In RAI 2.3.4-3, the staff requested the licensee to justify its determination of the evaluation boundary for the steam generator blowdown system ending at several valves, SGML-3-011, SGWL-3-031, SGWL-3-049, SGWL-4-011, SGWL-4-031, and SGWL-4-049. These valves are shown in Drawing Nos. 3-FW-04 and 4-FW-04 as normally opened. It was not clear that a failure of downstream piping of these valves did not affect the containment isolation function.

The licensee responded that the above valves are normally locked closed as shown in UFSAR Figures 10.2-55 and 10.2-56. These valves are only open when steam generator wet layup is in service, during outages when the plant is in Modes 5, 6, or defueled. Since these valves are normally closed, the staff finds the scoping boundary established by the applicant acceptable.

In RAI 2.3.4-4, the staff requested the licensee to justify its determination of the evaluation boundary for the steam turbines for AFW pumps in Drawing No. 0-AFW-01. The evaluation boundary for the piping ended, in some cases, at the components such as open valves, flow reducers, or orifices (e.g., ST-49, ST-52, ST-46, 20-461C, 20-462C, RO-6265C, ..., etc.) that are not pressure boundary. It was not clear that a failure of downstream piping of these components did not affect the pressure integrity of the AFW system.

The applicant responded that the restrictive orifices at the discharge of the AFW turbines were designed and sized to provide for continuous drainage from the turbine to prevent accumulation of condenser/water. The orifices are sized such that failure of the downstream piping will not impede the function of the turbine. Similarly, this system is designed such that the amount of steam leakage through the small diameter piping (small open valves) is insignificant and does not affect the system and component function. Steam traps are closed valves that open to release any accumulated condensate/water. Once the condensate is removed, the steam trap (valve) automatically returns to the closed position. Based on the above, the piping and components downstream of the orifices and steam traps do not perform or support any license renewal system functions that satisfy the scoping criteria of 10 CFR 54.4, and therefore, are not within the scope of license renewal. Based on the applicant's justification, the staff finds its determination of the steam turbines scoping boundary acceptable.

The staff identified, in drawing No. 4-AFW-01, part of the flow path from steam generator A in location G3 was within the scope of license renewal, but not highlighted. In the meeting of January 4, 2001, the applicant clarified that the flow path is correctly identified as within scope based on the license renewal boundary flag. The highlight, which the applicant used as a technique to facilitate the review, was erroneously cut off prior to the boundary. In the meeting the applicant stated that they would expand the highlight to the license renewal boundary whenever the drawing is revised. The staff agrees with the applicant.

On the basis of the NRC staff's review of the LRA and associated drawings, the Turkey Point UFSAR, and the applicant's responses to RAIs, the staff did not identify any omissions from the components highlighted in the diagrams that identify the system level scoping boundaries. The NRC staff also compared the components listed in Tables 3.5-1 through 3.5-3 of the LRA and the components highlighted in the drawings, and found them consistent.

2.3.4.3 Conclusion

On the basis of the review of Sections 2.3.4, and Sections 10.2.2, 10.2.4.3, and 9.11 of the UFSAR, the NRC staff has determined that there is reasonable assurance that the applicant has adequately identified the steam and power conversion systems components that are within the scope of the license renewal role and subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4 Scoping and Screening Results – Structures

2.4.1 Containment

The containment for each unit is a domed structure that houses the reactor vessel, reactor coolant system and supports, and other systems that interface with the reactor coolant system. The structures of the containment are divided into two classifications, i.e., containment structure and containment internal structures. The structural components of the containment are further grouped by material or function into component/commodity sets that require an AMR.

2.4.1.1 Containment Structure

In Section 2.4.1.1, "Containment Structure," of the LRA, the applicant described the containment structure and identified its structural components that are within the scope of license renewal and subject to an AMR. The design of the containment structure is described in Sections 5.1.2 and 5.1.6 of the UFSAR. The staff reviewed the information submitted by the applicant to determine whether the applicant has adequately demonstrated that the requirements of 10 CFR 54.4 and 10 CFR 54.21 have been met for the containment structure and its associated structural components.

2.4.1.1.1 Technical Information In the Application

In Section 2.4.1.1 of the LRA, the applicant states that the containment structure consists of a post-tensioned reinforced concrete cylindrical shaped wall, a shallow dome roof, and a reinforced concrete foundation slab. The containment is designed as a Seismic Category 1 structure that withstands all applicable loads without loss of function and prevents uncontrolled release of radioactive material as a result of a specified seismic event. The applicant has determined that seismic Category 1 structures meet the intent of 10 CFR 54.4(a)(1) and are within the scope of license renewal.

The internal surfaces of the containment, including wall, roof, and foundation, are lined with a carbon steel liner to maintain a high degree of leak-tightness. The external surface of the liner plates, except for the floor liner, is coated on the inside with inorganic zinc primer and painted. The liner plate for the floors is placed on top of the foundation concrete pour and is covered with an additional concrete floor cover. The boundary of the containment includes all the penetration assemblies that penetrate the containment wall, such as mechanical penetrations, electrical penetrations, the equipment and personnel hatches.

Various penetrations through the containment boundary provide for the passage of piping and electrical conduits. These penetrations are designed to maintain an essentially leak-tight barrier to prevent uncontrolled release of radioactivity. The mechanical penetrations are rigid welded type assemblies that are solidly anchored to the containment wall. The electrical penetrations consist of carbon steel pipe canisters with stainless steel or carbon steel header plates welded to each other. A fuel transfer tube penetrates the containment to link the refueling canal inside the containment and the SFP in the auxiliary building. During normal operation, a blind flange is installed on the fuel transfer tube to serve as a containment isolation barrier. The fuel transfer tube is addressed in Sections 6.6.2 and 6.6.3 of the UFSAR. Other penetrations are addressed in Sections 5.1.5.2 and 5.1.5.3 of the UFSAR.

There are two personnel hatches and an equipment hatch at the containment cylindrical wall. The equipment hatch is a large flanged penetration that provides access to the containment interior at the mezzanine level. A double-gasket dished head steel plate seals the opening. A double O-ring seal (with the O-rings in grooves in the head flange) makes up the final seal. The personnel hatch is a cylindrical tube that passes through the containment wall and is welded to the steel liner. The cylinder has doors at each end. A mechanical interlock permits only one door to be open at any given time. Each door is provided with double gaskets that are sealed with double O-rings. The machined surface of the doorplate seals the opening against the O-rings when the door is locked. The equipment hatch and personnel hatch are addressed in Section 5.1.5.1 of the UFSAR.

The applicant has determined that the structural components and commodities of the containment structure are within the scope of license renewal because they perform one or more of the following intended functions which meet the 10 CFR 54.4 criteria:

- Provide a leak-tight pressure boundary and/or fission product barrier.
- Provide structural support to safety-related components.
- Provide shelter/protection to safety-related components (including radiation shielding).
- Provide a rated fire barrier to retard spreading of a fire.
- Provide a missile barrier.
- Provide structural support to non-safety-related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions.
- Provide a flood protection barrier.
- Provide structural support and/or shelter to components required for fire protection, anticipated transient without scram, and/or station blackout events.
- Provide pipe whip restraint and/or jet impingement protection.

In Table 3.6-2 of the LRA, the applicant lists the structural components and commodities that are subject to an AMR for both the containment structure and containment internal structures. The applicant further grouped them into 36 structural components or unique commodities. These components and commodities meet the criteria of 10 CFR 54.21(a)(1) because they perform applicable intended functions without moving parts or without a change of configuration or properties, and they are not replaced based on a qualified life or specified time period.

2.4.1.1.2 Staff Evaluation

The staff reviewed Section 2.4.1.1 of the LRA and the UFSAR to determine whether the applicant has adequately implemented its methodologies as described in Section 2.1 of the LRA so that there is reasonable assurance that the structural components and commodities of the containment have been properly identified as being within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21, respectively. After completing its initial review, the staff issued a request for additional information (RAI) in a letter to the applicant dated February 2, 2001. The applicant responded to the staff's RAI in a letter to the NRC dated March 1, 2001.

The staff reviewed the information in Section 2.4.1.1 of the LRA, Sections 5.1.2 and 5.1.6 of the UFSAR, and additional information submitted by the applicant in response to the staff's RAIs to determine if there were any structures or components within the containment boundary that the applicant did not identify as being within the scope of license renewal or as being subject to an AMR. On the basis of this review, the staff has made the findings described below.

The lower tendon access galleries are the reinforced concrete enclosure constructed at the underside of the containment foundation slab perimeter. The tendon galleries serve as the access to the lower vertical tendon anchorage for tendon inspection and surveillance. In Section 2.4.1.1.1 of the LRA, the applicant states that the lower tendon access galleries and the inspection pits do not support the intended function of the containment structure and are not within the scope of license renewal. The staff reviewed this information and found that the tendon gallery protects the bottom anchorages of the tendons and provides access for tendon anchorage inspection. The staff agrees that the tendon access gallery does not have to be within the scope of license renewal because it does not perform a containment pressure boundary function or any other function under 10 CFR 54.4.

Waterproofing membranes and water-stops are used underneath the foundation mat and outside the lower portion of the containment wall. They were installed at the connections between the pit walls and base mat of the tendon gallery to inhibit the intrusion of groundwater. In Section 2.4.1.1.1 of the LRA, the applicant states that the waterproofing membranes and water-stops are piece parts and are not identified as a unique commodity within the scope of license renewal. The staff considers that the water-stops are important in maintaining the integrity of the components to which they connect. Groundwater in-leakage into the concrete construction joints could occur as a result of degradation of the water-stops. The staff asked the applicant why the water-stops are not considered as a unique commodity within the scope of license renewal.

In its response, the applicant stated that the systems and structures monitoring program is credited to manage the aging of concrete structures below the groundwater level. The program will monitor degradation of the waterproofing membranes and water-stops by identifying evidence of groundwater in-leakage at accessible internal surfaces of the tendon gallery walls below the groundwater level. The applicant has determined that the tendon gallery is not within the scope of license renewal because it is not part of the containment pressure boundary. The staff reviewed this information and found that excluding the waterproofing membranes and water-stops from the scope of license renewal is acceptable because degradation of the water-stops will not affect the containment integrity.

Section 2.4.1.1.1 of the LRA states that the load-carrying capacity of the containment liner plate anchorages is required to support equipment, such as the polar crane. The staff asked if there are any other cranes or load-carrying supports attached to the liner plate that are within the scope of license renewal. In its response, the applicant stated that the polar crane is the only crane attached to the liner plate. The polar crane support brackets penetrate through the containment liner plate and are embedded in the containment concrete wall. Other attachments, such as pipe supports and structural steels attached to the liner plate, are also anchored in the concrete. The applicant indicated that all the containment liner anchorages and embedment are within the scope of license renewal with no exception.

Table 3.6-2 of the LRA lists the mechanical piping penetrations, mechanical ventilation penetrations, and electrical penetrations as components that are subject to an AMR. The staff reviewed these penetrations to determine whether the applicant had properly identified the components of the penetrations that are subject to an AMR from among those containment penetrations within the scope of license renewal. The staff found that these penetrations are not individually described in the LRA and there is no reference which can be used to determine whether the applicant has properly identified the components subject to an AMR. However, Section 2.3.2.3 of the LRA states that all the containment penetrations and associated containment isolation valves and components that ensure containment integrity, regardless of where they are described, require an AMR. The applicant has determined that all the penetrations and associated components at the containment wall are in-scope and subject to an AMR for license renewal. Therefore, the staff determines that the applicant made no omissions in scoping the containment penetrations. These penetrations are part of the containment isolation system which is described in Section 6.6 of the USAR.

Table 3.6-2 of the LRA lists the components of the fuel transfer tube that are subject to an AMR for license renewal. The closures between the fuel transfer tube and the sleeves that are welded to the liner plate are not listed as components requiring an AMR. The applicant indicated that blind flanges and transfer tubes and sleeves are included within the containment pressure boundary for license renewal. The staff review found that the fuel transfer tube and its attachments are also within the scope of license renewal and subject to an AMR and are evaluated in Section 2.4.2.14 of this SER as part of components of the spent fuel storage and handling system.

In Table 3.6-2 of the LRA, the personnel hatch, emergency escape hatch, and equipment hatch are listed as components of the containment structure within the scope of license renewal. However, the applicant did not explain which of the subcomponents of the hatches require an AMR. The staff asked the applicant whether the hatch door interlock systems, equalizing valves, door seals, and operation mechanisms (such as gears, latches, hinges) are in-scope and subject to an AMR for license renewal.

In its response, the applicant stated that hatch door interlocks are active components and, therefore, do not require an AMR. Hatch valves that perform a containment pressure boundary isolation function are within the scope of license renewal and are listed in Table 3.3-3 of the LRA with the components of the containment purge system. Hatch seals are within the scope of license renewal and are listed in Table 3.6-2 of the LRA. Operation mechanisms (e.g., gears and linkages) that function to open and close the hatches are active components and do not require an AMR. However, the active mechanisms, such as latches and hinges, that are required to maintain the hatch in the closed position are within the scope of license renewal and are listed as part of the hatch in Table 3.6-2 of the LRA.

The staff reviewed the response in which the applicant identified certain active subcomponents that perform a passive function associated with maintaining the hatch in the closed position while others (e.g., gears and linkages) do not maintain the hatch in the closed position. The staff also confirmed the functions of the hatch subcomponents during the AMR inspection (August — September 2000).

The staff has reviewed the information presented in Section 2.4.1.1 of the LRA, the UFSAR, and the additional information submitted by the applicant in response to the staff's RAIs. The staff finds that the applicant made no omissions in scoping the containment structure and components for license renewal. The staff's review also found that all the passive SCs identified as being within the scope of license renewal were subject to an AMR.

2.4.1.1.3 Conclusion

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the containment structure and its associated structural components within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.1.2 Containment Internal Structural Components

In Section 2.4.1.2, "Containment Internal Structural Components," of the LRA, the applicant described the containment internal structures and identified the structural components that are within the scope of license renewal and subject to an AMR. The design of the containment internal structures is described in Sections 5.1.2 and 5.1.9 of the USAR. The staff reviewed this information provided by the applicant to determine whether the applicant has adequately demonstrated that the requirements of 10 CFR 54.4 and 10 CFR 54.21 have been met for the containment internal structures.

