, and thus, a one-time inspection was selected. The results of the inspection will be evaluated to determine if further inspections are warranted. If significant loss of material is detected, the appropriate corrective action, including program revision, if needed, will be taken in accordance with the applicant's 10 CFR Part 50 Appendix B, Corrective Action Program. The staff finds the applicant's response reasonable and acceptable, and on this basis the issue in RAI item 3.8.1-1 is resolved. With the resolution of the staff's concerns, the staff finds the overall scope of the Auxiliary Feedwater Pump Oil Coolers Inspection Program is acceptable.

[Preventive Actions] The applicant stated that no preventive actions are applicable to this program. The staff finds this acceptable because the staff does not find a need for any.

[Parameters Monitored] The applicant stated that the auxiliary feedwater pump coolers inspection will identify the presence of graphitic corrosion activity and will quantify the loss of structurally sound wall thickness of cast iron parts. The inspection will consist of two parts, an "as found" inspection of parts and an inspection of parts after light sandblasting to bare metal. The staff finds the program is acceptable.

[Detection of Aging Effects] The applicant stated that the visual inspection will be used to verify whether graphitic corrosion has taken place. The aging effect of concern, loss of material because of graphitic corrosion and other types of corrosion, will be further evident by the reduced wall thickness of the material in the cast iron parts being examined (following the sandblasting). The staff concurs with the applicant and finds the detection methods acceptable.

[Monitoring and Trending] As stated above, the applicant intends to do a one-time inspection of one cooler. If significant loss of material due to graphitic corrosion or other corrosion is detected, the applicant will assess the extent of the corrosion, and determine if inspection of other coolers and additional future monitoring are required. The staff finds the applicant's monitoring and the trending method acceptable.

[Acceptance Criteria] The applicant states that if the inspection results in white non-porous metallic surface without major indications, it may declare the part as "not affected by graphitic corrosion" and to not require further evaluation. If there is evidence of significant effects of graphitic corrosion, an evaluation will be prepared to establish the minimum required wall

thickness including a corrosion allowance adequate for a pre-determined inspection interval. Wall thickness measurements greater than minimum wall thickness values will be acceptable. In RAI 3.8.1-2, dated February 2, 2001, the staff requested the applicant to provide the basis for the quantitative acceptance criteria which will be used to make the determination that inspection of other coolers and future monitoring are required.

In its response (FPL Letter L-2001-75, dated April 19, 2001), the applicant stated that the auxiliary feedwater pump oil cooler inspection program, as described in Appendix B, Section 3.1.1, page B-10, consists of a confirmatory one-time inspection of one auxiliary feedwater oil cooler to verify that loss of material due to graphitic corrosion is not occurring. In the event that significant loss of material is detected during this inspection, appropriate corrective actions will be established per FPL's 10 CFR Part 50, Appendix B, Corrective Action Program. Evaluation of inspection results will consider the minimum required wall thickness for the component and a corrosion allowance. Followup inspections, if required, will be scheduled based on actual corrosion rates or inspection findings. The staff finds the applicant's response reasonable and acceptable and, on this basis, the issue of concern in RAI 3.8.1-2 is considered resolved. The staff finds that the acceptance criteria are adequate.

[Operating Experience and Demonstration] Visual inspections and wall thickness measurements of equipment have been performed at Turkey Point for many years. The techniques have proven successful in determining actual material condition of components.

The auxiliary feedwater pump oil coolers inspection is a new program that will use techniques with demonstrated capability and a proven industry record to detect loss of material due to graphitic corrosion. Visual examination has been used in the past to identify graphitic corrosion. This inspection will be performed utilizing approved procedures and qualified personnel. The staff finds the applicant's inspection methods applicable and acceptable.

3.8.1.3 FSAR Supplements

The staff has reviewed the information in the UFSAR Supplement Section 16.1.1 of Appendix A to the LRA and has confirmed that it contains the appropriate elements of the program.

3.8.1.4 Conclusion

In conclusion, based on the information provided by the applicant, the staff finds the implementation of the auxiliary feedwater pump oil coolers inspection program will provide reasonable assurance that loss of material will be managed such that the components within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

3.8.2 Auxiliary Feedwater Steam Piping Inspection Program

3.8.2.1 Summary of Technical Information in the Application

The auxiliary feedwater system supplies feedwater to the steam generators when normal feedwater sources are not available. It provides for auxiliary feedwater steam and feedwater isolation during a postulated steam generator tube rupture event, for auxiliary feedwater isolation to the faulted steam generator and limits feedwater flow to the steam generators to limit positive reactivity insertion during a postulated steam line break. The auxiliary feedwater system contains three steam turbine-driven pumps. The pumps can be supplied steam from the steam generators in either unit. The pumps take suction from either condensate storage tank and discharge to one of two redundant headers. Each header can supply each of the steam generators. The auxiliary feedwater system is normally maintained in standby with one pump aligned to one discharge header and two pumps aligned to the other header. Upon initiation, all three pumps start to supply the affected steam generator with feedwater. The condensate storage tank stores water for use by the auxiliary feedwater system to support safe shutdown of the plant. The intended functions for the auxiliary feedwater and condensate storage components subject to an aging management review are pressure boundary integrity, heat transfer, and throttling.

3.8.2.2 Staff Evaluation

In Table 3.5-3 of the LRA, the applicant identified loss of material to be the aging effect requiring management for the carbon steel auxiliary feedwater pump turbine casings, valves, steam traps, and piping/fittings that are exposed to either treated water-secondary and air/gas environments or outdoor environments. The applicant credited the Auxiliary Feedwater Steam Piping Inspection Program (Appendix B Section 3.1.2 of the Application) for the aging management of the identified aging effect.

The staff evaluation of the Auxiliary Feedwater Steam Piping Inspection Program focused on how the program manages the aging effect through the effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.

The corrective actions, confirmation process and administrative controls for license renewal are in accordance with the site-control quality assurance program pursuant to 10 CFR Part 50, Appendix B, and cover all structures and components subject to an aging management review. The staff evaluation of the applicant's quality assurance program is provided separately in Section 3.1.2 of this safety evaluation. This program satisfies the elements of corrective actions, confirmation process and administrative controls. The remaining seven (7) elements are discussed below.

[Program Scope] The applicant stated in Appendix B Section 3.1.2 of the Application that the Auxiliary Feedwater Steam Piping Inspection Program will manage the effects of loss of material due to general and pitting corrosion on the internal and external surfaces of the auxiliary feedwater steam supply carbon steel piping and fittings. The program will provide for representative volumetric examinations to detect loss of material in the auxiliary feedwater steam piping between the steam supply check valves and each of the three auxiliary feedwater pump turbines. In its RAI dated February 2, 2001, the staff requested the applicant to provide a detailed description of how samples will be selected for the representative volumetric examinations and the basis of the selection. The staff also requested the applicant to explain why, in Table 3.5-3 of the LRA, components other than piping and fittings, such as auxiliary feedwater pump turbine casings, are listed as the in-scope components to be managed by the program. The applicant provided its response to the RAI in a submittal dated April 19, 2001 (cf. L-2001-75). In its response, the applicant stated that sample selections will be based upon the potential for exposure to a wetted environment. This includes sections of lines where water

can accumulate, such as at the bottom of horizontal pipe runs and areas of contact with the lower section of wetted insulation. The staff considers the basis of the applicant's sample selection reasonable and, therefore, acceptable. The applicant also stated that having the least wall thickness, piping and fittings are considered the limiting components and the primary inspection points. However, where significant loss of material due to corrosion is detected, valves and steam traps would be inspected, as required. This is acceptable to the staff In regard to the staff's question on inclusion of the above-mentioned turbine casings. The applicant stated that Table 3.5-3 (pages 3.5-17 and 3.5-20) of the LRA inadvertently identified internal and external loss of material as an aging effect requiring management for the auxiliary feedwater (AFW) turbine casings, and credited the auxiliary feedwater steam piping integrity program for aging management. The applicant stated that, based on an inspection of an AFW turbine casing, after 17 years of operation, the aging management review of the AFW turbine casing has demonstrated that loss of material is indeed not an aging effect requiring management. The applicant stated that Table 3.5-3 (pages 3-17 and 3-20) will be revised accordingly. The staff finds the applicant's response to be in general accord with the industry experience and is, therefore, acceptable.

[Preventive Actions] The applicant stated that no preventive actions are applicable to this program, and the staff did not identify the need for any.

[Parameters Monitored or Inspected] The applicant stated that the program will monitor the wall thickness of representative piping/fittings in the auxiliary feedwater steam supply headers and the drain lines upstream of the steam traps. The volumetric examination will identify potential effects of inside diameter corrosion due to accumulation of water at the bottom of horizontal run pipes and outside diameter corrosion at areas of contact with the lower section of wet insulation. Based on the scope of the inspection, the staff finds parameters monitored are acceptable.

[Detection of Aging Effects] The applicant stated that the aging effect of concern, loss of material due to general and pitting corrosion, will be evident by the reduced wall thickness in the piping/fittings. Based on the scope of the inspection, the staff finds the detection method is acceptable.

[Monitoring and Trending] The applicant stated that the examination will initially be performed every five years. Piping/fittings thickness measurements will permit calculation of an integrated inside diameter and outside diameter corrosion rate. Inspection frequency may be adjusted based on corrosion rate to ensure that the minimum wall thickness requirements will be maintained. Based on the scope of the inspection the staff finds, the identified inspection frequency is acceptable.

[Acceptance Criteria] The applicant stated that wall thickness measurements greater than minimum values for the component design of record will be acceptable. Wall thickness measurements less than required minimum values will be entered into the corrective action program. This will ensure that the component section identified to have potentially inadequate wall thickness will be subject to subsequent evaluations and remedy actions. It is, therefore, acceptable to the staff.

[Operating Experience] Ultrasonic and computer-aided radiography wall thickness measurement techniques have been performed at Turkey Point for years. The applicant stated that these techniques have proven successful in determining wall thickness of piping and other components. Computer-aided radiography has been used in the auxiliary feedwater steam supply headers and drain lines. The results of these examinations have detected some areas of localized corrosion in the headers. The applicant stated that this new program will use the techniques with demonstrated capability and a proven industry record to measure pipe wall thickness. The examinations will be performed utilizing approved plant procedures and qualified personnel. Based on the applicant's description of the examination techniques and the evidence of their successful performance in the past, the staff considers the examination methods to be acceptable for the program.

3.8.2.3 FSAR Supplement

Section 16.1.2, "Auxiliary Feedwater Steam Piping Inspection Program," of Appendix A to the LRA provides an updated FSAR supplement for the auxiliary feedwater steam piping inspection program. The staff concludes that the updated FSAR Supplement is sufficient.

3.8.2.4 Conclusion

Based on the information provided by the applicant, the staff finds that the implementation of the auxiliary feedwater steam piping inspection program will provide reasonable assurance that loss of material will be managed such that the components within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

3.8.3 Emergency Containment Coolers Inspection

3.8.3.1 Summary of Technical Information in the Application

The emergency containment coolers inspection program is designed to determine the extent of loss of material due to erosion in the emergency containment cooler tubes. This is a one-time inspection of a representative sample of tubes in the containment coolers. The results of the inspection will be evaluated to determine an actual erosion rate and projected minimum wall thickness at the end of the extended period of operation. Programmatic changes will be made on the basis of the inspection results.

Emergency containment cooling components subject to an aging management review include the emergency fan cooler units (pressure boundary only) and associated heat exchanger coils. The intended functions for emergency containment cooling components subject to an aging management review include pressure boundary integrity and heat transfer. A complete list of emergency containment cooling components requiring an aging management review and the component intended functions are provided in Table 3.3-1 of the LRA. The aging management review for emergency containment cooling is discussed in Section 3.3 of the LRA. The applicant has credited the emergency containment cooler inspection program for managing the identified aging effects. The program is described in Appendix B, Section 3.1.3 of the LRA

The analyses for the current licensing basis for emergency containment cooling tubes have used conservative erosion rates. The applicant contends that the actual wall loss is expected to be less and confirmation of the actual wall thickness degradation will be obtained through inspection.

3.8.3.2 Staff Evaluation

In Table 3.3-1 of the LRA, the applicant identified loss of material to be the aging effect requiring management for the admiralty brass emergency containment cooling tubes exposed to a treated water environment. Emergency containment cooling tube wear was identified as a TLAA as discussed in Section 4.7.2 of the LRA. Option (iii) of 10 CFR 54.21 (c) (1) was selected to address this aging effect.

The staff evaluation of the emergency containment coolers inspection program focused on how the program manages the aging effect through the effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.

The corrective actions, confirmation process and administrative controls for license renewal are in accordance with the site-control quality assurance program pursuant to 10 CFR Part 50, Appendix B, and cover structures and components that are subject to an aging management review. The staff evaluation of the applicant's quality assurance program is provided separately in Section 3.1.2 of this safety evaluation. This program satisfies the elements of corrective actions, confirmation process and administrative controls. The remaining seven elements are discussed below.

[Program Scope] The applicant stated that the emergency containment cooling inspection is a one-time inspection that will determine the extent of loss of material due to erosion in the Unit 3 and 4 emergency containment cooler tubes. A sample of tubes for examination will be selected based on piping geometry and flow conditions that represent those with the greatest susceptibility to erosion. This inspection and evaluation will be implemented prior to the end of the initial operating terms.

In RAI 3.8.3-1, dated February 2, 2001, the staff requested the applicant to provide a justification for their determination that a one time inspection of the emergency containment coolers is adequate. Operating experience with these coolers at other nuclear power plants indicates that loss of material caused by erosion and flow-induced vibration can vary during plant operation due to unanticipated transients and flow conditions.

In its response dated April 19, 2001, the applicant stated that the aging effect requiring management for the emergency containment coolers is loss of material due to erosion on the inside surface of the cooler tubes. Cracking due to flow-induced vibration is not an aging effect requiring management. Except for surveillance testing, the emergency containment coolers are normally not in operation and have minimal cooling water flow through the tubes (see UFSAR Section 6.3.2, page 6.3-6). Therefore, the tubes are not susceptible to unanticipated transients. The results of the inspection will be evaluated to determine an actual erosion rate to verify that the minimum required wall thickness for the emergency containment cooling tubes will be maintained during the period of extended operation. As stated in Section 3.1.3 of Appendix B to the LRA, the evaluation of the inspection results may determine the need for additional testing, monitoring, and trending. The staff concurs with the applicant's response. RAI Item 3.8.3-1 is therefore closed.

In RAI 3.8.3-2, dated February 2, 2001, the staff requested the applicant to provide the specific percentage of tubes that will be examined during the inspection. In its response (FPL Letter L-2001-75, dated April 19, 2001), the applicant stated that a sample of tubes for examination will be selected based on geometry and flow conditions that represent those with the greatest susceptibility to erosion. All six emergency containment coolers (three in each unit) are identical and are subjected to the same cooling water conditions. Additionally, the emergency containment coolers are in service (during testing) approximately the same amount of time. On this basis, one emergency containment cooler will be selected for inspection as representative of all six. The number of tubes to be inspected in this cooler will be in accordance with the sampling plan recommended by the American Society for Quality Control publications. The staff finds the applicant's response reasonable and acceptable. On this basis, the issue in RAI item 3.8.3-2 is considered closed. With the resolution of the staff's concerns as discussed above, the staff finds the scope of the program acceptable.

[Preventive Actions] The applicant stated that no preventive actions are applicable to this inspection. The staff does not find a need for any preventive actions and therefore this is acceptable.

[Parameters Monitored or Inspected] The applicant stated that the inspection will document wall thickness of the emergency containment cooler heat exchanger tubes. The staff finds that the parameters monitored will permit timely detection of aging effects and are therefore acceptable.

[Detection of Aging Effects] The aging effect of concern, loss of material due to erosion, will be detected and sized in accordance with the volumetric technique chosen by the applicant. The staff finds the detection method will provide a satisfactory means for identifying the aging effect and is therefore acceptable.

[Monitoring and Trending] The results of the inspection will be evaluated by the applicant to verify that the minimum required wall thickness for the emergency containment cooler heat exchanger tubes will be maintained during the period of extended operation. In RAI 3.8.3-3, dated February 2, 2001, the staff requested that the applicant discuss the acceptance criteria which it will use for tube examination in the emergency containment coolers inspection program, and also clarify the source and basis for the acceptance criteria to be applied for this examination.

In its response (FPL Letter L-2001-75, dated April 19, 2001), the applicant stated that the acceptance criteria for the emergency containment cooler tubes is minimum wall thickness plus margin based upon actual erosion rate. The minimum wall thickness for the Emergency containment cooler tubes is based on the coolers' design pressure as calculated per ASME Section III, Class 3. Appendix B Section 3.1.3 of the LRA states that the results of the inspection will be evaluated to verify that the minimum required wall thickness for the Emergency containment cooler tubes will be maintained during the period of extended operation. The staff finds the applicant's response reasonable and acceptable. Therefore, the issue in RAI item 3.8.3-3 is closed.

In RAI 3.8.3-4, dated February 2, 2001, the staff requested that the applicant discuss how the acceptance criteria for the emergency containment cooler heat exchanger tubes consider fatigue failure due to flow-induced vibration. In its response (FPL Letter L-2001-75, dated April 19, 2001), the applicant stated that vibration induced fatigue is fast acting and typically detected early in the component's life, and, as a result, corrective actions are initiated to prevent recurrence. A review of Turkey Point's operating experience for the Emergency containment coolers did not indicate the presence of flow-induced vibration degradation conditions. Therefore, cracking due to mechanical fatigue is not an aging effect requiring management for the Emergency containment coolers. The staff finds the applicant's response reasonable and acceptable and therefore the issue in RAI item 3.8.3-4 is considered resolved. With the resolution of the staff's concerns as discussed above, the staff finds the monitoring and trending methods acceptable.

[Operating Experience] The applicant proposed a one-time inspection which is a new activity that will use techniques with demonstrated capability and a proven industry record to detect wall thickness (loss of material due to erosion). Effective and proven volumetric examination techniques will be selected for use in performing this inspection. This inspection will be performed utilizing approved procedures and qualified personnel.

The staff finds that based on operating experience, the implementation of the emergency containment coolers inspection will provide reasonable assurance that loss of material due to erosion will be managed in the containment coolers and is therefore acceptable.

3.8.3.3 FSAR Supplements

The staff has reviewed the UFSAR Section 16.1.3 provided in Appendix A to the LRA and confirmed that it contains the applicable elements of the program.