2.4.1.2.1 Technical Information in the Application

In Section 2.4.1.2 of the LRA, the applicant states that the containment internal structures consist mainly of the reactor primary shield wall, the lower secondary compartment, the upper secondary compartments, the refueling cavity, and the reactor coolant system supports.

The primary shield wall is a 7-ft thick cylindrical wall enclosing the reactor vessel that provides biological shielding and structural support. The lower secondary compartment consists of the secondary shield walls that support the intermediate floor at elevation 30'-6" and encloses the reactor coolant loops. There are four upper secondary compartments. Three of them enclose one reactor coolant loop each and the fourth encloses the pressurizer. The secondary compartment walls support the operating floor at elevation 58'-0" and provide secondary biological shielding. The primary and secondary shield walls and the operating floor also serve as missile barriers to prevent missiles generated by high-pressure equipment from damaging the containment liner, pipe penetrations, and the required engineered safeguard systems.

The refueling cavity (refueling canal) is a stainless-steel-lined reinforced concrete pool above the reactor for refueling purposes. The irregularly shaped pool, formed by the upper portions of the primary shield wall and other sidewalls of varying thicknesses, contains the space for storing the upper and lower reactor internals packages and miscellaneous refueling tools. A removable reinforced concrete cover, located above the reactor vessel head, is provided to block any postulated missile generated by the control rod drive mechanisms.

The reactor coolant system (RCS) supports include the supports for the reactor pressure vessel, steam generators, reactor coolant pumps, and the pressurizer. The reactor pressure vessel (RPV) is supported and restrained on its six nozzles, which provide vertical and tangential support to restrain the RPV for all the design loads. The support components are located near the beltline region of the RPV under the RPV nozzles. Each nozzle bears on three rollers set on a girder which is carried by three beams cantilevered from the primary shield wall. A shear lug on either side of the nozzle shoe provides tangential restraint. There are no vertical holddown clamps to resist upward forces because the dead weight of the reactor vessel and the rigid primary-loop pipes provide enough resistance against uplift.

The steam generator (SG) support restrains the SG for all design loading conditions and allows free thermal expansion of the RCS piping and the SG itself. Each SG has four support lugs near its bottom. Each lug is bolted to the horizontal web of a T-shaped weldment that is vertically supported by twin columns and horizontally restrained by another plate anchored in the concrete slab surrounding the reactor vessel. The four T-shaped weldments and the associated bearing plates constitute the bottom vertical and lateral support. An upper support, consisting of a ring girder, transfers lateral loads in all directions from the SG to the operating floor slab through embedded steel plates.

The reactor coolant pump (RCP) support restrains the RCP for all design loading conditions while allowing free thermal expansion of the RCS piping and the RCP itself. The RCP is supported by three support lugs, each of which is supported on twin columns with a T-shaped plate weldment and laterally restrained and bolted into the surrounding reinforced concrete structure which is similar to the lower lateral supports of the steam generators. Axial thermal expansion of the coolant pipe, radial expansion of pump casing, and upward expansion of the support columns are permitted by the same combination of slotted holes and lubricated plates as is used in the steam generator supports.

The pressurizer support restrains the pressurizer for all design loading conditions while allowing free movement of the pressurizer under the range of temperatures encountered during plant operation. The pressurizer is supported at the base with skirt support and the skirt is bolted onto the concrete floor. Lateral support near the center of gravity of the pressurizer is provided to resist seismic loads. There is no upper support.

To evaluate aging of the reactor coolant system supports, Westinghouse developed WCAP-14422, "License Renewal Evaluation: Aging Management for Reactor Coolant System Supports." The technical report is generically applicable to domestic commercial nuclear power plants that began operating from 1968 to 1996 with the Westinghouse nuclear steam supply system, including Turkey Point 3 and 4. The report is used as a reference for the license renewal application.

Other containment internal structures, such as concrete walls, floors, beams, equipment pads, and steel structures, are of conventional design and provide support for the systems, components, equipment, and concrete floors. There are steel structures inside the containment to allow access to the various elevations for inspection and maintenance and to support the safety-related and non-safety-related systems, components, and equipment, such as piping, ducts, miscellaneous equipment, electrical cable trays and conduits, instruments and tubing, and enclosures and racks for the electrical components and instrumentation. The associated components of these steel structures include steel beams and columns, stairways, ladders, and the attachments of the concrete walls and liner.

2.4.1.2.2 Staff Evaluation

The staff reviewed LRA Section 2.4.1.2 and the UFSAR to determine if there is reasonable assurance that the applicant has identified the SCs comprising the containment internals that are within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4 and 10 CFR 54.21, respectively. After completing its initial review, the staff requested additional information relating to the containment internals in a letter to the applicant dated February 2, 2001. The applicant responded to the staff's questions in a letter to the NRC dated March 1, 2001.

The applicant listed the structural components and commodities that are subject to an AMR in Table 3.6-2 of the LRA and listed their intended functions in Table 3.6-1 of the LRA. The staff reviewed the information submitted by the applicant and found that the grouping of the structural components and commodities was correct, except that the following areas need to be verified.

Section 2.4.1.2 of the LRA did not address the control rod drive service structure. In RAI 2.4.1-5, the staff asked whether the control rod drive service structures are within the scope of license renewal. In its response, the applicant stated that the control rod drive mechanism (CRDM) housings which serve the pressure boundary function are described in Section 2.3.1.5 of the LRA. They are the Seismic Category 1 structural components. The CRDM housings are supported by the reactor vessel closure head at the bottom and by lateral supports at the top. The lateral supports consist of a platform assembly and struts. The struts span the platform assembly and the reactor cavity wall. These supports are included within the scope of license renewal and are subject to an AMR. The structural components for the CRDM housings are included in Table 3.6-2 as the commodity group under the label "Safety-Related Piping and Component

Supports." The staff reviewed the information provided by the applicant and did not identify any omissions by the applicant for the control rod drive service structures.

Table 3.6-2 of the LRA lists the reactor vessel supports, steam generator supports, pressurizer supports, reactor coolant pump supports, and surge line supports as components of the containment internal structures subject to an AMR. However, Section 2.4.1.2.2 of the LRA did not describe these structures. In RAI 2.4.1-4, the staff asked that the applicant provide additional information on the reactor coolant system supports and their boundaries that are in-scope and are subject to an AMR for license renewal.

In its response, the applicant stated that the reactor coolant system supports are described in Section 4.2 of the USAR. Additional descriptions and figures are provided in WCAP-14422. Specifically, Table 2-2 of WCAP-14422 provides the primary component support configuration classification applicable to Turkey Point Units 3 and 4. In Section 2.4.1.2.2 of the LRA, the applicant also states that the design of the Turkey Point reactor coolant system supports and their intended functions are consistent with the descriptions contained in WCAP-14422. The reactor coolant system support boundaries subject to an AMR include all structural support items between the reactor coolant system components and the containment concrete structure up to, but not including, the integral attachments that are on the reactor coolant system components. The integral attachments on the reactor coolant components are reviewed with the components and the concrete structure is reviewed with the containment structure.

The staff reviewed the portion of WCAP-14422 that is applicable to the Turkey Point plant to determine whether the report has provided the required information to support this review. The staff also reviewed Section 4.2 of the USAR on the portions that were not addressed in the LRA to determine whether they are within the scope of license renewal. The staff summarized the technical information from the WCAP, the UFSAR, and the applicant's responses in Section 2.4.1.2.1 of SER. The staff found that some of the structural components normally associated with the reactor coolant system supports were included by the applicant in other sections of the LRA for scoping purposes. However, the applicant has determined that all the structural support items related to the reactor coolant system supports are within the scope of license renewal and subject to an AMR. Therefore, the staff found no omissions by the applicant.

There are two recirculating sumps in the containment and each has a line to the suction of the RHR pumps. The containment sumps are described in Sections 6.2.1 and 6.4.2 of the USAR. In Table 3.6-2 of the LRA, only sump screens are listed as the components subject to an AMR, but the sump itself is not included. The staff's review found that the containment sumps are in-scope and subject to an AMR for license renewal as part of the containment concrete floor.

2.4.1.2.3 Conclusion

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the containment internal structural components within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.2 Other Structures

The other structures within the scope of license renewal are the passive, long-lived structures other than the containment and containment internals. The applicant has determined that the following structures are included in the scope of license renewal: auxiliary building, cold chemistry laboratory, control building, cooling water canals, diesel driven fire pump enclosure, electrical penetration rooms, EDGB, fire protection monitoring station, fire-rated assemblies, intake structure, main steam and feed-water platforms, plant vent stack, spent fuel storage and handling, turbine building, turbine gantry cranes, Turkey Point Units 1 and 2 chimneys, and yard structures.

2.4.2.1 Auxiliary Building

In LRA Section 2.4.2.1, "Auxiliary Building," the applicant describes the auxiliary building structure and identifies the structural components of the auxiliary building that are within the scope of license renewal and subject to an AMR. The applicant states that the fuel handling building structure (including the concrete SFP and the reinforced concrete overhead sliding doors) is within the auxiliary building. Therefore, the fuel handling building structure is addressed in section 2.4.2.1 as a structural component in the auxiliary building. The design of the auxiliary building and its structural components, including the fuel handling building (the SFP), that are housed within the auxiliary building are described in Sections 5.2 and 9.5 of the UFSAR, respectively.

2.4.2.1.1 Summary of Technical Information in the Application

In LRA Figure 2.2-1, "Turkey Point Plant Structures," the applicant depicts the general location of the auxiliary building. The auxiliary building is located adjacent to and east of the control building and is flanked on its northwest and southwest corners by the Unit 3 and 4 containment structures, respectively. The auxiliary building houses some safety-related Class I systems (CCW, SFP cooling, chemical and volume control, primary water makeup, sample systems, waste disposal) and associated SCs that support normal operation, shutdown, and accident conditions. It is designed and constructed on a foundation mat with concrete bearing walls and slabs. It was built partially below grade. The construction joints of the exterior concrete wall contain a water-proofing membrane with concrete topping below the plant's design groundwater elevation. As stated in Section 5.2 in the UFSAR, certain portions of the auxiliary building structure and structural components are designed and constructed to Seismic Category I requirements. Seismic Category 1 structures are designed to prevent uncontrolled release of radioactivity and to withstand all applicable loads, including but not limited to system and seismic loadings, without loss of function. The applicant has determined that the Seismic Category 1 structural components of the auxiliary building meet the intent of 10 CFR 54.4(a)(1) for license renewal.

The structural components within the auxiliary building (i.e., the SFP and spent fuel storage pit) are lined with a seam-welded stainless steel plate liner and designed to withstand the earthquake loadings as Class I structures. The SFP and cask pit provide for underwater storage of spent fuel and control rods after they are removed from the reactor cavity. The spent fuel pit is lined with stainless steel and is used to store stainless steel storage racks that rest on the floor and hold fuel assemblies. The liner prevents leakage even in the event the reinforced concrete develops cracks. The applicant has determined that the liner is a Seismic Category I structure that meets the intent of 10 CFR 54.4(a)(1) for license renewal. The applicant listed the passive and long-lived components and commodities unique to the auxiliary building in Table 3.6-3. The applicant also determined that some areas in the auxiliary building (i.e., areas that serve as fire barriers) meet the scoping requirements of 10 CFR 54.4(a)(3) in that these components are relied upon in plant evaluations to perform functions compliant with 10 CFR 50.48. The fire barriers (i.e., fire retardant coatings, fireproofing, and fire doors) are grouped as fire-rated assemblies in Table 3.6-12, while fire walls and slabs are grouped as reinforced concrete components in Table 3.6.3. Fire barriers are addressed under Section 2.4.2.10 of this SER.

The applicant describes its methodology for identifying the structural components within the scope of license renewal in Section 2.1.1 of the LRA. Based on its scoping methodology, the applicant, in Section 2.2, Table 2.2-2, of the LRA, identifies the auxiliary building as being within the scope of license renewal and describes the results of its scoping methodology in Section 2.4.2.1 of the LRA.

The auxiliary building and its structural components meet the intent of 10 CFR 54.4(a)(1) for license renewal because they perform one or more of the following functions:

- House and provide structural support to safety-related components.
- Provide shelter/protection of safety-related components (including radiation shielding).
- Provide a rated fire barrier to retard spreading of a fire.
- Provide a missile barrier.
- Provide structural support to non-safety-related components whose failure could prevent satisfactory accomplishment of required safety-related functions.
- Provide a flood protection barrier.
- Provide structural support and/or shelter/protection to components required for fire protection, anticipated transients without scram (ATWS), and/or station blackout events.
- Provide pipe whip restraints and/or jet impingement protection.

On the basis of the above-described methodology, the applicant identifies both the structural components and the commodity groups that make up the auxiliary building and identifies the intended functions of the structural components and commodity groups that are subject to an AMR in Table 3.6-3 in the LRA. Some of the structural components in the auxiliary building are common to many other buildings; however, they are uniquely identified as commodity group items in Table 3.6-3 of the LRA. The commodity group is addressed by the applicant in Section 3.6.2 of the LRA. As stated by the applicant, the SCs and commodities in the auxiliary building are subject to an AMR because they perform their intended functions without moving parts or without change in configuration or properties, and are not subject to periodic replacement based on a qualified life or specified time limit.

2.4.2.1.2 Staff Evaluation

The NRC staff reviewed Section 2.4.2.1 of the LRA and the supporting information in Sections 5.2 and 9.5 of the Turkey Point Unit 3 and 4 UFSAR to determine whether there is reasonable assurance that the SCs and commodities of the auxiliary building have been adequately identified as being within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.21(a)(1).

The staff reviewed the structural component/commodity groupings in Table 3.6-3 (reinforced concrete foundations and walls; reinforced concrete foundation beams, columns, walls, floors/slabs; miscellaneous steel stairs, platforms, grating, etc.) to determine if there were any other components in the auxiliary building that meet the scoping criteria of 10 CFR 54.4(a) but were not included within the scope of license renewal. As a result of this review, the staff requested clarifying information regarding the auxiliary building and its structural components that serve as fire barriers. The applicant responded to the staff's concerns in a meeting on January 24, 2001. The applicant stated that the fire barriers and doors are not listed in Table 3.6-3 in the LRA as a commodity of the auxiliary building. Only the concrete structural components that serve as fire barriers are included in the commodity group in the auxiliary building. The fire barriers and doors, which are needed to protect safety-related SSCs by providing a rated fire barrier to confine a fire from spreading to adjacent areas of the plant of are listed in Table 3.6-12, "Fire-Rated Assemblies," and evaluated under Section 2.4.2.10 this SER.

In LRA Section 2.4.2.1, the applicant states that the fuel handling building itself is within the scope of license renewal. Any associated fire walls and slabs within the fuel handling building are within the scope of license renewal and subject to an AMR. These components are addressed along with those for the auxiliary building in Table 3.6-3.

The staff has reviewed Section 2.4.2.1 of the LRA and the Turkey Point Unit 3 and 4 UFSAR. The staff also examined the components and commodities listed in Tables 3.6-3 and 3.6-12 of the LRA to determine if they are the only SCs that are subject to an AMR in accordance with 10 CFR 54.21(a)(1). On the basis of the above review, the staff did not identify any omissions by the applicant.

2.4.2.1.3 Conclusions

On the basis of the review described above, the staff found that there is reasonable assurance that the applicant has appropriately identified the portions of the auxiliary building, including the fuel handling building, that are within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.2.2 Cold Chemistry Laboratory

In Section 2.4.2.2, "Cold Chemistry Laboratory," of the LRA, the applicant described the structure of the cold chemistry laboratory and identified its structural components that are within the scope of license renewal and subject to an AMR.

2.4.2.2.1 Summary of Technical Information in the Application

The cold chemistry laboratory building, located southwest of the turbine building, is a non-safety-related reinforced concrete frame structure with a reinforced concrete roof. The laboratory is used to process the non-radioactive samplings. The laboratory building does not perform any safety-related functions or directly protect any safety-related equipment. However, the building is located next to a safety-related mechanical system. The applicant has determined that the cold chemistry laboratory building is within the scope of license renewal because its failure could prevent satisfactory accomplishment of required safety-related functions. The location of the building is shown in Fig. 2.2-1 of the LRA.

2.4.2.2.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.2 of the LRA and the USAR to determine whether there is reasonable assurance that the structure and structural components of the cold chemistry laboratory have been properly identified as being within the scope of license renewal and subject to an AMR in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

The applicant listed the structural components of the cold chemistry laboratory in Table 3.6-4 of the LRA. In the table, the applicant listed the reinforced concrete foundations, walls, and roof as the components requiring an AMR. These components are passive and are considered to be long-lived, unless specific justification is provided to the contrary. In a meeting with the applicant on January 4, 2001, the staff verified the SCs of the cold chemistry laboratory with the applicant and found that the scoping of the structural components was correct. Therefore, there is reasonable assurance that the applicant has appropriately identified the SCs subject to an AMR for the cold chemistry laboratory pursuant to 10 CFR 54.21(a)(1).

2.4.2.2.3 Conclusion

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the SCs that are within the scope of license renewal and subject to an AMR in accordance with the requirements of 10 CFR54.4 and 10 CFR54.21(a)(1), respectively.

2.4.2.3 Control Building

In Section 2.4.2.3, "Control Building," of the LRA, the applicant described the structure of the control building and identified its structural components that are within the scope of license renewal and subject to an AMR. The design of the control building is described in Section 5.3-1 of the USAR. The staff reviewed the information provided by the applicant to determine whether the applicant has adequately demonstrated that the requirements of 10 CFR 54.4 and 10 CFR 54.21 have been met for the control building structure and components.

2.4.2.3.1 Summary of Technical Information in the Application

The control building is a three-story reinforced concrete structure that houses the following:

- reactor control rod drive equipment and 3B/4B motor control centers
- cable spreading room and battery room
- control room
- computer room

The control building is a seismic Category 1 structure and its walls and roof are designed for missile protection. Seismic Category 1 structures are structures which are designed to prevent uncontrolled release of radioactivity and withstand all loading without loss of function. The applicant has determined that the control building structure and its components are within the scope of license renewal because they perform one or more of the following intended functions:

- Provide structural support to safety-related components.

- Provide shelter/protection to safety-related components (including radiation shielding).

- Provide rated fire barriers to retard spreading of a fire.

- Provide a missile barriers.

- Provide structural support to non-safety-related components whose failure could prevent satisfactory accomplishment of required safety-related functions.

- Provide structural support and shelter to the components relied on during certain events, such as fires, anticipated transients without scram, and station blackout.

The applicant listed 20 component/commodity groups in Table 3.6-5 of the LRA. These structural components and commodities in the table are subject to an AMR because they perform the applicable intended functions without moving parts or without change in configuration or properties and are not subject to provide replacement based on a qualified life or specified time limit.

2.4.2.3.2 Staff Evaluation

The staff reviewed Section 2.4.2.3 of the LRA and the supporting information in the USAR to determine whether there is reasonable assurance that the structural components and commodities of the control building have been properly identified as being within the scope of license renewal and subject to an AMR.

In Section 2.4.2.3 of the LRA, the applicant did not explain whether the exterior walls and foundation of the control building have expansion joints, water-stops, or epoxy grout for the below-grade construction joints subject to an AMR. In a January 4, 2001 meeting, the applicant clarified that no structural components in the control building are exposed to the groundwater. Water-stops or epoxy grout is not required in the exterior walls or foundation. The structures with concrete components located below groundwater elevation are the containments, the intake structure, the discharge structure, and the floors and lower portions of the RHR pump and heat exchanger rooms in the auxiliary building.

Table 3.6-5 of the LRA lists 20 passive structural component and commodity groups that are subject to an AMR. The components and commodities in the table include reinforced concrete beams, columns, walls, floors, and the foundation (above groundwater elevation); masonry walls; control room ceiling and raised floor; weatherproofing roofing material (caulking/sealant); anchorages/embedment; safety-related and non-safety-related components supports; piping, cable tray, and conduit supports; cable trays, conduits, instrument racks and frames; electrical enclosures and supports; HVAC supports; and structural and miscellaneous steels, such as beams, columns, connections, stairs, platforms, and gratings, etc. The staff reviewed these component groupings and did not find any omissions of components or commodities subject to an AMR in accordance with 10 CFR 54.21(a). The staff also did not find any other components in the control building that were not included in the AMR table.

2.4.2.3.3 Conclusion

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the structural components and commodities that are within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and CFR 54.21(a)(1), respectively.

2.4.2.4 Cooling Water Canals

In Section 2.4.2.4, "Cooling Water Canals," of the LRA, the applicant describes the earthen structure of the cooling water canals and identifies the components of the canals that are within the scope of license renewal. A general description of the cooling water canals is provided in the Environmental Report of the LRA.

2.4.2.4.1 Summary of Technical Information in the Application

The cooling water canals are the earthen structures that provide cooling to the heated discharge water prior to reuse at the intake structure. The canals are a closed recirculating loop that serves as the plant's ultimate heat sink. The site occupies an area approximately 2 miles wide by 5 miles long and includes 168 miles of earthen canals. There are no cooling towers associated with this recirculating heat dissipation system. The canals discharge heated condenser water at one end and withdraw cooled water at the other end for reuse. The discharge canal receives heated effluent from the plant and distributes the flow into 32 feeder canals. Water in the feeder canals flows south and discharges into a single collecting canal that distributes water to six return canals. Water in the return canals flows north to the plant intake. The applicant has determined that the cooling water canals are within the scope of license renewal because they provide a source of cooling water for plant shutdown.

2.4.2.4.2 Staff Evaluation

The staff reviewed Section 2.4.2.4 and the Environmental Report of the LRA to determine if there is reasonable assurance that the components of the cooling water canals have been properly identified as being within the scope of license renewal and subject to an AMR. After completing its initial review, the staff requested additional information in a letter to the applicant dated February 2, 2001. The applicant responded to the staff's RAI in a letter to the NRC dated March 22, 2001.

In Table 3.6-5 of the LRA, the applicant listed the typical earthen canal as a component subject to an AMR. The structures associated with the earthen canal, such as the intake and discharge structures and the interceptor ditch, are not listed in the table as the components of the canals. The staff asked the applicant to provide justification for the omissions. In its response, the applicant stated that the intake structure is described in detail in Section 2.4.2.11 of the LRA and the discharge structures are described in Section 2.4.2.6 of the LRA. The staff's review found that these components are in-scope and subject to an AMR for the license renewal and are reviewed separately in the cited sections. There is a ditch along the northwest and west sides of the cooling canals called the interceptor ditch. The ditch is used to restrict inland movement of groundwater seeping from the cooling water canals by pumping interceptor ditch water back into the cooling water canals. The interceptor ditch does not perform the intended function of the canals and is not within the scope of license renewal.

The staff has completed its review of Section 2.4.2.4 of the LRA. As a result of this review, the staff did not find any omissions by the applicant. The applicant has properly identified the passive earthen canal subject to an AMR. The earthen canal meets the criteria of 10 CFR 54.21(a)(1) because it is long-lived and performs the intended function without moving parts or without a change in configuration or properties, and is not subject to replacement based on a qualified life or specified time period.

2.4.2.4.3 Conclusion

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has properly identified the structure associated with the cooling water canals that is within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.2.5 Diesel-Driven Fire Pump Enclosure

In Section 2.4.2.5, "Diesel-Driven Fire Pump Enclosure," of the LRA, the applicant described the enclosure structure of the diesel-driven fire pump and identified its structural components that are within the scope of license renewal. The applicant also identified the structural components that are subject to an AMR in Table 3.6-7 of the LRA.

2.4.2.5.1 Summary of Technical Information in the Application

The enclosure serves as a shelter from the external environment for the diesel-driven fire pump. It is a prefabricated steel frame structure with aluminum sidings and is anchor-bolted to a reinforced concrete foundation. Access is provided through the double doors at each end of the building. The building is a non-safety-related structure and is designed in accordance with the South Florida Building Code (below Seismic Category 2). The location of the enclosure is shown in Fig. 2.2-1 of the LRA.

2.4.2.5.2 Staff Evaluation

The staff reviewed Section 2.4.2.5 of the LRA to determine if there is reasonable assurance that the structural components and commodities of the diesel-driven fire pump enclosure have been properly identified as being within the scope of license renewal and subject to an AMR.

The diesel-driven fire pump enclosure is not specifically credited for fire protection. However, the footnote of Table 3.6-1 of the LRA for intended function #10 states that although not credited in the analyses for the events, these components have been conservatively included within the scope of license renewal. The applicant has determined that the enclosure structure is within the scope of license renewal because it provides shelter to the components relied on during certain postulated fire events.

In Table 3.6-7 of the LRA, the applicant listed seven structural components of the enclosure that require an AMR. The structural components in the table include the reinforced concrete foundations and anchorage/embedment (above groundwater elevation), anchorage/embedment (exposed surfaces), manufactured structure (steel frame and aluminum sidings), pipe supports, doors, and louvers. However, there are no design drawings or detailed descriptions for the enclosure in the UFSAR that the staff can use for verification. In a meeting on January 4, 2001, the staff discussed the structure and components with the applicant and found that the scoping of the components was correct. The applicant has properly identified the components and commodities in Table 3.6-7 of the LRA that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.5.3 Conclusion

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the components and commodities of the diesel-driven fire pump enclosure that are within the scope of license renewal and subject to an AMR in accordance with the requirements of 10 CFR 54.21(a) and 54.21(a)(1), respectively.

2.4.2.6 Discharge Structure

In Section 2.4.2.6, "Discharge Structure," of the LRA, the applicant described the components of the discharge structure that are within the scope of license renewal and subject to an AMR.

2.4.2.6.1 Summary of Technical Information in the Application

The discharge structure is located along the west edge of the plant secured area. The function of the discharge structure is to collect and provide for the emission of effluents from circulating water, intake cooling water, screen wash, and storm drains into the cooling water canals.

The Unit 3 discharge structure includes a concrete seal well, north concrete headwall, south concrete headwall, and associated steel framing and platforms. The seal well introduces circulating water into the cooling water canals via underground piping. The north headwall introduces flow from the safety-related intake cooling water pipe (from the CCW heat exchangers) and the non-safety-related screen refuse and storm drain pipes. The south headwall introduces flow from the non-safety-related intake cooling water pipe (from the turbine plant cooling water heat exchangers) into the cooling water canals.

The Unit 4 discharge structure includes a concrete seal well and a south headwall. The seal well introduces flow from the buried circulating water piping into the cooling water canals. The south headwall introduces flow from both the safety-related and non-safety-related intake cooling water piping as well as the storm drain pipes. No north headwall is required because the screen refuse pipe is common to both units and is part of the Unit 3 discharge structure.

The applicant described the process for identifying the SCs within the scope of license renewal in LRA Section 2.1.2.2, "Civil Structures." Using the methodology described in Section 2.1.2 of the LRA, the applicant compiled a list of component/commodity groupings within the license renewal boundaries that are subject to an AMR and identified their intended functions. The applicant listed these components/groups in Table 3.6-8 of the LRA. The applicant identified the two reinforced concrete headwalls that contain the safety-related intake cooling water piping from Unit 3 and Unit 4 as being subject to an AMR. The intended function of these components is to provide structural support for the safety-related piping.

2.4.2.6.2 Staff Evaluation

The staff reviewed Section 2.4.2.6 of the LRA to determine whether there is reasonable assurance that the applicant appropriately identified the discharge structure components and supporting structures within the scope of license renewal in accordance with 10 CFR 54.4 and subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the text submitted by the licensee in Section 2.4.2.6 of the LRA to identify if there were portions of the discharge structure that the applicant did not identify as within the scope of license renewal that performed intended functions. Only those portions of the discharge structure that perform an intended function are included within the scope of license renewal and are identified as such by the licensee in Section 2.4.2.6 of the LRA. For scoping systems and structures, the staff focused their review on those SCs of the discharge structure that were not identified as being within the scope of license renewal to verify that they do not have any intended functions that meet the scoping requirements of 10 CFR 54.4. As described in detail below, the staff found no omissions by the applicant. Therefore, there is reasonable assurance that the applicant adequately identified all portions of the discharge structure that fall within the scope of license renewal in accordance with 10 CFR Part 54.4.

The staff determined whether the applicant had properly identified the SCs subject to AMR from among those identified as within scope of license renewal. The applicant identified and listed the SCs subject to AMR for the discharge structure in Table 3.6-8 of the LRA using the screening methodology described in Section 2.1 of the LRA. The staff evaluated the scoping and screening methodology and documented their findings in Section 2.1 of this SER. As described in more detail below, the staff performed the review by sampling SCs that were within the scope of license renewal but not subject to AMR to verify that these SCs performed their intended functions with moving parts or a configuration change or were subject to replacement on the basis of a qualified life or specified time period (i.e., active or short-lived).