3.8.3.4 Conclusion

On the basis of the information provided by the applicant, the staff finds the implementation of the emergency containment cooler inspection program will provide reasonable assurance that loss of material will be managed such that the components within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

3.8.4 Field-Erected Tanks Internal Inspection

Florida Power and Light described its field-erected tanks internal inspection program in Section 3.1.4 of Appendix B to the LRA. The applicant credits this inspection program with managing, in part, the aging effect of the loss of material due to corrosion of the tanks within the scope of the program. The staff reviewed the Application to determine whether the applicant has demonstrated that the field-erected tanks internal inspection program will adequately manage the loss of material aging effect for the tanks within the scope of the program during the period of extended operation as required by 10 CFR 54.21(a) (3).

3.8.4.1 Summary of Technical Information in the Application

In Appendix B, Section 3.1.4, of the LRA, the applicant described a new aging management program, the field-erected tanks internal inspection, that manages, together with the chemistry control program, the loss of material aging effect for the two condensate storage tanks, two refueling water storage tanks, and the shared demineralized water storage tank. The applicant lists these tanks in Table 3.3-4 (refueling water storage tanks), Table 3.5-2 (demineralized water storage tank), and Table 3.5-3 (condensate storage tanks) of the LRA. These tanks are fabricated from carbon steel and the internal tank surfaces are coated to reduce corrosion. Each of the tanks contains treated water beneath an environment of air/gas.

The applicant plans on implementing the field-erected tanks internal inspection program as a one-time inspection of the two condensate storage tanks, two refueling water storage tanks, and the shared demineralized water storage tank rather than as a periodic inspection program. This one-time inspection will utilize either direct (e.g., divers) or remote (e.g., television cameras, fiber optic scopes, periscopes) observations. In addition to the field-erected tanks internal inspection program, the applicant also plans to use the chemistry control program to monitor the condition of the treated water in each of the tanks.

3.8.4.2 Staff Evaluation

The staff's evaluation of the field-erected tanks internal inspection program focused on how the program manages the loss of material aging effect through the effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.

The application indicated that the corrective actions, confirmation process, and administrative controls for license renewal are in accordance with the site-controlled corrective actions program pursuant to 10 CFR Part 50, Appendix B and cover all structures and components subject to an aging management review. The staff evaluation of the applicant's corrective actions program is provided separately in Section 3.1.2 of this SER. The corrective actions program satisfies the elements of corrective actions, confirmation process, and administrative controls. The remaining seven elements are discussed below.

[Program Scope] The applicant stated in Appendix B, Section 3.1.4, of the LRA, that the field-erected tanks internal inspection program will be a one-time inspection of the two condensate storage tanks, two refueling water storage tanks, and the shared demineralized water storage tank. This one-time inspection will cover selected internal areas, including surface welds, to determine the extent of internal corrosion in the tanks listed above. In order to ensure that the most susceptible internal areas of each tank are inspected, in RAI 3.8.4-2, dated February 2, 2001, the staff requested that the applicant describe the locations within each of the tanks that are the most susceptible to corrosion and to discuss why these locations are the most susceptible. In response (FPL Letter L-2001-75, dated April 19, 2001), the applicant stated that all locations within each of the tanks are considered to be susceptible to corrosion and therefore, all accessible internal surfaces of the tanks will be visually inspected rather than focusing on limited select locations suspected of being more susceptible to corrosion. The applicant's response to the staff is acceptable to close the issue in RAI Item 3.8.4-2.

[Preventive or Mitigative Actions] There are no preventive or mitigative actions taken as part of this program, and the staff did not identify the need for such actions.

[Parameters Inspected or Monitored] The applicant will perform visual inspections to determine the extent of any internal corrosion for each of the tanks. The internal tank surfaces will be examined for evidence of flaking, blistering, peeling, discoloration, pitting, or excessive corrosion. To determine the adequacy of the visual inspection, the staff requested in RAI 3.8.4-4 that the applicant describe the visual examination procedures in more detail, including any lighting and resolution requirements. In addition, the applicant was asked to describe any provisions for additional volumetric or surface examinations in the event that the scheduled one-time visual examination reveals extensive loss of material. In response, the applicant stated that the lighting and resolution requirements necessary to accomplish the internal tank inspections have not yet been established but the inspection requirements will be documented in the implementing procedure. Since the program requirements have not yet been established, RAI 3.8.4-4 became Open Item 3.8.4-1(b). In response to Open Item 3.8.4-1, dated November 1, 2001, the applicant stated that although the internal tank inspection will not be an ASME Section XI inspection, the lighting and resolution requirements will be the same as those specified for a VT-3 inspection, which is described in IWA-2210 of ASME Section XI. In addition, the applicant stated that if visual examination of the tanks reveals significant loss of material, the condition would be resolved through the FPL 10 CFR Part 50, Appendix B, corrective action program, which may involve volumetric or surface examinations. The applicant's response to the staff is acceptable to close Open Item 3.8.4-1(b). The staff finds that the monitoring of evidence of flaking, blistering, peeling, discoloration, pitting, or excessive corrosion is acceptable since they are directly related to the degradation of the internal tank surfaces, and visual inspections are effective and adequate to detect this condition.

[Detection of Aging Effects] An appropriate inspection frequency interval is important to ensure that the loss of material aging effect is identified before there is a loss of intended function; however, the applicant has determined that the field-erected tanks internal inspection program is to be a one-time inspection. In RAI 3.8.4-1, the staff has requested that the applicant justify a one-time inspection program rather than periodic inspections for each of the tanks. In response, the applicant stated that the condensate storage tanks (CSTs), the refueling water storage tanks (RWSTs), and demineralized water storage tank (DWST) are not currently inspected on a periodic basis. The Unit 4 CST was internally inspected and recoated in 1983. The Unit 3 CST was internally inspected, several $^1/_{16}$ inch pits were weld repaired, and the tank was recoated in 1991. The need for recoating activities was attributed to operational practices and the original coatings being inadequate for the application, and both have been corrected. The applicant further stated that a review of plant-specific operating experience revealed no other incidences of internal degradation for the CSTs. Since the results of previous inspections of the RWSTs and DWST were not provided by the applicant in response to RAI 3.8.4-1, the staff requested further information and RAI 3.8.4-1 became Open Item 3.8.4-1(c). In response to Open Item 3.8.4-1, dated November 1, 2001, the applicant stated that although the RWSTs and DWST are not currently inspected internally on a periodic basis, the DWST was recently inspected as part of a pre-inspection performed by divers and the cognizant engineer prior to the installation of a floating cover inside the tank. The DWST inspection did not identify any degraded coatings or tank corrosion. The applicant's expectation is that the RWST will similarly show little or no degradation and, therefore, the one-time field-erected tank internal inspection will provide confirmation that there are no aging effects requiring management for the field-erected tanks. However, if the inspection reveals internal surface degradation of the tanks,

then the degradation will be evaluated and repaired, as necessary, and additional inspections will be scheduled, as needed. The applicant's response to the staff is acceptable to close Open Item 3.8.4-1(c).

[Monitoring and Trending] Since the field-erected tanks internal inspection program is to be a one-time inspection, no monitoring and trending is anticipated; however, the applicant stated in Section 3.1.4 of Appendix B to the LRA, that the results of the one-time inspection will be evaluated to determine if additional actions are required.

[Acceptance Criteria] Specific acceptance criteria have not yet been developed for the field-erected tanks internal inspection program. In Section 3.1.4 of Appendix B to the LRA, the applicant stated that acceptance criteria will be provided in the implementing procedure. Since the review of acceptance criteria are an essential part of the staff evaluation of the effectiveness of an aging management program, the staff requested as Part A of Open Item 3.8.4-1 that the applicant provide acceptance criteria for the field-erected tanks internal inspection program. In response to Open Item 3.8.4-1(a), dated November 1, 2001, the applicant stated that the acceptance criteria for the internal inspection of field-erected tanks internal inspection will be the design corrosion allowance. Thus, any loss of material greater than the tank's corrosion allowance will require corrective action to ensure that the tank's intended functions are maintained under all CLB design conditions. The applicant further stated that the threshold at which additional inspections, beyond the one-time inspection, will be implemented is corrosion of the tank steel. Thus, if corrosion is observed, appropriate corrective actions will be implemented and additional inspections will be scheduled based on the corrective actions implemented. The applicant's response to the staff is acceptable to close Open Item 3.8.4-1(a).

[Operating Experience] The field-erected tanks internal inspection program is a new program; thus, the applicant did not submit Turkey Point-specific operating experience. However, in response to the staff's RAI 3.8.4-1, the applicant stated that previous inspections of the Unit 4 CST in 1983 and the Unit 3 CST in 1991 revealed corrosion at some of the welds at the roof to wall connection and coating degradation at several areas in the floor and wall of the tank. The applicant attributed these conditions to operational practices and the inadequacy of the original coatings, however, the applicant stated that both of these causes have been corrected. In addition, as documented above under *Detection of Aging Effects*, the DWST was also recently inspected and there were no signs of degradation. The RWSTs have not been previously internally inspected; however, the applicant expects to find little or no degradation to the internal surfaces of the RWSTs. In the event that the field-erected tanks internal inspection reveals degradation of the internal tank surfaces, appropriate corrective actions will be implemented and additional inspections will be scheduled based on the corrective actions implemented. The staff finds that the applicant's operating experience has demonstrated that significant aging of the internal tank surfaces is unlikely and, therefore, a one-time inspection, with the need for further inspections and corrective actions to be determined based on the one-time inspection results, is reasonable and sufficient.