The staff review of the discharge structure included the circulating water system, the intake cooling water system and the storm water and cooling canal, and determined that only the north pipe headwall and the south pipe headwall performed an intended function by providing structural support for the intake cooling water piping that discharges water from the CCW heat exchangers.

2.4.2.6.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.4.2.6 of the application, the staff did not find any omissions by the applicant and, therefore, concludes that there is reasonable assurance that the applicant adequately identified those portions of the discharge structure that fall within the scope of license renewal and are subject to an AMR, in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1).

2.4.2.7 Electrical Penetration Rooms

In Section 2.4.2.7, "Electrical Penetration Rooms," of the LRA, the applicant described the components of the electrical penetration rooms that are within the scope of license renewal and subject to an AMR. The rooms are further described in Section 5E-2.2 of the Turkey Point UFSAR.

2.4.2.7.1 Summary of Technical Information in the Application

The function of the electrical penetration rooms is to provide shelter and protection for safety-related SCs (containment electrical penetrations and cables). The rooms also provide structural support for non-safety-related components to preclude interaction with safety-related components in the rooms.

Each unit has two electrical penetration rooms. Unit 3 has a West and South room, and Unit 4 has a West and North room. All four rooms are constructed of reinforced concrete. The North and South rooms are integral with the auxiliary building and the West rooms are independent structures located immediately west of each containment building.

The applicant described the process for identifying the SCs within the scope of license renewal in LRA Section 2.1.2.2, "Civil Structures." Using the methodology described in Section 2.1.2 of the LRA, the applicant compiled a list of component/commodity groupings within the license renewal boundaries that are subject to an AMR and identified their intended functions. The applicant listed these components/groups in Table 3.6-9 of the LRA. The applicant identified nine component/commodity groups as subject to an AMR: steel anchorages/embedments, cable trays and conduits (and their supports), electrical enclosures, electrical component supports, instrument racks, structural steel, ladders/platforms, and weatherproofing. The intended functions of these components include: structural support for safety-related and non-safety-related components, shelter/protection, fire barrier, missile barrier, and structural support/shelter to components required for fire protection, ATWS, and SBO.

2.4.2.7.2 Staff Evaluation

The staff reviewed Section 2.4.2.7 of the LRA to determine whether there is reasonable assurance that the applicant appropriately identified the electrical penetration room components and supporting structures within the scope of license renewal in accordance with 10 CFR 54.4 and subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the text submitted by the licensee in Section 2.4.2.7 of the LRA and the Turkey Point UFSAR to identify if there were portions of the structures that the applicant did not identify as within the scope of license renewal that performed intended functions. Only those portions of the electrical penetration rooms that perform at least one intended function are included within the scope of license renewal and are identified as such by the licensee in Section 2.4.2.7 of the LRA. For scoping systems and structures, the staff focused their review on those SCs of the electrical penetration rooms that were not identified as being within the scope of license renewal to verify that they do not have any intended functions that meet the scoping requirements of 10 CFR 54.4. The staff also reviewed the UFSAR to determine if there were any additional functions that were not identified as intended functions in the LRA and verified that those additional functions did not meet the scoping requirements of 10 CFR 54.4. As described in detail below, the staff found no omissions by the applicant. Therefore, there is reasonable assurance that the applicant adequately identified all portions of the electrical penetration rooms that fall within the scope of license renewal in accordance with 10 CFR Part 54.4.

The staff determined whether the applicant had properly identified the SCs subject to AMR from among those identified as within the scope of license renewal. The applicant identified and listed the SCs subject to an AMR for the electrical penetration rooms in Table 3.6-9 of the LRA using the screening methodology described in Section 2.1 of the LRA. The staff evaluated the scoping and screening methodology and documented their findings in Section 2.1 of this SER. As described in more detail below, the staff performed the review by sampling SCs that were within the scope of license renewal but not subject to AMR to verify that these SCs performed their intended functions with moving parts or a configuration change or were subject to replacement on the basis of a qualified life or specified time period (i.e., active or short-lived).

During a December 21, 2000 conference call, the staff asked the applicant to clarify whether the safety-related and non-safety-related components in the electrical penetration rooms that could prevent the accomplishment of safety-related functions were considered in scope. The applicant clarified that there are safety-related instrument racks, electrical enclosures, cable trays, and conduits located in the rooms. The failure of non-safety-related components, such as ladders, platforms, or supports could affect the safety-related components in the rooms, and were included in the scope of license renewal and are subject to an AMR.

2.4.2.7.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.4.2.7 of the application and the supporting information in the Turkey Point UFSAR, the staff did not find any omissions by the applicant and, therefore, concludes that there is reasonable assurance that the applicant adequately identified those portions of the electrical penetration rooms that fall within the scope of license renewal and are subject to an AMR, in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1).

2.4.2.8 Emergency Diesel Generator Buildings

The original on-site emergency AC power source for Turkey Point Units 3 and 4 consisted of two EDGs housed in a building adjacent to Unit 3. In 1990-1991, two additional EDGs were installed. The new EDGs were installed in the new Unit 4 EDG building and designated 4A and 4B, while the two original EDGs housed in the Unit 3 EDG building were designated 3A and 3B. The function of the two reinforced concrete EDG buildings is to house and protect the EDGs and their support systems. The first floor of each building is divided into two bays, with each bay containing one of the two engine-generator sets. The buildings also house the fuel oil, starting air, lubricating oil, combustion air, and exhaust air equipment.

The components and arrangement of components are different in the two EDG buildings, with the most notable difference in the fuel oil systems. The Unit 3 system uses an outdoor storage tank (3T36) with two day tanks (3T23A and 3T23B) located in elevated tank rooms above each EDG set, and a smaller skid tank adjacent to each of the two EDG sets. The Unit 4 EDG system uses two concrete encased fuel oil storage tanks (4T259A and 4T259B) located in the Unit 4 EDG building with a small tank (4T260A and 4T260B) located adjacent to each EDG set.

2.4.2.8.1 Summary of Technical Information in the Application

In the LRA, Section 2.4.2.8, "Emergency Diesel Generator Buildings," the applicant described the components of the EDG buildings that are within the scope of license renewal and subject to an AMR. These buildings are further described in Sections 5.3.2 (Unit 3) and 5.3.4 (Unit 4) of the Turkey Point UFSAR.

The applicant described the process for identifying the structural components within the scope of license renewal in LRA Section 2.1.2.2, "Civil Structures." Using the methodology described in LRA Section 2.1.2, the applicant compiled a list of structural component/commodity groupings within the license renewal boundaries that are subject to an AMR and identified their intended functions. The applicant listed the EDG building components/groups in Table 3.6-10 of the LRA. The applicant identified twelve component/commodity groups as subject to an AMR: structural steel, stairs/platforms/ grating, anchorages/embedments, pipe and component supports, cable tray and conduit, electrical component supports, electrical enclosures, instrument racks and frames, HVAC supports, unreinforced masonry walls, and weatherproofing.

The intended functions of these components include structural support to safety-related and non-safety-related components, shelter/protection to safety-related components, fire barrier, missile barrier, flood protection barrier, and structural support/shelter for components required for fire protection, ATWS, and station blackout (SBO).

2.4.2.8.2 Staff Evaluation

The staff reviewed Section 2.4.2.8 of the LRA and the Turkey Point UFSAR to determine whether there is reasonable assurance that the applicant appropriately identified the EDG building components and supporting structures within the scope of license renewal in accordance with 10 CFR 54.4 and subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the text and diagrams submitted by the licensee in Section 2.4.2.8 of the LRA and the Turkey Point UFSAR to identify if there were portions of the building structures that the applicant did not identify as within the scope of license renewal that performed intended functions. Only those portions of the EDG buildings that perform at least one intended function are included within the scope of license renewal and are identified as such by the licensee in Section 2.4.2.8 of the LRA. For scoping systems and structures, the staff focused their review on those SCs of the EDG buildings that were not identified as being within the scope of license renewal to verify that they do not have any intended functions that meet the scoping requirements of 10 CFR 54.4. The staff also reviewed the UFSAR to determine if there were any additional system functions that were not identified as intended functions in the LRA and verified that those additional functions did not meet the scoping requirements of 10 CFR 54.4. As described in detail in the staff's review of LRA Section 2.3.3.15 of this SER, the staff questioned (RAI 2.4.2.8-1) the omission of the alternate fuel oil fill lines for the Unit 3 EDG from the scope of license renewal. The Unit 4 EDGs are not affected because the tanks are missile-protected. Thus, the Unit 4 EDGs are assured of adequate fuel oil for 7 days of operation.

The staff determined whether the applicant had properly identified the SCs subject to AMR from among those identified as within scope of license renewal. The applicant identified and listed the structural components subject to AMR for the EDG buildings in Table 3.6-10 of the LRA using the screening methodology described in Section 2.1 of the LRA. The staff evaluated the scoping and screening methodology and documented their findings in Section 2.1 of this SER. As described in more detail below, the staff performed the review by sampling structural components that were within the scope of license renewal but not subject to AMR to verify that these structural components performed their intended functions with moving parts or a configuration change or were subject to replacement on the basis of a qualified life or specified time period (i.e., active or short-lived).

The applicant's response to RAI 2.4.2.8-1 indicated that the valves, piping, and fittings associated with both of the Unit 3 EDG day tank alternate fill lines were included in the AMR for Section 3.4 of the LRA, "Emergency Diesel Generators and Support Systems." On the basis of this review, the staff found that the applicant properly identified the EDG building structural components subject to an AMR.

2.4.2.8.3 Conclusion

On the basis of the review of Section 2.4.2.8 of the LRA, and Sections 5.3.2 and 5.3.11 of the UFSAR, the NRC staff has determined that there is reasonable assurance that the applicant adequately identified those portions of the EDG buildings that fall within the scope of license renewal and are subject to an AMR, in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.2.9 Fire Protection Monitoring Station

2.4.2.9.1 Summary of Technical Information in the Application

In Section 2.4.2.9 of the LRA the applicant described the components of the fire protection monitoring station that are within the scope of license renewal and subject to an AMR.

The fire protection monitoring station is a concreted block structure located adjacent to the west wall of the control building. It contains numerous video screens used to monitor various areas of the plant as a compensatory measure pending resolution of corrective actions related to the application of Thermo-Lag fire retardant.

2.4.2.9.2 Staff Evaluation

The staff reviewed Section 2.4.2.9 of the LRA and the Turkey Point UFSAR to identify if there were portions of the structures that the applicant did not identify as within the scope of license renewal that performed intended functions. It was concluded that there is reasonable assurance that the applicant adequately identified all portions of the fire protection monitoring station that fall within the scope of license renewal in accordance with 10CFR Part 54.4. The staff also sampled the SCs that were within the scope of license renewal but not subject to AMR and verified that these SCs performed their intended functions with moving parts or a configuration change or were subject to replacement on the basis of a qualified life or specified time period (i.e., active or short-lived).

The staff questioned the applicant about the membrane roof for the fire protection monitoring station during a conference call on December 21, 2000. The licensee indicated that, the roof was protected from weather by an overhang from the control building and would not be subject to weathering effects, and that the station is manned around the clock so that any leak would be identified in a timely manner.

On the basis of the staff's review of the information contained in Section 2.4.2.9 of the application, the clarification provided in the December 21, 2000, conference call, and the supporting information provided in the Turkey Point UFSAR, the staff did not find any omissions by the applicant and, therefore, concluded that there is reasonable assurance that the applicant adequately identified those portions of the fire protection monitoring station that fall within the scope of license renewal and are subject to an AMR, in accordance with 10CFR54.4(a) and 10CFR54.21(a)(1).

Following the completion of the review discussed above, the applicant sent a letter L-2001-234 dated October 22, 2001, stating that by FPL letter L-2001-114 dated June 18, 2001, FPL notified the NRC that it had completed all commitments in response to Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers." The Fire Protection Monitoring Station was previously installed as a compensatory measure required until all Thermo-Lag upgrades were completed. As a result of completing the commitments to the Generic Letter, the Fire Protection Monitoring Station is no longer in the scope of license renewal. This is acceptable to the staff.

2.4.2.9.3 Conclusion

On the basis of the staff's review of the information contained in Section 2.4.2-9 of the application and as supplemented by letter dated October 22, 2001, the staff concludes that the Fire Protection Monitoring Station is no longer in the scope of license renewal.

2.4.2.10 Fire-Rated Assemblies

In the LRA Section 2.4.2.9, "Fire-Rated Assemblies," the applicant described the fire-rated components that are within the scope of license renewal and subject to an AMR.

2.4.2.10.1 Summary of Technical Information in the Application

Fire-rated assemblies include fire barriers, fire doors, fire dampers, penetration seals, and electrical conduit seals. These components are described in UFSAR Appendix 9.6A, Sections 3.11 through 3.15. Fire dampers are reviewed under LRA Section 2.3.3.14, and will not be included in this section.

Fire barriers limit the spread of fire by compartmentalization and containment, to ensure that one set of redundant safety-related equipment remains free of fire damage so that it is available to shut down the reactor and maintain it in a shutdown condition. Fire barriers include walls, floors, ceilings, raceway protection, structural steel fireproofing, Thermo-Lag barriers, manhole covers, and hatches, and radiant energy shields. Concrete walls, floors, and ceilings were evaluated as part of the structures with which they are associated. Manhole covers were evaluated as part of the yard structures. Radiant energy shields (inside containment) were evaluated with the containment structures.

Fire door assemblies (door, frame, lockset, etc.) prevent the spread of fire through passageways and fire barriers.

Penetration seals maintain the integrity of fire barriers at barrier penetrations. Penetrations, may be restored with grout or concrete, or they may be sealed using solid silicone elastomers, boot seals, high-density self-supporting gel seals, prefabricated fire seals, or hydrosil material seals.

Electrical conduit seals limit flame propagation, protect open-ended conduit from fixed water suppression spray, and keep Halon from escaping an area protected by a Halon suppression system.

2.4.2.10.2 Staff Evaluation

The staff reviewed Section 2.4.2.10 of the LRA to determine whether there is reasonable assurance that the applicant appropriately identified the fire rated assemblies within the scope of license renewal in accordance with 10 CFR 54.4 and subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the text submitted by the licensee in Section 2.4.2.10 of the LRA and the Turkey Point UFSAR to identify if there were assemblies that the applicant did not identify as within the scope of license renewal that performed intended functions. Only those fire-rated assemblies that perform at least one intended function are included within the scope of license renewal and are identified as such by the licensee in Section 2.4.2.7 of the LRA. For scoping systems and structures, the staff focused their review on those SCs of the fire-rated assemblies that were not identified as being within the scope of license renewal to verify that they do not have any intended functions that meet the scoping requirements of 10 CFR 54.4. The staff also reviewed the UFSAR to determine if there were any additional functions that were not identified as intended functions in the LRA and verified that those additional functions did not meet the scoping requirements of 10 CFR 54.4. As described in detail below, the staff found no omissions by the applicant. Therefore, there is reasonable assurance that the applicant adequately identified all fire-rated assemblies that fall within the scope of license renewal in accordance with 10 CFR 54.4.

The staff determined whether the applicant had properly identified the SCs subject to AMR from among those identified as within scope of license renewal. The applicant identified and listed the SCs subject to AMR for the fire-rated assemblies in Table 3.6-11 of the LRA using the screening methodology described in Section 2.1 of the LRA. The staff evaluated the scoping and screening methodology and documented their findings in Section 2.1 of this SER. As described in more detail below, the staff performed the review by sampling SCs that were within the scope of license renewal but not subject to AMR to verify that these SCs performed their intended functions with moving parts or a configuration change or were subject to replacement on the basis of a qualified life or specified time period (i.e., active or short-lived).

2.4.2.10.3 Conclusions

On the basis of the staff's review of the information contained in Section 2.4.2.10 of the application, and the supporting information in the Turkey Point UFSAR, the staff did not find any omissions by the applicant and, therefore, concludes that there is reasonable assurance that the applicant adequately identified those fire-rated assemblies that fall within the scope of license renewal and are subject to an AMR, in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1).

2.4.2.11 Intake Structure

In LRA Section 2.4.2.11, "Intake Structure," the applicant describes the intake structure and identifies the structural components of the intake structure that are within the scope of license renewal and subject to an AMR. The staff reviewed Section 2.4.2.11 to determine if there is reasonable assurance that the applicant has identified and listed the structural components of the intake structure that are subject to an AMR. The design of the intake structure is described in Section 5.3.2 of the Turkey Point Unit 3 and 4 UFSAR. The general location of the intake structure is identified in Figure 2.2-1 of the LRA.

2.4.2.11.1 Summary of Technical Information in the Application

Cooling water and circulating water are provided to Turkey Point Units 3 and 4 by the intake structure at the west end of the intake canal. The intake canal is located east of the plant proper along the shore of Biscayne Bay. The intake structure is designed to Seismic Category 1 requirements. It is also designed to withstand the impacts of all internally and externally generated missiles. It is also designed for protection against the effects of an external flood. One integrally constructed intake structure services both Units 3 and 4. It is constructed primarily of reinforced concrete and steel. There are eight intake channels. A portion of the intake structure area is above grade elevation, and a portion of it below grade and exposed to groundwater, saltwater flow, and saltwater splash.

The intake structure houses and supports the intake cooling water system, including its piping, pumps and motors, and the circulating water and screen wash pumps and motors. The pumps suction water from the intake channels and supply it to Units 3 and 4. Each intake channel is equipped with a stationary screen and a traveling screen. The stationary screens filter large debris to avoid damage to the traveling screens, while the traveling screens prevent debris from damaging the pumps. At the outermost end of the intake canal is a steel grating that prevents debris from entering the intake canal.

The applicant describes its methodology for identifying the structural components within the scope of license renewal in Section 2.1.1 of the LRA. Based on its scoping methodology, the applicant, in Section 2.2, Table 2.2-2, of the LRA, identifies the intake structure as being within scope of license renewal and describes the results of its scoping methodology in Section 2.4.2.11 of the LRA.

The intake structure and its structural components meet the intent of 10 CFR 54.4(a)(1) for license renewal because they perform one or more of the following functions:

- Provide structural support to safety-related components.
- Provide shelter/protection to safety-related components (including radiation shielding).
- Provide a source of cooling water for plant shutdown.
- Provide structural support to non-safety-related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions.
- Provide flood protection barriers.
- Provide structural support and/or shelter/protection to components required for fire protection, anticipated transients without scram (ATWS), and/or SBO events.

On the basis of the above-described methodology, the applicant has identified both the structural components and the commodity groups of the intake structure, and identified their intended functions that are subject to an AMR in Table 3.6-13 in the LRA. The applicant has determined that the intake structure is within the scope of 10 CFR 54.4(a)(1) and 10 CFR 54.21(a)(1).

2.4.2.11.2 Staff Evaluation

The NRC staff reviewed Section 2.4.2.11 of the LRA and the Turkey Point Unit 3 and 4 UFSAR to determine if the applicant has adequately implemented its methodologies so that there is reasonable assurance that the structural components and commodities of the intake structure have been properly identified as being within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a)(1) and 10 CFR 54.21(a)(1).

The intake structure consists of various SCs and commodities that support the SSCs that are within the scope of license renewal. The applicant listed the SCs and commodities that are subject to an AMR in Table 3.6-13 of the LRA. In the table, the applicant identified the structural components and commodities common to the intake structure in four material groups: carbon steel (structural beams and columns, anchorages/embedments), carbon steel-galvanized (stairs, platforms, gratings, cable trays, conduits and supports, and electrical enclosures and supports); stainless steel (seismic anchors non-safety-related pipe segments, and the intake traveling screens), and concrete (embedments, and reinforcement).

The staff did not find any omissions in the SCs of the intake structure identified by the applicant as being subject to an AMR in accordance with 10 CFR 54.21(a).

2.4.2.11.3 Conclusion

On the basis of the review described above, the staff found that there is reasonable assurance that the applicant has appropriately identified the SCs of the intake structure that are within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.4.2.12 Main Steam and Feedwater Platforms

In LRA Section 2.4.2.12, "Main Steam and Feedwater Platforms," the applicant describes the structural components of the main steam and feedwater platforms that are within the scope of license renewal and subject to an AMR. The general location of the main steam and feedwater platforms is identified in Figure 2.2-1 of the LRA.

2.4.2.12.1 Summary of Technical Information in the Application

There are two main steam and feedwater platforms, one for each plant unit. They are located directly west outside of the Unit 3 and 4 containment buildings. The main steam and feedwater platforms are designed to Seismic Category I criteria and provide support primarily to piping and mechanical components of the main steam system, the feedwater system, and the auxiliary feedwater system. These systems consist of Class I structures and equipment that are supported by the main steam and feedwater platforms.

The applicant describes its methodology for identifying the structural components within the scope of license renewal in Section 2.1, "Plant-Level Scoping." Based on its scoping methodology, the applicant, in Section 2.2, Table 2.2-2 in the LRA, identifies the main steam and feedwater platforms as being within scope of license renewal and describes the results of its scoping methodology in Section 2.2.12, of the LRA. The applicant states that the main steam and feedwater platforms are within the scope of license renewal because they do the following:

- Provide support and protection for safety-related components that are relied upon during and following certain design-basis events.
- Provide support for non-safety-related SCs whose failure could prevent satisfactory accomplishment of the required safety-related functions.

- Provide support to SCs that are relied upon during certain postulated fires, ATWS, and SBO.

- Provide protection to SCs from missiles, pipe whip restraints, and jet impingements.

On the basis of the above described methodology, the applicant, in relation to 10 CFR 54.4 (a)(2), identifies both the structural components and the commodity groups that make up the main steam and feedwater platforms and identifies the intended functions of each structural component and commodity group in Table 3.6-14 of the LRA. Figure 2.2-1 of the LRA shows the general layout of the Turkey Point Unit 3 and 4 main steam and feedwater platforms.

2.4.2.12.2 Staff Evaluation

The staff reviewed Section 2.4.2.12 in the LRA to determine if there is reasonable assurance that the applicant has identified the main steam and feedwater platforms and adequately identified the structural components of the platforms that are subject to an AMR in accordance with 10 CFR 54.4(a)(2), and 10 CFR 54.21(a)(1), respectively. The staff also reviewed Figure 2.2-1 and Table 3.6-14 to identify any structural components that may have been omitted from the scope of license renewal. In the table, the applicant identified the structural components of the main feedwater platform as structural steel beams, columns, steel connections, stairs, platforms, gratings, anchorages/embedments, safety-and non-safety-related pipe supports, pipe whip restraints, cable tray conduits and supports, instrument racks and frames, and above-and below-grade reinforced concrete foundations. These component/commodity groups of the main steam and feedwater platforms are described in four material groups: carbon steel, carbon steel-galvanized steel, and reinforced concrete.

The staff did not find any omissions in the main steam and feedwater platform SCs as identified by the applicant as being subject to an AMR in accordance with 10 CFR 54.21(a).

2.4.2.12.3 Conclusion

On the basis of the review described above, the staff found that there is reasonable assurance that the applicant has appropriately identified the SCs of the main steam feedwater platforms that are within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.4.2.13 Plant Vent Stack

In LRA Section 2.4.2.13, "Plant Vent Stack," the applicant describes the structural components of the plant vent stack that are within the scope of license renewal and subject to an AMR.

2.4.2.13.1 Summary of Technical Information in the Application

The plant vent stack is a steel tubular structure that provides a means of releasing plant processed gases to the atmosphere. It is located in the auxiliary building and protrudes through the roof of the auxiliary building adjacent to the Unit 4 containment. It is supported at the base by the auxiliary building and laterally restrained at its top to the Unit 4 containment structure.

The methodology for identifying the structural components that are within the scope of license renewal is described in Section 2.1, "Plant-Level Scoping." Based on the scoping methodology, the applicant, in Section 2.2, Table 2.2-2, of the LRA, identifies the plant vent stack as being within scope of license renewal and describes the results of its scoping methodology in Section 2.4.2.13 in the LRA. Further, Figure 2.2-1 of the LRA shows the general layout of the location of the plant vent stack. The applicant states that the plant vent stack is within the scope of license renewal because it is a non-safety-related structure whose failure could prevent satisfactory accomplishment of the required safety-related functions.

On the basis of the above-described methodology, the applicant, in accordance with 10 CFR 54.4 (a)(2), identifies both the structural components and the commodity groups that make up the plant vent stack and identifies the intended functions of each structural component and commodity group in Table 3.6-15 of the LRA.

2.4.2.13.2 Staff Evaluation

The NRC staff reviewed Section 2.4.2.13 of the LRA to determine if there is reasonable assurance that the applicant has identified the plant vent stack and adequately identified the structural components of the plant vent stack that are subject to an AMR in accordance with 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1), respectively. The staff also reviewed the UFSAR and Table 3.6-15 to determine if there are any structural components that may have been omitted from the scope of license renewal. In the table, the applicant identified the structural components as a steel vent stack, structural steel supports and restraints, conduits and conduit supports, electrical enclosures, and anchorages/embedments. These SCs and commodities common to the plant vent stack are identified under three material groups: carbon steel, carbon steel-galvanized, and concrete.

The staff did not find any omissions in the SCs identified by the applicant as being subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.4.2.13.3 Conclusion

On the basis of the review described above, the staff found that there is reasonable assurance that the applicant has adequately identified the SCs of the plant vent stack that are within the scope of license renewal and subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.4.2.14 Spent Fuel Storage and Handling

In LRA Section 2.4.2.14, "Spent Fuel Storage and Handling," the applicant describes all the equipment and structural components that are involved in the handling and storage of spent fuel and are within the scope of license renewal and subject to an AMR. Spent fuel storage and handling are further described in Sections 5.2.4 and 9.5 in the Turkey Point Unit 3 and 4 UFSAR.

2.4.2.14.1 Summary of Technical Information in the Application

Spent fuel storage and handling include all the equipment and structural components that are necessary to remove spent fuel from its location, transport it, and place it in storage. The fuel handling system consists basically of the refueling cavity, the spent fuel pit, and the fuel transfer system. Specifically, spent fuel storage and handling includes all equipment and tools needed to remove spent fuel from the reactor vessels, transport it to the SFPs, place it in the storage racks, and remove it from the pools to alternative storage facilities.

The refueling cavity is not addressed in this section of the LRA. The spent fuel storage facilities include the spent fuel pit, spent fuel pit liners, key gates, and the spent fuel storage racks, spent fuel pit pumps, motor, and heat exchanger. As stated previously in this SER, the spent fuel pit is addressed under Section 2.4.2.1, "Auxiliary Building." The auxiliary building houses the fuel handling area (the SFP and the concrete sliding doors).

The equipment and tools used for spent fuel handling include the reactor cavity seal rings, the manipulator cranes, the fuel transfer system (including the refueling canal inside containment and the fuel transfer canal inside the spent fuel building), the fuel transfer tubes, the penetration sleeves, the gate valves, the spent fuel bridge cranes, the fuel handling tools, and the overhead spent fuel cask crane.

The methodology for identifying the structural components that are within the scope of license renewal is described in Section 2.1, "Plant-Level Scoping." Based on the scoping methodology, the applicant, in Section 2.2, Table 2.2-2, of the LRA, identifies the spent fuel storage and handling system as being within scope of license renewal and describes the results of its scoping methodology in Section 2.4.2.14 in the LRA. The applicant states that the fuel storage and handling facilities and equipment are within the scope of license renewal because they perform the following functions:

- Provide a pressure boundary.
- House and provide shelter/protection and structural support for safety-related systems.
- Provide fire-rated barriers to retard the spreading of a fire.
- Provide missile barriers.

Various components of the spent fuel handling system such as the spent fuel bridge cranes, the fuel handling tools, and the overhead spent fuel cask crane are non-safety-related components whose failure could prevent satisfactory accomplishment of required safety-related functions.

On the basis of the above-described methodology, the applicant, in accordance with 10 CFR 54.4, identifies in Table 3.6-16 of the LRA, the components, equipment and tools, and the commodity groups that make up the spent fuel storage and handling systems and identifies the intended functions of each component, piece of equipment and tool, and commodity group.

2.4.2.14.2 Staff Evaluation

The staff reviewed Section 2.4.2.14 of the LRA and the supporting information in Sections 5.2.4 and 9.5 of the Turkey Point Unit 3 and 4 UFSAR to determine whether there is reasonable assurance that the SCs and commodities in spent fuel storage and handling operations have been adequately identified as being within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1).