3.8.4.3 FSAR Supplement

The staff has reviewed the UFSAR Section 16.1.4 as amended by the resolution of Open Item 3.8.4-1, and confirmed that it contains an acceptable program description.

3.8.4.4 Conclusions

The staff has reviewed the information in Appendix B, Section 3.1.4, of the LRA and responses to the staff's RAIs and Open Item. The staff also reviewed the program description provided in Section 16.1.4 of the UFSAR. The staff concludes that the applicant has demonstrated that the field-erected tanks internal inspection program will be adequate to detect the presence of the loss of material aging effect for each of the tanks covered by this inspection and that the one-time inspection results will be used to determine the need for additional inspections and/or corrective actions.

3.8.5 Galvanic Corrosion Susceptibility Inspection Program

3.8.5.1 Summary of Technical Information in the Application

Section 3.1.5, "Galvanic Corrosion Susceptibility Inspection Program," of Appendix B to the LRA, describes the program aimed at verifying the integrity of components subject to galvanic corrosion. The staff reviewed this section of the application to determine whether the applicant has demonstrated that the effects of aging caused by galvanic corrosion will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

As identified in Chapter 3, the galvanic corrosion susceptibility inspection program is credited for aging management of specific component/commodity groups in the following systems: auxiliary feedwater and condensate storage; chemical and volume control; CCW; containment spray; control building ventilation; emergency containment cooling; emergency diesel generators and support systems; feedwater and blowdown; fire protection; instrument air; normal containment and control rod drive mechanism cooling; reactor coolant; residual heat removal; safety injection; spent fuel pool (SFP) cooling; turbine building ventilation; and waste disposal.

The galvanic corrosion susceptibility inspection program manages the aging effect of loss of material due to galvanic corrosion on the internal surfaces of susceptible piping and components. The program involves selected, one-time inspections of the internal surfaces of piping and components with the greatest susceptibility to galvanic corrosion. Loss of material is expected mainly in carbon steel components directly coupled to stainless steel components in raw water systems. However, baseline examinations in select systems will be performed and evaluated to establish if the corrosion mechanism is active. On the basis of the results of these inspections, the need for followup examinations or programmatic corrective actions will be established. The program will be implemented prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4.

3.8.5.2 Staff Evaluation

The staff evaluation of the galvanic corrosion susceptibility inspection program focused on how the activities managed aging effects through the effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.

The application indicated that the corrective actions, confirmation process, and administrative controls for license renewal are in accordance with the site-controlled quality assurance program pursuant to 10 CFR Part 50, Appendix B, and cover all structures and components subject to AMR. The staff's evaluation of the applicant's quality assurance program is provided separately in Section 3.1.2 of this SER. This program satisfies the elements of corrective actions, confirmation process, and administrative controls. The remaining seven elements are discussed below.

[*Program Scope*] The galvanic corrosion susceptibility inspection program will manage the potential effects of loss of material due to galvanic corrosion on the internal surfaces of susceptible piping and components. Carbon steel components directly coupled to stainless steel components in raw water systems at Turkey Point are the most susceptible to galvanic corrosion. However, baseline examinations will be performed and evaluated to establish if the corrosion mechanism is active in other systems. The program will involve selected one-time inspections, the results of which will be utilized to determine the need for additional actions. The staff finds that the scope of the galvanic corrosion susceptibility inspection program is adequate because locations likely to experience galvanic corrosion will be examined.

[*Preventive or Mitigative Actions*] Components and systems utilize insulating flanges or cathodic protection to minimize galvanic corrosion. The use of insulated flanges and cathodic protection is not credited with the elimination of galvanic corrosion. Since the applicant does not take credit for systems and components that minimize galvanic corrosion, there are no preventive or mitigative actions and the staff does not find a need for any.

[*Parameters Inspected or Monitored*] The program will assess the loss of material due to galvanic corrosion between dissimilar metals in locations determined to represent the most limiting conditions. Selection of the most limiting conditions will be based on high galvanic potential, high cathode/anode area ratio, and high conductivity of the fluid in contact with the materials. The staff finds the general program is acceptable because visual examination of selected locations will establish if galvanic corrosion is occurring.

[*Detection of Aging Effects*] Loss of material due to galvanic corrosion will be evident by material loss at the location of the junction between the dissimilar metals. Volumetric examinations or visual inspections will be utilized to address the extent of material loss.

Initial inspection results will be utilized to assess the need for expanded sample locations. Inspection frequency will be determined based on the corrosion rate identified during the initial inspections. The staff agrees that these are acceptable methods for identifying loss of material.

[*Monitoring and Trending*] These are planned as one-time inspections; therefore, there is no monitoring or trending, and the staff does not find any need for monitoring and trending.

[*Acceptance Criteria*] Wall thickness measurements greater than required minimum wall thickness values for the components will be acceptable. Wall thickness measurements less than required minimum values will be entered into the corrective action program. The staff finds that the acceptance criteria are adequate because this program will establish if the minimum wall thickness requirement is being satisfied.

[*Operating Experience*] Visual and volumetric inspection techniques have been used at Turkey Point for years. These techniques have proven successful in determining the material condition of components.

This is a new program that will use techniques with demonstrated capability and a proven industry record to monitor material loss due to galvanic corrosion. This examination will be performed utilizing approved procedures and qualified personnel. The inspection techniques used in this program have been previously used to monitor material condition for plant systems.

The applicant did not provide any operating experience on galvanic corrosion, either for Turkey Point, Units 3 and 4, or for the nuclear industry in general in the LRA. The applicant provided a summary of their operating experience in RAI response L-2001-65, Attachment 1. They reviewed their plant operating and maintenance history and discovered only a few incidences of loss of material in treated water systems. The applicant identified loss of material due to galvanic corrosion in the plant ventilation chilled water systems. The applicant installed electrical isolation kits and no further galvanic corrosion has been observed. There were also instances of loss of material in air handling units where aluminum fins are in contact with copper tubing in areas where condensation pooling has occurred.

The applicant stated in RAI response L-2001-65 that galvanic corrosion is more likely in raw water than in treated water. The applicant states that the effects of galvanic corrosion are precluded by design using such things as isolation and coating of dissimilar metals. The applicant states that galvanic corrosion is most likely in the intake cooling water (ICW). However, the applicant has the ICW system inspection program instead of the galvanic corrosion inspection program to manage this aging.

3.8.5.3 FSAR Supplement

The staff has reviewed the UFSAR Section 16.1.5 and confirmed that it contains an acceptable program description.

3.8.5.4 Conclusions

The staff has reviewed the information provided in Appendix B, Section 3.1.5 of the LRA and responses to the staff's RAIs. On the basis of this review, as set forth above, the staff concludes that the applicant has demonstrated that there is reasonable assurance that the galvanic corrosion susceptibility inspection program will adequately manage aging effects for dissimilar metals in contact with fluid for the period of extended operation.

3.8.6 Reactor Vessel Internals Inspection Program

Section 3.1.6, "Reactor Vessel Internals Inspection Program," of Appendix B to the LRA describes the program credited for aging management of the reactor vessel internals. The reactor vessel internals inspection program consists of two types of examinations, visual and ultrasonic testing (UT), to manage the aging effects of cracking, reduction in fracture toughness, and loss of mechanical closure integrity.

As described in the LRA, the reactor vessel internals inspection program will involve the combination of several activities culminating in the inspection of Turkey Point Unit 3 and 4 reactor vessel internals once for each unit during the 20-year period of extended operation. The applicant states that this program is intended to supplement the reactor vessel internals inspections required by the ASME Section XI, Subsections IWB, IWC, and IWD inservice inspection program. In addition, ongoing industry efforts are aimed at characterizing the aging effects associated with the reactor vessel internals. As described in response to RAI 3.8.6-1, the applicant is a participant in industry research activities addressing aging effects on reactor vessel internals being conducted by the materials reliability project (MRP) of EPRI. Further understanding of these aging effects will be developed by industry over time and will provide additional bases for the inspections under this program. Pending results of industry progress with regard to validation of the significance of dimensional changes due to void swelling, the applicant states that the visual examinations may be supplemented to incorporate requirements for measurement of critical parts to evaluate potential dimensional changes. Accordingly, an evaluation will be performed to establish the requirements for dimensional verification of critical reactor vessel internals parts as part of the visual examination scope.

Commitment dates associated with the implementation of this new program are provided in Appendix A to the LRA. Specifically, this program will be in place prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4. As described in response to RAI 3.8.6-4, FPL will submit to the NRC a report that will summarize the understanding of aging effects to apply to the reactor vessel internals, and will provide the Turkey Point inspection plan, including required methods for detection and sizing of cracks and acceptance criteria. This report will be submitted prior to the end of the initial 40-year operating license term for Unit 3. As described in response to RAI 3.8.6-3, the first of the reactor vessel internals inspections will occur early in the license renewal period on the unit leading in fluence at that time, and the second inspection will be conducted on the other unit at the next 10-year inspection interval, or 10 to 12 years into the license renewal term.

Since the application focuses discussion of this program around the visual examinations and the UT examinations, the review and evaluation of this program will be structured along those same lines.

3.8.6.1 Visual Examination

3.8.6.1.1 Summary of Technical Information in the Application

The application provides a description of this examination in Section 3.1.6.1 of Appendix B the LRA. The examination description is covered under eight items: scope, preventive actions, parameters monitored, or inspected, detection of aging affects, monitoring and trending, acceptance criteria, confirmation process, and operating experience and demonstration. A description of the contents of the application is provided below in the staff evaluation.

3.8.6.1.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Section 3.1.6.1 of Appendix B of the LRA regarding the applicant's demonstration of the visual examination activity of the reactor vessel internals inspection program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

The application indicated that the corrective actions, confirmation process, and administrative controls for license renewal are in accordance with the site-controlled quality assurance program pursuant to 10 CFR Part 50, Appendix B, and cover all structures and components subject to AMR. The staff's evaluation of the applicant's quality assurance program is provided separately in Section 3.1.2 of this SER. This program satisfies the elements of corrective actions, confirmation process, and administrative controls. The remaining seven elements are evaluated below.

[*Program Scope*] As described in the application, this activity will manage the aging effects of cracking due to irradiation-assisted stress corrosion (IASCC) and reduction in fracture toughness due to irradiation and thermal embrittlement on accessible parts of the Turkey Point Unit 3 and 4 reactor vessel internals. The reactor vessel internals susceptible to these aging effects and included in the visual examination scope are accessible areas of the lower core plates and fuel pins, lower support columns, core barrel, baffle/former assemblies, thermal shields, and lower support forgings. The program will consist of VT-1 examinations utilizing remote equipment such as television cameras, fiber-optic scopes, periscopes, etc. The staff finds the scope of this program adequate for managing the aging effects for which it is intended because the program addresses the reactor vessel internal components of interest.

[*Preventive or Mitigative Actions*] The application states that there are no practical preventive actions available that will prevent IASCC and reduction in fracture toughness. However, to minimize the potential for IASCC, the concentrations of chlorides, fluorides, and sulfates in the reactor coolant are controlled by implementation of the chemistry control program. The staff agrees with the applicant's conclusions that there are no practical preventive actions.

[*Parameters Monitored or Inspected*] This examination monitors the effects of cracking and reduction in fracture toughness on the reactor vessel internals selected parts by the detection and sizing of cracks. The staff finds that the cited examination will be effective in managing IASCC and reduction in fracture toughness in reactor vessel internals components because this is a proven method for detecting and sizing of cracks in the components.

[*Detection of Aging Effects*] Cracking of reactor vessel selected parts will be detected by performance of VT-1 examinations. Cracking is expected to initiate at the surface and, therefore, will be detectable by visual examination. If ultrasonic examination of bolting (see Section 3.8.6.2.2 of this SER) determines that IASCC is occurring, then enhanced VT-1 inspections capable of detecting 0.5 mile wire against a gray background of the accessible areas of the lower core plates and fuel pins, lower support columns, core barrels, baffle/former assemblies, thermal shields, and lower support forgings will be performed. The staff finds that the visual examinations described by the applicant will be effective in detecting the aging effects cited in the application because this is a proven method for inspecting these components.

[*Monitoring and Trending*] The VT-1 examination of selected parts of the reactor vessel internals will be performed one time for each unit during the period of extended operation. On the basis of the results of each examination, additional examinations and/or repairs will be scheduled. The staff finds this approach to be acceptable because it provides a reasonable approach for addressing any degradation identified.

[*Acceptance Criteria*] The LRA states that acceptance criteria will be developed prior to the visual examinations, and cracks that are detected during the inspections will be evaluated for determination of the need and method of repair. The staff finds this approach to be acceptable because the acceptance criteria will be developed using acceptable procedures.

[*Operating Experience*] The LRA states that the remote visual examination proposed by this program utilizing equipment such as television cameras, fiber-optic scopes, periscopes, etc., has previously been demonstrated as an effective method to detect cracking of reactor vessel internals. The applicant states in the LRA that similar visual examinations were successfully performed at St. Lucie Unit 1 during the core barrel repair/modification. The staff concludes that the visual examination will be effective in managing the aging effects cited by the applicant because it uses proven techniques for the components of interest.

3.8.6.2 Ultrasonic Examination

3.8.6.2.1 Summary of Technical Information in the Application

The application provides a description of this examination in Section 3.1.6.2 of Appendix B of the LRA. The examination description is covered under eight items: scope, preventive actions, parameters monitored or inspected, detection of aging affects, monitoring and trending, acceptance criteria, confirmation process, and operating experience and demonstration. A description of the contents of the application is provided below in the staff evaluation.

3.8.6.2.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Section 3.1.6.2 of Appendix B of the LRA regarding the applicant's demonstration of the UT examination activity of the reactor vessel internals inspection program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

The application indicated that the corrective actions, confirmation process, and administrative controls for license renewal are in accordance with the site-controlled quality assurance program pursuant to 10 CFR Part 50, Appendix B, and cover all structures and components subject to AMR. The staff's evaluation of the applicant's quality assurance program is provided separately in Section 3.1.2 of this SER. The program satisfies the elements of corrective action, confirmation process, and administrative controls. The remaining seven elements are discussed below.

[*Program Scope*] This activity manages the aging effect of loss of mechanical closure integrity on reactor vessel internals baffle/former bolts, barrel/former bolts, and lower support column bolts. The volumetric examination will involve UT examination on the baffle/former bolts in each unit to supplement the current examination techniques. The results of this examination will be utilized to determine the need for similar examinations of the barrel/former bolts, lower support column bolts, and other reactor vessel internals bolting. Additionally, the baffle/former bolting is the leading location for determining the extent of IASCC that may be occurring because it is subject to more limiting fluences and higher stresses than other potentially susceptible parts of the reactor internals addressed under the scope of the Reactor Vessel Internals Inspection Program. If IASCC is identified by the ultrasonic examination of the baffle/former bolting, then FPL will perform an enhanced VT-1 inspection capable of detecting 0.5mil wire against a gray background of the accessible areas of the lower core plates and fuel pins, lower support columns, core barrels, baffle/former assemblies, thermal shields and lower support forgings. The staff finds the scope of this program adequate for managing the aging effects for which it is intended.

[*Preventive or Mitigative Actions*] There are no practical preventive actions available that will prevent loss of mechanical closure integrity of reactor vessel internals bolting. However, to minimize the potential for loss of mechanical closure integrity due to IASCC, the concentrations of chlorides, fluorides, and sulfates in the reactor coolant are controlled by implementation of the chemistry control program. There are no preventive or mitigative actions associated with the ultrasonic examination, nor did the staff identify a need for such actions.

[*Parameters Monitored or Inspected*] This examination monitors loss of mechanical closure integrity of the reactor vessel internals bolts by the detection and sizing of cracks. The staff finds that the ultrasonic examination will be effective in managing the cited aging effects in the reactor vessel internals components.

[*Detection of Aging Effects*] The aging effect of loss of mechanical closure integrity of reactor vessel internals bolting will be detected by performance of ultrasonic examinations. The staff finds that the ultrasonic examinations described by the applicant will be effective in detecting the aging effects cited in the application because approved methods will be used to develop these criteria.

[*Monitoring and Trending*] The ultrasonic examination of the reactor vessel internals baffle/former bolts will be performed one time on each unit during the period of extended operation. On the basis of the results of the examination, additional examinations and/or repairs will be scheduled. The staff finds this approach to be acceptable based on industry experience of limited cracking of baffle/former bolts.

[*Acceptance Criteria*] The LRA states that the quantity of cracked baffle/former bolts shall be less than the number of bolts that can be damaged without affecting the intended function of the reactor vessel internals. This quantity will be established by evaluation. The staff finds this approach to be acceptable.

[*Operating Experience*] The LRA states that the UT examination methods are proven techniques that have been used in other programs to successfully detect cracking, and that UT examinations have been demonstrated as an effective method of detecting cracking in baffle/former bolting at other Westinghouse plants. The ultrasonic examinations utilize techniques with a demonstrated capability and a proven industry record to detect cracking. These examinations are performed utilizing approved procedures and qualified personnel.

The staff agrees that UT examination methods are effective for the components of interest.

3.8.6.3 FSAR Supplement

Section 16.1.6, "Reactor Vessel Internals Inspection Program," of Appendix A to the LRA provides an updated FSAR supplement for the reactor vessel internals inspection program, as amended by the applicant's response to RAI 3.8.6-4. The staff concludes that the updated FSAR Supplement is sufficient.

3.8.6.4 Conclusion

The staff has reviewed the information in Appendix B, Section 3.1.6 of the LRA and responses to the staff's RAIs. On the basis of the above evaluations of the visual and ultrasonic examination activities of the reactor vessel internals inspection program, the staff finds that this program provides reasonable assurance that the applicable aging effects will be managed so that reactor vessel internal components will continue to perform their intended functions consistent with the CLB throughout the period of extended operation.

3.8.7 Small Bore Class 1 Piping Inspection

The small bore Class 1 piping inspection program is credited for aging management of small bore Class 1 piping in the reactor coolant systems (RCS).