The staff reviewed the component/commodity groups in Table 3.6-14 (manipulator cranes, spent fuel bridge cranes, spent fuel cask crane, fuel transfer sheave frames, spent fuel pit (pools), transfer canals and refueling pool liners, fuel transfer tubes, spent fuel handling equipment and tools, reactor cavity seal rings, spent fuel storage racks, reinforced concrete overhead sliding doors, Boraflex, etc.) to determine if there were any other components involved in spent fuel storage and handling systems that meet the scoping criteria of 10 CFR 54.4 but were not included within the scope of license renewal.

The staff has reviewed Section 2.4.2.14 of the LRA and the Turkey Point Unit 3 and 4 UFSAR. The staff also examined the components and equipment and tools listed in Table 3.6-16 of the LRA to determine if there are SCs that are subject to an AMR in accordance with 10 CFR 54.21(a)(1). On the basis of the above review the staff did not identify any omissions by the applicant.

2.4.2.14.3 Conclusion

On the basis of the review described above, the staff found that there is reasonable assurance that the applicant has adequately identified the structures and structural components of the spent fuel storage and handling that are within the scope of license renewal and subject to an AMR in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.4.2.15 Turbine Building

In Section 2.4.2.15, "Turbine Building," of the LRA, the applicant describes the structural components of the turbine building that are within the scope of license renewal and subject to an AMR. The turbine building is further described in various sections in the Turkey Point UFSAR.

2.4.2.15.1 Summary of Technical Information in the Application

In the LRA, in Figure 2.2-1, "Turkey Point Plant Structures," the applicant depicts the general location of the turbine building. The turbine building is located adjacent to and east of the control building and is flanked on its northwest and southwest corners by the Unit 3 and 4 containment structures, respectively. The function of the turbine building is to house the Unit 3 and 4 safety-related equipment and structures, including: the 4160V switchgear; the 480V load centers and associated concrete enclosures; the feedwater pump discharge valves and associated blockwall enclosures; the turbine generators and drivers, and the EDG 3A and 4A motor control centers and associated steel enclosures. Additional safety-related equipment housed in the turbine building includes, but is not limited to, miscellaneous safety-related equipment such as the auxiliary feedwater supply lines from the condensate storage tanks and numerous conduits and cable trays.

The turbine building also houses a number of non-safety-related systems and associated structures that are relied upon to support the intended functions of safety-related structures, systems, and components (SSCs). It is designed and constructed on a foundation mat with concrete bearing walls and slabs and is built partially below grade. The construction joints of the exterior concrete wall contain a water-proofing membrane with concrete topping below the plant's design groundwater elevation.

Although the turbine building houses some safety-related systems, the turbine building structure and structural components are not designed and constructed to seismic Category I requirements. As stated in the UFSAR, Section 5A.1.2, seismic Category 1 structures are designed to prevent uncontrolled release of radioactivity, and to withstand all applicable loads, including but not limited to system and seismic loadings without loss of function. Accordingly, the turbine building is not designed to seismic Category 1 requirements. The applicant listed the passive and long-lived components and commodities unique to the turbine building in Table 3.6-17. The applicant also determined that some areas in the turbine building (i.e., areas that serve as fire barriers) meet the scoping requirements of 10 CFR 54.4(a)(3) in that these components are relied upon in plant evaluation to perform functions compliant with 10 CFR 50.48. The fire barriers (i.e., fire-retardant coatings, fireproofing, and fire doors) are grouped as fire-rated assemblies in Table 3.6-12, while fire walls and slabs are grouped as reinforced concrete components in Table 3.6.3. Fire barriers are addressed under Section 2.4.2.10 in this SER.

The applicant describes its methodology for identifying the structural components within the scope of license renewal in Section 2.1.1 of the LRA. Based on its scoping methodology, the applicant, in Section 2.2, Table 2.2-2 in the LRA, identifies the turbine building as being within scope of license renewal and describes the results of its scoping methodology in Section 2.4.2.15 in the LRA.

The turbine building and its structural components meet the intent of 10 CFR 54.4(a)(1) for license renewal because they perform one or more of the following functions:

- House and provide structural support to safety-related components.
- Provide shelter/protection of safety-related components (including radiation shielding).
- Provide rated fire barriers to retard spreading of a fire.
- Provide missile barriers.
- Provide structural support to non-safety-related components whose failure could prevent satisfactory accomplishment of required safety-related functions.
- Provide flood protection barriers.
- Provide structural support and/or shelter/protection to components required for fire protection, ATWS, and/or SBO.

On the basis of the above described methodology, the applicant identifies both the structural components and the commodity groups that makeup the turbine building and identifies the intended functions the SCs and commodity groups that are subject to an AMR in Table 3.6-3 in the LRA. Some of the structural components in the turbine building are common to many other buildings, however, they are uniquely identified as a commodity group item in Table 3.6-17 of the

LRA. The commodity group is addressed by the applicant in Section 3.6.2 of the LRA. As stated by the applicant, the SCs and commodities in the turbine building are subject to an AMR because they perform their intended function(s) without moving parts or without change in configuration or properties, and are not subject to periodic replacement based on qualified life or specified time limit.

2.4.2.15.2 Staff Evaluation

The NRC staff reviewed Section 2.4.2.15 of the LRA and the supporting information in various sections in the Turkey Point Units 3 and 4 UFSAR to determine whether there is reasonable assurance that the SCs and commodities of the turbine building have been adequately identified as being within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.21(a)(1).

The staff reviewed the structural component/commodity groupings in Table 3.6-17 (i.e., reinforced concrete foundations and walls; reinforced concrete foundation beams, columns, walls, floors/slabs; miscellaneous steel-stairs, platforms, gratings, etc.) to determine if there were any other components in the turbine building that met the scoping criteria of 10 CFR 54.4(a) but were not included within the scope of license renewal.

As a result of this review, the staff requested clarifying information regarding the turbine building and its structural components that serve as fire barriers. The applicant addressed the staff's concerns in a meeting on January 24, 2001. The applicant stated that the fire barriers and doors are not listed in Table 3.6-17 in the LRA as a commodity of the turbine building. Only the concrete structural components that serve as fire barriers are included in the commodity group in the turbine building. The fire barriers and doors which are needed to protect safety-related SSCs in the plant against the spread of fire are listed in Table 3.6-12, "Fire-Rated Assemblies," in the LRA. Staff evaluation of the fire-rated assemblies is provided under Section 2.4.2.10 in this SER.

The staff has reviewed Section 2.4.2.15 of the LRA and the Turkey Point Units 3 and 4 UFSAR. The staff also examined the components and commodities listed in Tables 3.6-17 in the LRA to determine if they are the SCs that are subject to an AMR in accordance with 10 CFR 54.21(a)(1). On the basis of the above review the staff did not identify any omissions by the applicant.

2.4.2.15.3 Conclusions

On the basis of the review described above, the staff found that there is reasonable assurance that the applicant has appropriately identified the structural components of the turbine building that are within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.2.16 Turbine Gantry Cranes

In Section 2.4.2.16, "Turbine Gantry Cranes," of the LRA, the applicant describes the structural components of the turbine gantry crane system that are within the scope of license renewal and subject to an AMR. The turbine gantry cranes are further described in Appendix 5I.3, "Heavy Load Handling System," of the Turkey Point UFSAR.

2.4.2.16.1 Summary of Technical Information in the Application

As stated in the UFSAR Appendix 5I, the heavy load handling systems have been identified and classified into two groups: (1) Group I which includes handling systems that need to conform to guidelines in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," because a load drop from these systems could result in damage to irradiated fuel or systems required for plant shutdown or decay heat removal, and (2) Group II which includes handling systems (excluded from Group I) that do not need to conform to the guidelines in NUREG-0612 because a load drop from these systems will impact at points that are sufficiently separated from safety-related components so as not to result in any significant impact to plant operations and safety.

The turbine gantry cranes are classified as Group I overhead handling systems. There are two turbine gantry cranes: one for Units 1 and 2 and the other for Units 3 and 4. The two cranes share rails that are common to all four units and are used for lifting heavy loads exclusively for Units 1 and 2 and 3 and 4, respectively. A heavy load is a load whose weight is greater than the combined weight of a spent fuel assembly and its handling tool. Turkey Point defines a heavy load as 1760 lbs., however, Turkey Point uses 2000 lbs. which includes the weight of the control element assembly used for lifting spent fuel assemblies in the SFP area only. The Units 1 and 2 crane has a rated capacity of 70/15 tons (70 tons in the main hook and 15 tons in the auxiliary hook). The Units 3 and 4 crane has a rated capacity of 145/35 tons. As stated in the UFSAR Appendix 5I.3.7, the cranes satisfy Guideline 7 in NUREG-0612, Section 5.1.1 and, therefore, comply with the Crane Manufacturers Association of America (CMAA) Specification 70 and Chapter 2-1 in ANSI B30.2-1976, "Overhead and Gantry Cranes." Safe load paths and other controls required for use of the turbine gantry cranes are included in administrative procedures that govern the heavy load handling operations.

The applicant has determined that the turbine gantry cranes are load handling systems that meet the intent of 10 CFR 54.4(a)(1)(iii) and 10 CFR 54.4(a)(2) for license renewal. The applicant listed the passive and long-lived components and commodities unique to the turbine gantry cranes in Table 3.6-18.

The applicant describes its methodology for identifying the SCs within the scope of license renewal in Section 2.1.1 of the LRA. Based on its scoping methodology, the applicant, in Section 2.2, Table 2.2-2 in the LRA, identifies the turbine gantry cranes as being within scope of license renewal and describes the results of its scoping methodology in Section 2.4.2.16 in the LRA.

The turbine gantry cranes and their associated components meet the intent of 10 CFR 54.4(a)(1) and (a)(2) for license renewal because they perform the following function:

- Provide structural support to non-safety-related components whose failure could prevent satisfactory accomplishment of required safety-related functions.

On the basis of the above described methodology, the applicant identified both the SCs and the commodity groups that are part of the turbine gantry cranes and identified the intended functions of the structural components and commodity groups that are subject to an AMR in Table 3.6-18 in the LRA. As stated by the applicant, the SCs and commodities of the turbine gantry cranes are subject to an AMR because they perform their intended function(s) without moving parts or without change in configuration or properties, and are not subject to periodic replacement based on qualified life or specified time limit.

2.4.2.16.2 Staff Evaluation

The NRC staff reviewed Section 2.4.2.16 in the LRA and the supporting information in Section 51.3 of the Turkey Point Units 3 and 4 UFSAR to determine whether there is reasonable assurance that the SCs and commodities of the turbine gantry cranes have been adequately identified as being within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.21(a)(1).

The staff reviewed the structural component/commodity groupings in Table 3.6-18 (i.e., runway rails, runway beams and frames, main girders, platforms, railings, gratings, ladders and stairways, trolley rails and structure, cab, anchorages/embedments, and electrical enclosures, etc.) to determine if there were any other components associated with the turbine gantry cranes that meet the scoping criteria of 10 CFR 54.4(a), but were not included within the scope of license renewal. The staff has reviewed Section 2.4.2.16 in the LRA and the Turkey Point Units 3 and 4 UFSAR. The staff also examined the components and commodities listed in Tables 3.6-18 in the LRA to determine if they are the SCs that are subject to an AMR in accordance with 10 CFR 54.21(a)(1). On the basis of the above review the staff did not identify any omissions by the applicant.

2.4.2.16.3 Conclusions

On the basis of the review described above, the staff found that there is reasonable assurance that the applicant has appropriately identified the components of the turbine gantry cranes that are within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.2.17 Turkey Point Units 1 and 2 Chimneys

In Section 2.4.2.17, "Turkey Point Units 1 and 2 Chimneys," of the LRA, the applicant describes the structural components of the chimneys that are within the scope of license renewal and subject to an AMR. The chimneys are further described in Section 5A-1.4.2 of the Turkey Point UFSAR.

2.4.2.17.1 Summary of Technical Information in the Application

As stated in the LRA, Turkey Point Units 3 and 4 are located adjacent to oil and gas fired Units 1 and 2 at the Turkey Point Plant. The Unit 1 and 2 chimneys are located directly north of the Unit 3 containment structure. The chimneys do not perform any safety-related functions nor directly protect any safety-related equipment. However, failure of the chimneys has the potential to adversely affect safety-related systems (i.e., systems that are housed in and support the Unit 3 containment and other safety-related systems). As stated in Section 5A-1.4.2 in the UFSAR, the chimneys have been designed not to fail in order to preclude adverse interactions with safety-related equipment. Accordingly, the chimneys have been designed to Class I seismic loads and wind loads including hurricane loads of 145 mph and tornado loads of 225 mph.

The applicant has determined that the Turkey Point Units 1 and 2 chimneys meet the intent of 10 CFR 54.4(a)(2) for license renewal. The applicant listed the passive and long-lived components and commodities unique to the Units 1 and 2 chimneys in Table 3.6-19.

The applicant describes its methodology for identifying the SCs within the scope of license renewal in Section 2.1.1 of the LRA. Based on its scoping methodology, the applicant, in Section 2.2, Table 2.2-2 in the LRA, identified the Turkey Point, Units 1 and 2, chimneys as being within scope of license renewal and describes the results of its scoping methodology in Section 2.4.2.17 in the LRA.

The Turkey Point, Units 1 and 2, chimneys and their associated SCs meet the intent of 10 CFR 54.4(a)(1) and (a)(2) for license renewal because they perform functions as follows:

- They are non-safety-related structures whose failure could prevent satisfactory accomplishment of required safety-related functions.

On the basis of the above described methodology, the applicant identified both the SCs and the commodity groups that are part of the chimneys and identified the intended functions of the SCs and commodity groups that are subject to an AMR in Table 3.6-19 in the LRA. As stated by the applicant, the SCs and commodities of the chimneys are subject to an AMR because they perform their intended function(s) without moving parts or without change in configuration or properties, and are not subject to periodic replacement based on qualified life or specified time limit.

2.4.2.17.2 Staff Evaluation

The NRC staff reviewed Section 2.4.2.17 in the LRA and the supporting information in Section 5A-1.4.2 of the Turkey Point, Units 3 and 4, UFSAR to determine whether there is reasonable assurance that the SCs and commodities of the Turkey Point, Units 1 and 2, chimneys have been adequately identified as being within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.21(a)(1).