3.8.7.1 Summary of Technical Information in the Application

The applicant describes the piping inspection in Section 3.1.7, "Small Bore Class 1 Piping Inspection," of Appendix B to the LRA. This inspection will be a one-time inspection of a sample of Class 1 piping less than 4 inches in diameter. As described in Appendix A to the LRA, this inspection will be performed prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4, using a volumetric technique chosen to permit detection and sizing of significant cracking of small bore Class 1 piping. Since this is a one-time inspection, no monitoring or trending is anticipated by the applicant. The evaluation of the inspection results may result in additional examinations consistent with ASME Section XI, subsection IWB. A small sample of the affected welds will be selected for examination based on piping geometry, piping size, and flow conditions. As described in response to RAI 3.8.7-1, the sample of welds to be examined will be selected using a risk-informed approach approved previously by the NRC.

This one-time inspection is described in the LRA as a new activity, which will use techniques with demonstrated capability and a proven industry record to detect piping weld and base material flaws. The applicant states that effective and proven volumetric examination techniques will be selected for use in performing this inspection. This inspection will be performed utilizing approved procedures and qualified personnel. Results and recommendations from industry initiatives will be incorporated into the inspection. The staff reviewed the applicant's description of the program in Section 3.1.7 of Appendix B to the LRA to determine if the small bore Class 1 piping inspection will adequately manage cracking in small bore Class 1 piping welds such that these components will to perform their intended functions for the period of extended operation as required by 10 CFR 54.21(a)(3).

3.8.7.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Section 3.1.7 of Appendix B to the LRA regarding the applicant's demonstration of the small bore Class 1 piping inspection to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

The application indicated that the corrective actions, confirmation process, and administrative controls for license renewal are in accordance with the site-controlled quality assurance program pursuant to 10 CFR Part 50, Appendix B, and cover all structures and components subject to AMR. The staff's evaluation of the applicant's quality assurance program is provided separately in Section 3.1.2 of this SER. This program satisfies the elements of corrective actions, confirmation process, and administrative controls. The remaining seven elements are discussed below.

[*Program Scope*] The small bore Class 1 piping inspection is a one-time inspection of a sample of Class 1 piping less than 4 inches in diameter. As described in response to RAI 3.8.7-1, the sample of welds to be examined will be selected using a risk-informed approach approved previously by the NRC. Commitment dates associated with the implementation of this new program are provided in Section 16.1.7, of Appendix A to the LRA. The staff agrees with the adequacy of the applicant's description of the scope of this program.

[*Preventive or Mitigative Actions*] The applicant states that no preventive actions are applicable to this inspection. The staff concurs with this finding.

[*Parameters Monitored or Inspected*] The LRA states that the volumetric technique chosen will permit detection and sizing of significant cracking of small bore Class 1 piping. The staff agrees with the adequacy of the examination technique described by the applicant because this is a proven method for this type of inspection.

[*Detection of Aging Effects*] The applicant states that the aging effect requiring management, cracking, will be detected and sized in accordance with the volumetric technique chosen. The staff agrees with the adequacy of the examination technique described by the applicant because this is a standard industry technique.

[*Monitoring and Trending*] The LRA states that this is a one-time inspection and, as such, no monitoring or trending is anticipated. Further, the LRA states that the evaluation of the inspection results may result in additional examinations consistent with ASME Section XI, Subsection IWB. The staff finds this approach acceptable because cracking of small bore piping has not been prevalent in the industry and a one-time inspection program is adequate.

[*Acceptance Criteria*] The LRA states that any cracks identified will be evaluated and, if appropriate, entered into the corrective action program. The staff finds this approach acceptable because industry standards will be used in the acceptance criteria.

[*Operating Experience*] The LRA describes this one-time inspection as a new activity, which will use techniques with demonstrated capability and a proven industry record to detect piping weld and base material flaws. Effective and proven volumetric examination techniques will be selected for use in performing this inspection. This inspection will be performed utilizing approved procedures and qualified personnel. Results and recommendations from industry initiatives will be incorporated into the inspection. The staff finds this approach acceptable.

3.8.7.3 FSAR Supplement

Section 16.1.7 of Appendix A to the LRA states that the small bore Class 1 piping inspection will be performed prior to the end of the initial operating license terms for Turkey Point, Units 3 and 4. The staff agrees with the timing for this inspection. Because the LRA does not specify the number of items to be inspected nor the specific lines to be inspected, the applicant has committed to provide to the NRC a report describing the inspection plan prior to implementation of this inspection (Ref. FPL letter L-2001-136, dated June 25, 2001).

3.8.7.4 Conclusion

The staff has reviewed the information in Section 3.1.7 of Appendix B of the LRA and responses to the staff's RAIs. On the basis of the evaluation of the small-bore Class 1 piping inspection program, the staff finds that this program provides reasonable assurance that the applicable aging effects will be managed so that the small bore Class 1 piping and nozzles will continue to perform their intended functions consistent with the CLB throughout the period of extended operation.

3.9 Existing Aging Management Programs

3.9.1 ASME Section XI Inservice Inspection Programs

The applicant described the inservice inspection (ISI) programs, Section 3.2.1, "ASME Section XI Inservice Inspection Program," of Appendix B to the LRA. The applicant credits the examinations performed under the ASME Code, Section XI, ISI program with managing the effects of aging for Class 1, 2, 3, and MC pressure-retaining components and their supports during the period of extended operation. The staff has reviewed the section of the application to determine whether the applicant has demonstrated that the effects of aging will be adequately managed by the ISI program during the extended period of operation as required by 10 CFR 54.21(a)(3). The ASME Section XI ISI programs are broken down into the following four programs:

- ASME Section XI, subsections IWB, IWC, and IWD inservice inspection program
- ASME Section XI, subsection IWE inservice inspection program
- ASME Section XI, subsection IWF inservice inspection program
- ASME Section XI, subsection IWL inservice inspection program

3.9.1.1 ASME Section XI, Subsections IWB, IWC, and IWD Inservice Inspection Program

3.9.1.1.1 Summary of Technical Information in the Application

The ASME Section XI, subsections IWB, IWC, and IWD ISI program is described in Section 3.2.1.1, "ASME Section XI, Subsections IWB, IWC, and IWD Inservice Inspection Program," of Appendix B to the LRA. The applicant credits this program for managing the effects of cracking, loss of mechanical closure integrity, and loss of material for piping and components in the reactor coolant system during the period of extended operation. The staff has reviewed the section of the application to determine whether the applicant has demonstrated that the effects of aging will be adequately managed by the ISI plan during the period of extended operation as required by 10 CFR 54.21(a)(3).

As identified in Chapter 3, Table 3.2-1 of the LRA, the ASME Section XI, Subsections IWB, IWC, and IWD ISI program is credited for aging management of specific component/commodity groups in the RCS.

The staff notes that the licensee submitted a request to revise the Turkey Point Unit 3 ISI scope for Class 1 piping to risk informed inservice inspection (RI-ISI). The revision affects the nondestructive examination (NDE) scope of Class 1 piping currently required by ASME Section XI. Examinations performed are based upon the postulated failure mechanism associated with the piping being inspected. The licensee plans to submit a similar request for Turkey Point Unit 4 at a later date. The staff's evaluation of the Unit 3 request is dated November 30, 2000.

In Section 3.2.1.1 of Appendix B of the LRA, the applicant stated its intent to meet the requirements of the latest edition and addenda to the ASME Code, Section XI, that are incorporated by reference in 10 CFR 50.55a(b) for ISI.

3.9.1.1.2 Staff Evaluation

The staff evaluation of the ASME Section XI, subsections IWB, IWC, and IWD ISI program focused on how the activities managed aging effects through the effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.

The application indicated that the corrective actions, confirmation process, and administrative controls for license renewal are in accordance with the site-controlled quality assurance program pursuant to 10 CFR Part 50, Appendix B, and covers all structures and components subject to an AMR. The staff evaluation of the applicant's quality assurance program is provided separately in Section 3.1.2 of this SER. This program satisfies the elements of corrective actions, confirmation process, and administrative controls. The remaining seven programs are evaluated below.

[*Program Scope*] The ASME Section XI, subsections; IWB, IWC, and IWD ISI program, as defined by the third interval ISI program for Turkey Point, Units 3 and 4, is credited with managing the aging effects of cracking, loss of mechanical closure integrity, and loss of material for piping and components. This program provides for the inspection and examination of components, including welds, pump casing, valve bodies, steam generator tubing, and pressure-retaining bolting. (The staff notes that steam generator tubing is also covered under LRA Section 3.2.14, "Steam Generator Integrity Program," and in this safety evaluation in Section 3.9.14.)

ISI requirements may be modified by applicable relief requests and code cases that are approved specifically for each unit. A particular code edition is applicable for a 120-month interval. Prior to the end of each interval, the program is revised to reflect the updated requirements of 10 CFR 50.55a.

Although ASME Section XI, subsection IWD is included in the scope of this program, this application does not credit subsection IWD for managing the effects of aging of in-scope Class 3 pressure retaining components and their integral attachments. The aging effects of these items are credited by other aging management programs.

The staff finds that the scope of the ASME Section XI, subsections; IWB, IWC, and IWD ISI program is adequate.

[*Preventive or Mitigative Actions*] There are no specific actions under this program to prevent or mitigate the effects of aging. Specific actions that serve to limit the effects of aging for Class 1, 2, and 3 piping and components are conservative design, fabrication, construction, ISIs, and strict control of chemistry. The operating experience with the ISI program indicates that it has been successful in identifying and leading to correction of degradation effects as expected of this program. The staff did not identify a need for preventive actions.

[*Parameters Inspected or Monitored*] ISI includes visual inspections, surface examinations, and volumetric examinations in accordance with the requirements of ASME Section XI. The parameters monitored are specified in the ASME Code for each type of examination required. The staff accepts the parameters being monitored during ISI of Class 1, 2, and 3 components in managing age-related degradation.

[*Detection of Aging Effects*] The degradation of piping and components is determined by visual, surface, or volumetric examination in accordance with the requirements of ASME Section XI as modified by the third interval ISI program for Turkey Point, Units 3 and 4 [Reference B-4 of the LRA]. Piping and components are examined for evidence of operation-induced flaws using volumetric and surface techniques. The VT-1 visual examination is used to detect cracks, symptoms of wear, corrosion, erosion, or physical damage. VT-2 examinations are conducted to detect evidence of leakage from pressure-retaining components. VT-3 examinations are conducted to determine the general mechanical and structural condition of components and to detect discontinuities and imperfections such as loss of integrity at bolted or welded connections, loose or missing parts, debris, corrosion, wear, or erosion. The extent and frequency of inspections are specified in ASME Section XI, as modified in accordance with the third interval ISI program for Turkey Point, Units 3 and 4. The frequency and scope of examinations are sufficient to ensure that the aging effects are detected before they impact the components' intended functions. The inspection intervals are not restricted by the Code to the current term of operation, and are valid for the period of extended operation. The staff accepts the NDE methods prescribed by the Code for each class of components to be reliable and effective in detecting age-related degradation of components that are within the scope of license renewal.

[*Monitoring and Trending*] The frequency and scope of examinations are sufficient to ensure that the aging effects are detected before impacting the component's intended functions. Inspections are performed in accordance with the inspection intervals specified by ASME Code Section XI as modified by the third interval ISI program for Turkey Point, Units 3 and 4.

Examinations performed during any inspection interval that reveal flaws or areas of degradation exceeding the acceptance criteria are to be extended to include additional examinations within the same category. When examination results require evaluation of flaws or areas of degradation, the areas are reexamined during subsequent inspection intervals in accordance with the requirements of ASME Section XI.

Records of the inspection program, examination and test procedures, results of activities, examination/test data, and corrective actions taken or recommended are maintained in accordance with the requirements of ASME Section XI, subsection IWA.

The staff accepts this methodology to undertake further programmatic actions, including additional examinations, corrective actions, and repair and replacement in accordance with ASME Section XI, to manage these aging effects.

[*Acceptance Criteria*] Acceptance standards for the ISIs are identified in ASME Section XI. Relevant indications that are revealed by the ISI may require additional inspections of similar components in accordance with ASME Section XI. Examinations that reveal indications exceeding the acceptance standards are made acceptable by repair, replacement, or evaluation. The staff accepts the flaw evaluation methodology of the Code as the industry standard and, therefore, the management of aging effects based on the Code criteria is acceptable.

[*Operating Experience*] ASME Section XI provides rules and requirements for ISI, testing, repair, and replacement of Class 1, 2, and 3 components. Components are chosen for inspection in accordance with the requirements of subsections IWB, IWC, and IWD and are inspected using the volumetric, surface, or visual examination methods.

The ASME Section XI inspections are conducted as part of the ISIs typically performed during plant refueling outages. The ISI of Class 1, 2, and 3 components and piping has been conducted since initial plant start-up as required by the plant technical specifications and 10 CFR 50.55a. These inspections have documented, evaluated, and corrected degraded conditions associated with piping and components inspected under the program.

Implementation of the ASME Section XI program at Turkey Point currently includes more than 480 Class 1, 2, and 3 examinations per unit per 10-year interval. For Class 1 piping, the examinations have yielded only indications of surface anomalies and surface geometry with no indication of fatigue cracking. For Class 2 piping, the only indications have been surface anomalies, acceptable slag inclusion, surface geometry, and fatigue cracking of steam generator feedwater nozzle reducers. The feedwater reducers were replaced and subsequent inspections are being performed in accordance with the requirements of ASME Section XI.

The staff finds that operating experience shows the ASME Section XI, subsections IWB, IWC, and IWD ISI program has been successful in identifying and leading to correction of aging effects. Therefore, the staff finds the program effective in the management of age related degradation.

3.9.1.1.3 FSAR Supplement

Section 16.2.1.1, "ASME Section XI, IWB, IWC, and IWD ISI Program," of Appendix A to the LRA provides an updated FSAR supplement for the ASME Section XI, Subsections IWB, IWC, and IWD ISI program. The staff concludes that the updated FSAR supplement is sufficient.

3.9.1.1.4 Conclusion

The staff has reviewed the information in Section 3.2.1 of Appendix B of the LRA. On the basis of this review, the staff finds that the ASME Section XI, subsections IWB, IWC, and IWD ISI program provides reasonable assurance that the aging effects of cracking, loss of mechanical closure integrity, and loss of material will be managed such that components within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis during the period of extended operation.

3.9.1.2 ASME Section XI, Subsection IWE Inservice Inspection Program

3.9.1.2.1 Summary of Technical Information in the Application

The applicant credits this program with managing the effects of loss of material for containment steel components and changes in material properties for elastomers (seals, gaskets, and moisture barriers) associated with containment steel components. The program addresses the following program elements: scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, confirmation process, and operating experience and demonstration. These elements are discussed in 3.9.1.2.2.

3.9.1.2.2 Staff Evaluation

Addressing the 10 program elements (scope, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience) provides an efficient method of describing the processes involved in an aging management program.

It is noted that corrective actions, confirmation process, and administrative controls for license renewal are in accordance with the site-controlled quality assurance program pursuant to 10 CFR Part 50, Appendix B, and covers all SSCs subject to an aging management review.

The staff evaluation of the applicant's quality assurance program is provided separately in Section 3.1.2 of this safety evaluation report. This program satisfies the elements of corrective actions, confirmation process and administrative controls. The remaining seven elements are discussed below.

[Program Scope] The program includes the examination, testing, and repair/replacement activities for the metallic components, moisture barriers, seals, and gaskets of the containment pressure boundary.

[Preventive Actions] In describing preventive actions, the applicant stated that coatings, cathodic protection, and moisture barriers are not credited in determination of the aging effects requiring management. However, it is the degradation of coating and moisture barriers and malfunction of cathodic protection system that could give rise to the degradation of the protected safety-related components. That is the reason Subsection IWE requires periodic examination of moisture barriers, and coating. The effectiveness of these preventive measures should be periodically assessed as part of the aging management program for the protected components. In RAI 3.9.1.2-1 the staff stated that the applicant should provide a summary of the procedures used for managing the effectiveness of these preventive measures.

In its response, the applicant stated, "moisture barriers located at the interface of the containment liner and concrete floor are credited in the determination of aging effects for the containment liner plate, and the aging degradation of the moisture barrier is provided by the implementation of ASME Section XI, Subsection IWE." On the subject of the protective benefits of coatings and cathodic protection, the applicant stated that the existing plant procedures ensured that these protective measures were effective. However, the applicant argued that these protective measures did not perform a license renewal intended function as defined in 10 CFR 54.4(a)(1), (2), and (3) and they were not credited in the determination of aging effects requiring management for protected structures and components. Therefore, coatings and cathodic protection did not require aging management review and aging management. In response to RAI 3.6.1.5-2, however, the applicant has provided the procedures used for ensuring the effectiveness of protective coatings. In a discussion on April 11, 2001, the applicant emphasized that the procedures for ensuring the effectiveness of the cathodic protection system are available at the plant site for a staff review. In the AMR inspection during August 20 - September 14, 2001, the inspectors verified that the operation procedures for the CPS are available at the plant site and are adequate.

[Parameters Monitored or Inspected] The parameters monitored and inspected are in accordance with the requirements of Subsection IWE of the ASME Section XI Code (the Code). They include examination categories E-A for containment surfaces; E-C for augmented examination; E-D for seals, gaskets, and moisture barriers; E-G for pressure-retaining bolting; and E-P for pressure-retaining components. For seals and gaskets, the applicant takes credit for implementing Appendix J to 10 CFR Part 50, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," as required by Examination Category E-P. The staff finds the parameters monitored and inspected acceptable.

[Detection of Aging Effects] Implementation of Subsection IWE examination requirements is credited for detecting aging effects of metal surfaces, such as pitting, excessive corrosion, and arc strikes. To detect the aging effects on seals and gaskets, the applicant relies on the requirements of Appendix J to 10 CFR Part 50.

With reference to the detection of aging effects element, the bottom liner plate of the containment structure at Turkey Point is covered with fill concrete, and hence its direct examination is not feasible. At the same time, borated water leaks and thermal and shrinkage related cracking of the fill concrete could give rise to corrosion of the bottom liner plate. In RAI 3.9.1.2-2 the staff asked if FPL has any program, whether as part of the IWE ISI or as part of the maintenance rule programs to detect the degradations and aging effects of the bottom liner plate. In the absence of a specific program, the applicant was asked to confirm that the bottom liner plate is not subjected to such degradation.