The staff reviewed the SCs/commodity groupings in Table 3.6-19 (i.e., reinforced concrete chimney and reinforced concrete foundation) to determine if there were any other components associated with the chimneys that meet the scoping criteria of 10 CFR 54.4(a) but was not included within the scope of license renewal. The staff has reviewed Section 2.4.2.17 in the LRA and the Turkey Point Units 3 and 4 UFSAR. The staff also examined the components and commodities listed in Tables 3.6-19 in the LRA to determine if they are the SCs that are subject to an AMR in accordance with 10 CFR 54.21(a)(1). On the basis of the above review the staff did not identify any omissions by the applicant.

2.4.2.17.3 Conclusions

On the basis of the review described above, the staff found that there is reasonable assurance that the applicant has appropriately identified the components of the Turkey Point, Units 1 and 2, chimneys that are within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.4.2.18 Yard Structures

In LRA Section 2.4.2.18, "Yard Structures," the applicant describes the yard structures at the plant site, and identifies the structural components of the yard structures that are within the scope of license renewal and subject to AMR. The general location of the yard structures is identified in Figure 2.2-1 in the LRA.

2.4.2.18.1 Summary of Technical Information in the Application

As described in Section 2.4.2.18.1 of the LRA, the yard structures include concrete foundations for miscellaneous components and structures, concrete trenches for piping (e.g., intake cooling water and safety injection piping) and utilities, concrete electrical duct banks, and manholes. These yard structures for Turkey Point Units 3 and 4 include:

- condensate storage tank foundations
- Unit 3 emergency diesel fuel oil storage tank foundation
- 3A and 3B EDG fuel oil transfer pump foundations
- refueling water storage tank foundations
- auxiliary feedwater pump foundations
- demineralized water tank foundations
- foundations for the diesel-driven instrument air compressors
- diesel-driven standby steam generator feedwater pump foundations
- raw water tank foundations
- diesel fire pump fuel oil storage tank foundations
- electric fire pump foundations
- fire water jockey pump foundations
- Unit 3 and 4 safety injection pipe trench
- electrical duct banks for various SSCs

The foundations for the two condensate storage tanks (CSTs) are Seismic Category 1 structures located at the northwest and southwest side of the Turkey Point Unit 3 and 4 containment buildings, respectively. They are circular-shaped reinforced concrete mat foundations.

The Unit 3 emergency diesel fuel oil storage tank foundation, located just east of the Unit 3 EDG building between the Unit 3 and 4 EDG buildings, is also designed to meet Seismic Category I requirements and to resist dead load, live load, and hurricane and tornado winds.

The two EDGs for each unit are supported by a diesel fuel oil storage facility that contains two diesel oil storage tanks and two EDG diesel fuel oil transfer pumps. The two Unit 4 EDG fuel oil transfer pumps, along with the 4A and 4B EDGs, are housed within the Unit 4 EDG building. The Unit 3 EDGs (3A and 3B) are housed within the unit 3 EDG building, however, the two unit 3 EDG diesel oil transfer pumps are located on separate structures (identified as yard structures in the LRA) just north of the EDG building. The foundations for the 3A and 3B EDG fuel oil transfer pumps are Seismic Category 1 structures designed to withstand the effects of earthquakes, tornados, hurricanes, and externally generated missiles. A common reinforced concrete mat foundation supports the 3A and 3B EDG fuel oil transfer pumps.

The Unit 3 and 4 refueling water storage tank (RWST) foundations are located in the yard just east of the auxiliary building between the auxiliary building and the intake structure. The RWST provides borated water to the safety injection system and the RHR and containment spray systems during maximum hypothetical accident conditions. Borated water stored in the RWST is provided through piping in the Unit 3 and 4 safety injection pipe trench. The RWST foundations and the pipe trenches are made of reinforced concrete that is designed to Seismic Category 1 requirements. It is located above the groundwater elevation and therefore not subject to adverse below-grade conditions.

Three steam turbine-driven auxiliary feedwater pumps (A, B, and C) are provided for Turkey Point Units 3 and 4. The pumps are located in a cluster along the east wall of the turbine building between the turbine building and the Unit 3 containment. The pump foundations are made of reinforced concrete that is designed to Seismic Category 1 requirements.

The demineralized water storage tank foundation is located west of the turbine building and south of the discharge canal. Water stored in the DWST is provided for cooling of some of the components in the engineered safety feature systems. The DWST foundations are made of reinforced concrete that is designed to Seismic Category 1 requirements. A portion of the DWST foundation is below grade; however, it is located above the groundwater elevation and therefore is protected from groundwater and adverse conditions.

There are two diesel-driven instrument air compressors for Units 1 and 2. The Unit 3 instrument air compressor is located just west of the Turbine building. The Unit 4 instrument air compressor is located in the southwest corner of the turbine building. The foundations for the air compressors are made of reinforced concrete that is designed to Seismic Category 1 requirements.

There is one diesel-driven standby steam generator feedwater pump that supports fire protection, ATWS, and/or SBO events. It is located just southwest of the unit containment. The foundation for the diesel-driven standby steam generator feedwater pump is made of reinforced concrete that is designed to seismic Category 1 requirements.

The yard structures also include foundations for two raw water tanks, the diesel fire pump fuel oil storage tank, the electric fire pump, the fire water jockey pump foundations, the Unit 3 and 4 safety injection pipe trench, electrical duct banks, and manholes.

The applicant states that the yard structures are within the scope of license renewal because they perform the following functions:

- Provide structural support or functional support to safety-related equipment, or provide shelter or protection to safety-related equipment.

- Provide fire-rated barriers to confine or retard a fire from spreading to or from missile (internal or external) barriers in an adjacent area.

- Provide structural or functional support to non-safety-related equipment, failure of which could directly prevent satisfactory accomplishment of required safety-related functions.

- Provide protective barriers for internal flood events

The applicant lists the individual structural components noted above, and identifies their intended functions in Table 3.6-20 of the LRA. The structural components of the yard structures are identified under five material groups: carbon steel, carbon steel-galvanized, reinforced concrete for foundations above groundwater elevation, stainless steel, and steel (anchorages/embedments above groundwater elevation).

2.4.2.18.2 Staff Evaluation

The staff reviewed Section 2.4.2.18 of the LRA to determine if the applicant has adequately implemented its methodologies so that there is reasonable assurance that the structures and structural components of the yard structures have been properly identified as being within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.21(a)(1).

Additional supporting information is provided in Table 3.6-20, in which the applicant provides a list of the structural components of the various yard structures (i.e., the component or commodity group that comprises the yard structures), the associated intended functions, the material makeup of the component/commodity group, the environment of the structure, the aging effect of the material, and the required AMP.

The staff reviewed Section 2.4.2.18 and Table 3.6-20 of the LRA, and verified the SCs of the yard structures with the drawing in Figure 2.2-2. As a result of this review, the staff found no omissions by the applicant in scoping the yard structures as required by 10 CFR 54.4(a). The staff also found no omissions in the SCs identified in LRA Table 3.6-20 that are subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.4.2.18.3 Conclusions

On the basis of the review described above, the staff concludes that there is reasonable assurance that the applicant has appropriately identified those portions of the yard structures, and the associated structural components, that are within the scope of license renewal and subject to an AMR in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.5 Scoping and Screening Results – Electrical and Instrumentation and Controls (I&C)

In Section 2.5, "Scoping and Screening Results – Electrical and Instrumentation and Controls (I&C)," of the Turkey Point Units 3 and 4 LRA, the applicant describes the electrical components that are within the scope of license renewal and subject to an AMR. The staff reviewed this section of the LRA to determine whether there is reasonable assurance that all SSCs within the scope of license renewal have been identified, as required by 10 CFR 54.4(a), and that all SCs subject to an AMR have been identified, as required by 10 CFR 54.21(a)(1).

2.5.1 Summary of Technical Information in the Application

The screening for electrical/I&C components was performed on a generic component commodity group basis for the in-scope electrical/I&C systems listed in Tables 2.2-1, 2.2-2, and 2.2-3 of the LRA, and the methodology employed is consistent with the guidance in NEI 95-10. The screening methodology included electrical/I&C components that were separate and not part of larger components. For example, a circuit breaker was screened but not the wiring, terminal blocks, and connections inside a breaker cubicle. These components were considered to be parts of the breaker.

A review of controlled drawings, the plant equipment database, and interface with the parallel mechanical and civil/structural screening efforts were used to identify the electrical/I&C component/commodity groups within the scope of license renewal. The list includes all electrical/I&C NEI 95-10, Appendix B component commodity groups, with the exception of the following component/commodity groups, which were eliminated from consideration based on plant-level scoping:

- electrical bus
- transmission conductors
- high-voltage insulators

These isolated-phase buses/switchyard buses, transmission conductors, and high-voltage insulators listed above are not relied on to meet the license renewal scoping requirements of 10 CFR 54.4(a).

The applicant's scoping methodology identified the following electrical/I&C component/commodity groups as meeting the screening criteria of 10 CFR 54.21(a)(1)(i) and requiring further evaluation against the criteria of 10 CFR 54.21(a)(1)(ii):

- insulated cables and connections (including splices, connectors, and terminal blocks)
- uninsulated ground conductors
- electrical/I&C penetration assemblies

2.5.2 Staff Evaluation

The staff reviewed Section 2.5 of the LRA to determine whether there is reasonable assurance that the applicant has identified the electrical components within the scope of license renewal, in accordance with 10 CFR 54.4, and subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.5.2.1 Electrical Components Within the Scope of License Renewal and Subject to an Aging Management Review

In the first step of its evaluation, the staff determined that the applicant had properly identified the electrical component types installed in the plant. The applicant developed the following comprehensive list of electrical component types installed in the plant without regard for system function or license renewal in-scope status:

Alarm units	Electrical/I&C controls and panel internal component assemblies	Indicators	Motor control centers
Analyzers	Electrical/I&C penetration assemblies	Isolators	Power distribution panels
Annunicators	Elements	Light bulbs	Transformers
Batteries	Resistance temperature detectors (RTDs)	Loop Controllers	Transmitters
Bus-insulated cables and connectors	Sensors	Meters	
Cables and connections (terminal blocks, connectors, and splices)	Thermocouples	Power supplies	
Bus-uninsulated ground cables	Transducers	Radiation monitors	
Chargers	Fuses	Recorders	
Converters	Generators/motors	Regulators	
Inverters	Heat tracing	Relays	
Circuit breakers	Heaters	Signal conditioners	
Communication equipment		Solenoid operators	
		Solid-state devices	
		Surge arresters	
		Switches	
		Switchgear	

In the second step of its evaluation, the staff reviewed the basic function of each component type and the applicant's determination of which component types perform their functions without moving parts or a change in configuration or properties (passive and long-lived components) and therefore are subject to an AMR. The staff concludes that the applicant has properly identified the passive, long-lived electrical component types.

In the third step of its evaluation, the staff reviewed the list of passive, long-lived electrical component types to determine which met the criteria of 10 CFR 54.3(a)(1) through (3). This step defined the set of electrical component types subject to an AMR.

The following is a list of in-scope electrical component types subject to an aging management review:

- Insulated cables and connections (including splices, connectors, and terminal blocks) not included in the Environmental Qualification Program
- uninsulated ground conductors
- twenty-two electrical/I&C penetration assemblies that are within the scope of license renewal but not included in the Environmental Qualification Program

Finally, the staff reviewed the information submitted by the applicant and verified that the applicant had not omitted or misclassified any electrical components requiring an AMR.

2.5.3 Conclusions

On the basis of the staff's review of the information presented in Section 2.5 of the LRA and the supporting information in the Turkey Point Units 3 and 4 UFSAR, the staff did not find any omissions by the applicant, and therefore concludes that there is reasonable assurance that the applicant has identified those parts of the electrical systems that are within the scope of license renewal, as required by 10 CFR 54.4(a), and subject to an AMR, as required by 10 CFR 54.21(a)(1).

3. AGING MANAGEMENT REVIEW RESULTS

The staff's evaluation of the applicant's aging management programs (AMPs) focuses on program elements, rather than the details of specific plant procedures. To determine whether the applicant's AMPs are adequate to manage the effects of aging so that the intended functions of systems, structures, and components (SSCs) within the scope of license renewal will be maintained in a manner that is consistent with the current licensing basis (CLB) throughout the period of extended operation, the staff used 10 elements to evaluate each program and activity. The 10 elements of an effective AMP were developed as part of the staff's draft standard review plan (SRP) for license renewal, which was released in 1997 and contained in the final SRP, NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (July 2001). This SER describes the extent to which the 10 elements apply to a particular program or activity, and evaluates each program and activity against those elements that are determined to be applicable. On the basis of the NRC's experience with maintenance programs and activities, the staff concluded that conformance with the 10 elements of an AMP, or a combination of AMPs, provides reasonable assurance that an AMP (or combination of programs and activities) is demonstrably effective at managing the applicable aging effects. The following 10 elements of an effective AMP are considered in evaluating each AMP used by the applicant to manage the applicable aging effects identified within this SER:

- 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
- operating experience

In Section 2.0, "Structures and Components Subject to an Aging Management Review," of Appendix B to the license renewal application (LRA), the applicant states that the elements involving corrective actions 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 systems and components that are subject to an aging management review (AMR). In addition, the applicant states that the confirmation process element ensures that corrective actions have been taken and are effective. The staff's evaluation of the applicant's corrective action program, including the confirmation process, is separately discussed and generically evaluated in Section 3.1.2 of this SER.

3.1 Common Aging Management Programs

3.1.1 Chemistry Control Program

Section 3.2.4, "Chemistry Control Program," of Appendix B to the LRA includes a review of relevant material from Sections 3.2, "Reactor Coolant System," 3.3, "Engineered Safety Features Systems," 3.4, "Auxiliary Systems," 3.5, "Steam and Power," and 3.6, "Structures and

Structural Components," of the LRA. These sections address the interaction of the primary, secondary, treated water, and diesel generator fuel oil with the components in different systems and describes the resulting aging effects. The staff reviewed the applicant's description of the program in Section 3.2.4 of Appendix B to the LRA and the material in the other referenced sections of the LRA to determine whether the applicant has demonstrated that the chemistry control program will adequately manage the applicable aging effects so that the systems covered by this activity will perform their intended functions in accordance with the CLB throughout the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.1.1 Summary of Technical Information in the Application

The chemistry control program applies to the systems containing primary, secondary, and treated water, as well as diesel fuel oil. Specifically, the LRA identified the following systems:

- systems containing primary water
  - reactor coolant system
  - steam generator primary side
  - residual heat removal system
  - safety injection system
  - chemical and volume control system
  - containment spray system
  - emergency containment filtration system
  - spent fuel pool cooling system
  - spent fuel storage and handling system
  - sample system
- systems containing secondary water
  - steam generator secondary side
  - feedwater and blowdown system
  - auxiliary feedwater and condensate storage system
  - main steam and turbine generators
  - sample system
- systems containing treated water
  - control building ventilation system
  - turbine building ventilation system
  - component cooling water system
  - primary water makeup system
  - EDG cooling water
- systems containing diesel generator fuel oil
  - emergency diesel generators and support systems

The LRA identified the following aging effects caused by the water and diesel fuel oil environments:

- loss of material
- cracking
- fouling

These aging effects were caused by the following corrosion mechanisms identified in the LRA:

- general corrosion
- pitting corrosion
- crevice corrosion
- microbiologically influenced corrosion
- graphitic corrosion
- stress corrosion cracking
- intergranular attack
- corrosion fouling
- fouling caused by microbiologically influenced corrosion

The applicant concluded that the chemistry control program will mitigate these corrosion effects in the systems that are exposed to water or diesel fuel oil environments, and the appropriate corrective actions can be taken so that the components will perform their intended functions in a manner that is consistent with the CLB, throughout the period of extended operation.