In its response to RAI 3.9.1.2-2, the applicant explained, that the Turkey Point containment structures have bottom liner plates that are embedded in the concrete with no exposed surfaces. The 18-inch thick concrete over the bottom liner protects the steel from corrosion. Containment concrete components are constructed of dense, well-cured concrete consistent with the guidance provided in ACI 201.2R-77. The concrete was designed in accordance with ACI 318-63. The aggregates were tested in accordance with ASTM C295. The concrete over the bottom liner is not normally exposed to an aggressive environment. These features ensure concrete cracking is minimized. Consequently, the concrete over the containment liner plate provides adequate protection of the inaccessible portions of the liner plate. In addition, a moisture barrier is provided that prevents intrusion of moisture between the concrete and the inaccessible liner surfaces. Additionally, when events occur such as borated water leaks, potential degradation of inaccessible structures is evaluated as part of the Corrective Action Program. Finally, the containment liner plate is periodically pressure tested in accordance with the ASME Section XI, Subsection IWE, Inservice Inspection Program (Category E-P), described in Application Appendix B, Subsection 3.2.1.2 (page B-30). Based on the design features and programs discussed above, there is reasonable assurance that the containment liner plate will continue to perform its intended function throughout the period of extended operation. Based on this response, the staff concludes that the applicant's program for managing the degradation of inaccessible liner plate is reasonable. The issue in RAI 3.9.1.2-2 is therefore closed. Based on the program element and the additional information provided by the applicant, the staff finds this element of the program acceptable.

[Monitoring and Trending] For frequency of examinations and augmented examinations which are required for monitoring and trending the aging effects the applicant relies on the examination and accepted criteria prescribed in subsection IWE. Furthermore, the applicant states that examinations performed during any inspection interval that reveal flaws or areas of degradation exceeding the acceptance criteria are expanded to include additional examinations within the same category. When examination results require evaluation of flaws or areas of degradation, the area(s) are reexamined during the next inspection interval. Flaws or areas of degradation are documented and evaluated in accordance with the corrective action program and the requirements of the ASME Section XI, Subsection IWE Inservice Inspection Program. The staff finds it acceptable

[Acceptance Criteria] Acceptance criteria are based on the acceptance standards established in IWE-3000 of Subsection IWE of the ASME Section XI Code. Moreover, the applicant stated that the inspection results that reveal evidence of degradation exceeding the acceptance standards may be subjected to additional inspections to determine the nature and extent of the conditions. The staff considers this acceptable.

[Operating Experience and Demonstration] The applicant stated that prior to the implementation of Subsection IWE as required by 10 CFR 50.55a, the examination of the containment's steel components were performed in accordance with the requirements of Appendix J to 10 CFR Part 50. The Appendix J tests performed at the Turkey Point units during the years of operation have not shown any loss of intended function of the containment steel components. Moreover, the applicant stated that material properties for nonmetallic components (such as gaskets and seals) change over time, and these components are replaced in accordance with approved plant procedures. Based on the inspections performed prior to the implementation of Subsection IWE, as part of the operating experience, in RAI 3.9.1.2-4 the applicant was asked to provide a summary of significant events related to the following failure mechanisms:

- liner corrosion
- major penetrations leakage (equipment hatches, airlocks, main steam line, feedwater line) that does not meet the Type B leakage rate requirements
- leakage and corrosion of bellows (if applicable)
- isolation valve leakages (system or Type B test)
- Type A tests that do not meet the containment leak rate criteria

The applicant was also asked to include the corrective actions taken and procedures modified to alleviate such events in the future. In its response, the applicant provided a summary of the operating experience related to the five items in the RAI. These responses indicated that the applicant is fully cognizant with the plant-specific experience, and the aging management program factors in the lessons learned from the operating experience. The issue in RAI item 3.9.1.2-4 is therefore closed

The staff believes that the applicant has provided pertinent operating experience and the program element is acceptable.

3.9.1.2.3 FSAR Supplement

UFSAR Supplement Section 16.2.1.2 included with the application contains a sufficient program description.

3.9.1.2.4 Conclusion

Based on the staff's review described above, the staff concludes that this aging management program provides reasonable assurance that the aging of the pressure retaining components of the primary containment structures at Turkey Point, Units 3 and 4, will be adequately managed during the period of extended operation.

3.9.1.3 ASME Section XI Subsection IWF Inservice Inspection Program

3.9.1.3.1 Summary of Technical Information in the Application

The applicant described its ASME Section XI, Subsection IWF Inservice Inspection Program in Section 3.2.1.3 of Appendix B to the Application. The applicant stated that the program is credited for aging management of Class 1, 2, and 3 component supports in the containments, auxiliary building, emergency diesel generator building, and yard structures.

3.9.1.3.2 Staff Evaluation

As indicated in Table 3.6-2 of the Application, the containments contain safety-related piping and component supports, reactor vessel supports, steam generator supports, pressurizer supports, reactor coolant supports, and surge line supports, all manufactured from carbon steel, which are exposed to the containment air environment. The applicant credited the Subsection IWF Inservice Inspection Program for managing the aging effect (loss of material) for these piping and component supports. Tables 3.6-3, 3.6-10, and 3.6-20 of the Application indicated the auxiliary building, emergency diesel generator building, and yard structures contain safety-related piping and component supports, manufactured from carbon steel, which are exposed to an indoor environment that is not air-conditioned. Based on Table 3.6-20, the yard structures also contain safety-related piping and component supports, manufactured from carbon steel, which are exposed to the outdoor environment. The applicant credited the Subsection IWF Inservice Inspection Program for managing the aging effect (loss of material) for these piping and component supports.

The staff evaluation of the Subsection IWF Inservice Inspection Program focused on how the program manages the aging effect of loss of material through effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience.

It is noted that corrective actions, confirmation process, and administrative controls for license renewal are in accordance with the site-controlled quality assurance program pursuant to 10 CFR Part 50, Appendix B, and covers all structures and components subject to an aging management review. The staff evaluation of the applicant's quality assurance program is provided separately in Section 3.1.2 of this safety evaluation report. This program satisfies the elements of corrective actions, confirmation process and administrative controls. The remaining seven elements are discussed below.

[Program Scope] The applicant stated that the ASME Section XI, Subsection IWF Inservice Inspection Program is credited with managing the aging effect of loss of material for Class 1, 2, and 3 component supports (including pipe supports) located in the containments, auxiliary building, emergency diesel generator building, and yard structures. The scope of the Turkey Point program provides inspection and examination of accessible surface areas of these component supports. This is acceptable to the staff.

[Preventive Actions] The applicant stated that carbon steel surfaces are typically coated, in accordance with plant procedures, to reduce the effects of loss of material due to corrosion. Coatings minimize corrosion by limiting exposure to the environment. However, coatings are not credited in the determination of the aging effects requiring management. Therefore, no preventive actions are applicable to this program.

[Parameters Monitored or Inspected] The applicant stated that Class 1, 2, and 3 component supports are examined in accordance with ASME Section XI, Subsection IWF. The Subsection IWF Inservice Inspection Program provides for visual examination for general corrosion that could reduce the structural capacity of the component supports. This is acceptable to the staff, because the is in accordance with accepted industry code.

[Detection of Aging Effects] The applicant stated that the presence of corrosion that could lead to loss of material is determined by visual inspection of component supports. Surfaces are examined for evidence of flaking, blistering, peeling, discoloration, wear, pitting, corrosion, arc strikes, gouges, surface discontinuities, dents, or other signs of surface irregularities. The extent and frequency of the inspections are in accordance with ASME Section XI, Subsection IWF. This is acceptable to the staff.

[Monitoring and Trending] Selected supports are monitored during each inspection period. The program inspects 25% of non-exempt Class 1 piping supports, 15% of Class 2 piping supports, and 10% of Class 3 piping supports, plus several unique supports other than piping supports. The applicant stated that, for those component supports within a system that have similar design, function, and service, only one support is examined. Unacceptable supports are subject to corrective measures or evaluation, and are reexamined during the next inspection period. This is acceptable to the staff, because this is in accordance with accepted industry code.

[Acceptance Criteria] The applicant stated that acceptance standards for the examination and evaluation of supports are provided in ASME Section XI, Subsection IWF. A condition observed during a visual examination that requires supplemental examination, corrective measures, repair, replacement, or analytical evaluation is categorized as a relevant condition and is not considered acceptable. This is acceptable to the staff, because this is in accordance with accepted industry code.

[Operating Experience] The ASME Section XI, Subsection IWF, inspections are conducted as part of the inservice inspections typically during plant refueling outages. The applicant stated that the inspection of Class 1, 2, and 3 component supports has been conducted since initial plant startup, as required by the Technical Specifications.

ASME Section XI provides the rules and requirements for inservice inspection testing, repair, and replacement of Class 1, 2, and 3 component supports. The ASME Section XI, Subsection IWF Inservice Inspection Program applies to Class 1, 2, and 3 component supports. These supports are chosen for inspection in accordance with the requirements of ASME Section XI, Subsection IWF, and shall be inspected using visual examination methods.

The visual examinations of Class 1, 2, and 3 component supports look for deformations or structural degradations, corrosion, and other conditions that could affect the intended function of the support. All conditions noted during the inspection of component supports, whether or not they are considered to require further review, are documented on inspection reports. The applicant stated that the FPL Nuclear Division Quality Assurance Department performed an audit of the inservice inspection program, and concluded that the program was complete and in compliance with the requirements of the ASME Code, Section XI, and applicable commitments.

The staff finds that the past plant operation serves to ensure successful future performance of the ASME Section XI, Subsection IWF ISI program, and is acceptable.