As described in the following paragraphs, different chemical environments exist in the systems containing primary, secondary, and treated water, and diesel generator fuel oil; therefore, different types of chemistry control apply to these systems, and different types of sampling and analysis are needed.

Primary Water

The primary water identified in the LRA consists of treated water-primary and treated water-borated. The distinction between these two types of primary water is that the treated water-primary is the water in the reactor coolant system, and the treated water-borated is the water in all other systems that perform functions requiring borated water. Both of these types of water contain dissolved boric acid. In the reactor coolant system, the boron concentration is controlled by a boron/lithium/pH chemistry regime that is required for reactivity, radiation, and corrosion control. Its concentration varies during plant operation. In the systems containing treated water-borated, the concentration of boric acid remains constant. Most of the components in the systems containing primary water are made of stainless steel, but other materials (such as Alloy 600, which is used for steam generator tubing) are also present. All of these components may be subject to corrosion if the chemistry of the primary water is not properly controlled.

Secondary Water

Treated water-secondary is a demineralized water containing pH and oxygen controlling chemicals. The components in the systems containing secondary water are constructed mostly from carbon steel, although other materials (such as stainless steel or low alloy steel) are also present. Proper chemistry control is needed to prevent their corrosion.

Treated Water

Treated water is a demineralized water that is used in systems requiring clean water. Depending on its application, treated water can be deaerated and can contain corrosion inhibitors and biocides. Five systems containing treated water are included in the chemistry control program in the LRA. Specifically, these are the component cooling water (CCW), primary water makeup, EDG Cooling Water, Control Building Ventilation, and Turbine Building Ventilation systems. The CCW system removes heat from various power plant auxiliary systems. It contains components that are made from carbon steel, stainless steel, cast iron, aluminum brass, copper nickel, and brass. These materials may corrode in an uncontrolled treated water environment. The primary water makeup system stores high-purity treated water. Valves and piping in this system are included in the chemistry control program. Although these components are made from stainless steel, in an uncontrolled treated water environment, they may exhibit aging effects caused by a loss of material due to corrosion.

The EDG Cooling Water system provides cooling for the emergency diesel generators. It contains components made of carbon steel, cast iron, and copper alloys. The Control Building and Turbine Building Ventilation Systems utilize chilled water for removal of heat from rooms that contain essential electrical equipment. They contain components made of carbon steel, stainless steel, and copper. These materials may corrode and foul in an uncontrolled treated water environment.

Diesel Generator Fuel Oil

Emergency diesel generator support systems ensure proper operation of the emergency diesel generator. The fuel oil portion of the system includes the storage tank; day tanks; skid tanks; fuel oil pumps; and various valves piping, tubing, and hoses. These components are made from carbon steel, stainless steel, cast iron, and copper. They are exposed to the environment of diesel fuel oil, which can produce aging effects due to loss of materials by corrosion in the presence of accumulated water.

3.1.1.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in the LRA regarding the applicant's demonstration that the chemistry control program for water and fuel oil chemistries will ensure that the effects of aging will be adequately managed so that intended functions will be maintained consistent with the CLB throughout the period of extended operation for all components in the systems included in the LRA. After completing the initial review, the staff issued several requests for additional information (RAIs) by letter dated February 1, 2001. By letter dated April 19, 2001, the applicant responded to the staff's RAIs.

The staff's evaluation of the applicant's AMPs related to water and fuel oil chemistries focused on program elements, rather than detailed plant-specific procedures. To determine whether these programs adequately mitigate the effects of aging to maintain intended functions consistent with the CLB throughout the period of extended operation, the staff evaluated seven elements that apply to these programs. The corrective actions and administrative controls for license renewal were not discussed in this section because the application indicates that they are in accordance with the site-controlled quality assurance program pursuant to 10 CFR Part 50, Appendix B, and cover all structures and components that are subject to an AMR. For the confirmation process element, the applicant states that followup testing is performed to confirm satisfactory completion of the corrective action. The staff's evaluation of the quality assurance program including the confirmation process is provided separately in Section 3.1.2 of this SER. The remaining seven elements are discussed below.

[Program Scope] In Section 3.2.4 of Appendix B to the LRA, the applicant stated that the scope of this program includes managing the aging effects of loss of material, cracking, and fouling within the systems specified in LRA Sections 3.2, 3.3, 3.4, 3.5, and 3.6. The scope of inspection consists of sampling activities and analysis of treated water-primary, treated water-borated, treated water-secondary, treated water, and diesel fuel oil. Appropriate corrective actions are taken when the chemistry parameters do not meet specified limits. The staff finds that there is reasonable assurance that the applicant has included all plausible aging effects related to water and fuel oil chemistries for aging management considerations, and the scope of the chemistry control program is adequate.

[Preventive or Mitigative Actions] The objective of the chemistry control program is to ensure that the chemistry parameters for water and diesel fuel oil remain within their optimum values. Although it will not completely eliminate corrosion, the program will reduce the damaging effects of corrosion, and will ensure that the resultant aging effects will not invalidate the functions performed by the components that are exposed to water or diesel fuel oil environments. The staff finds that the chemistry control program will effectively mitigate aging effects caused by corrosion.

[Parameters Monitored or Inspected] The chemistry control program monitors chemistry parameters in different systems in the plant for the purpose of aging management. The monitoring and inspection procedures are based on the guidelines specified in Electric Power Research Institute (EPRI) reports TR-105714, Rev. 4, and TR-102134, Rev. 5, for primary and secondary water chemistries, respectively. The procedures also rely on different equipment vendor specifications, and information from water treatment experts. These procedures allow the applicant to determine the concentrations of different chemical species, including fluoride, sulfate, oxygen, biocide, and corrosion inhibitor. The chemistry control program for the diesel fuel oil relies on the American Society for Testing and Materials (ASTM) D-4176 qualitative test and the ASTM D-2276 quantitative test for monitoring water and particulate content in diesel fuel oil. The staff finds that these procedures for monitoring and inspecting chemistry parameters will help the applicant to control aging effects in the affected plant systems.

[Detection of Aging Effects] Aging effects due to corrosive environments of water and diesel fuel oil are specific for different systems, and their detection is handled by the appropriate programs described in the LRA and evaluated by the staff. Localized corrosive damage (such as crevice corrosion) is detected during routine and corrective maintenance when the inspected components are disassembled and visually inspected for loss of material and other aging effects. The staff finds that the chemistry control program has the capability to satisfactorily manage aging effects.

[Monitoring and Trending] The monitoring and trending requirements for the parameters that are controlled by the chemistry control program are included in plant procedures. The staff finds that these procedures will allow the applicant to detect operational problems and take appropriate corrective action.

[Acceptance Criteria] The acceptance criteria in the chemistry control program for the chemistry parameters to be monitored in the systems carrying primary, secondary, and treated water chemistries and diesel fuel oil are described in the Nuclear Chemistry Parameters Manual, Technical Specifications, and other plant procedures. These parameters specify operational chemistry limits for specific systems. The staff finds that these criteria will ensure that chemistries of water and diesel fuel oil will be maintained at their optimum conditions.

[Operating Experience] The applicant states that review of Turkey Point's past performance has indicated that the overall effectiveness of the program is supported by very satisfactory operating experience for the systems, structures, and components that are affected by the program. A review of plant condition reports indicated that no Level 3 chemistry excursions, as defined by EPRI's water chemistry guidelines, were experienced. The program has been subject to periodic internal and external assessments to ensure continuous effectiveness and improvement. The staff finds that the operating experience presented by the applicant supports the determination that the chemistry control program will adequately manage the aging effects associated with the chemical environments existing at the Turkey Point nuclear power plant throughout the period of extended operation.

3.1.1.3 Conclusions

The staff has reviewed the information in Section 3.2.4 of Appendix B to the LRA and the applicant's responses to staff's RAIs. On the basis of its review, the staff concludes that the applicant has demonstrated that there is reasonable assurance that the chemistry control program will adequately manage aging effects associated with primary, secondary, treated water, and diesel generator fuel oil chemistries in accordance with the CLB throughout the period of extended operation.

3.1.2 FPL Quality Assurance Program

The NRC staff has reviewed LRA Section 3.1.2, "FPL Quality Assurance Program," in accordance with 10 CFR 54.21(a)(3) and 10 CFR 54.21(d). In Section 3.1.2 of the LRA, the applicant references its quality assurance program information contained in Section 2.0, "Aging Management Program Attributes," of Appendix B, "Aging Management Programs," to the LRA. The staff has evaluated the adequacy of certain aspects of the applicant's programs to manage the effects of aging. The particular aspects reviewed by the staff in this section encompass three quality assurance program attributes, namely corrective actions, confirmation process, and administrative controls. These three attributes of the quality assurance program are addressed for all of the applicant's aging management programs.

The license renewal applicant is required to demonstrate that the effects of aging on structures and components that are subject to an AMR will be adequately managed to ensure that their intended functions will be maintained in a manner that is consistent with the CLB of the facility throughout the period of extended operation. Therefore, those aspects of the aging management process that affect the quality of safety-related SSCs are subject to the quality assurance requirements of Appendix B to 10 CFR Part 50. For non-safety-related SSCs that are subject to an AMR, the existing 10 CFR Part 50, Appendix B, quality assurance program may be used by the applicant to address the attributes of corrective actions, confirmation process, and administrative controls.

3.1.2.1 Summary of Technical Information in Application

In Section 2.0 of Appendix B to the LRA, the applicant provides a generic description of the corrective actions, administrative controls, and confirmation process common to all aging management programs within the scope of license renewal. In this section, the applicant states that the corrective actions and administrative controls apply to all aging management programs that are credited for license renewal. The confirmation process is described as a process to ensure that adequate corrective actions have been completed and are effective. The corrective actions and administrative controls are described as part of the applicant's quality assurance program required by 10 CFR Part 50, Appendix B. For each aging management program listed in Section 3.0, "Aging Management Programs," of Appendix B to the LRA, the confirmation process is described as establishing followup examination requirements based on the evaluation of the inspection results. Also, the applicant states that it will enter unacceptable inspection results into its corrective action program.

The applicant's programs and activities that are credited with managing the effects of aging can be divided into new and existing programs. As defined in Section 2.0 of Appendix B to the LRA, the applicant uses the following specific attributes to describe these programs and activities:

- Corrective Actions: A description of the action taken when the established acceptance criterion or standard is not met. This includes timely root cause determination and prevention of recurrence, as appropriate.
- Administrative Controls: The identification of the plant administrative structure under which the programs are executed.
- Scope: A clear statement of the reason why the program exists for license renewal.
- Preventive Actions: A description of preventive actions taken to mitigate the effects of the susceptible aging mechanisms, and the basis for the effectiveness of these actions.
- Parameters Monitored or Inspected: A description of parameters that are monitored or inspected, and how they relate to the degradation of the particular component or structure and its intended function.

- Detection of Aging Effects: A description of the type of action or technique used to identify or manage the aging effects or relevant conditions.

- Monitoring and Trending: A description of the monitoring, inspection, or testing frequency and sample size (if applicable).

- Acceptance Criteria: The identification of the acceptance criteria or standards for the relevant conditions to be monitored or the chosen examination methods.

- Confirmation Process: A description of the process to ensure that adequate corrective actions have been completed and are effective.

- Operating Experience and Demonstration: A summary of the operating experience of the aging management program, including past corrective actions resulting in program enhancements or additional programs. Program demonstration is also included in this summary.

The applicant's programs and activities that 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 are described in Section 3.0, "Aging Management Programs," of Appendix B to the LRA. Summary descriptions of new and existing programs are contained in Chapter 16 of the applicant's UFSAR Supplement, which is provided in Appendix A to the LRA.

3.1.2.2 Staff Evaluation

The staff has determined the adequacy of certain aspects of the applicant's programs to manage the effects of aging. The particular aspects reviewed by the staff in this section encompass three quality assurance program attributes, namely corrective actions, confirmation process, and administrative controls. These three attributes of the quality assurance program are used by all of the applicant's aging manage programs. During the scoping/screening methodology and quality assurance audit conducted on November 13–16, 2000, the NRC staff reviewed the applicant's implementation of the corrective actions, administrative controls, and confirmation process described in LRA Section 3.1.2. The results were documented in an audit report dated April 25, 2001.

Chapter 3.0, "Aging Management Review Results," of the LRA provides an aging management review summary for each unique structure, component, or commodity group at Turkey Point determined to require aging management during the period of extended operation. This summary includes identification of aging effects requiring management and aging management programs utilized to manage these aging effects. Appendix B to the LRA demonstrates how the identified programs manage aging effects using attributes described in Section 3.1.2.1 of this SER. The staff determined that the attributes identified for each program consistent with those attributes described in Section A.1, "Aging Management Review — Generic," Table A.1-1, "Elements of an Aging Management Program for License Renewal," of the draft SRP.

Pursuant to 10 CFR 54.21, a license renewal applicant must demonstrate that the effects of aging on structures and components that are subject to an AMR will be adequately managed so that the intended functions will be maintained in a manner that is consistent with the CLB of the facility throughout the period of extended operation. Consistent with this approach, the applicant's aging management programs should contain the elements of corrective action, confirmation process, and administrative controls in order to ensure proper supervision of the aging management programs.

For all of these aging management programs, two attributes (corrective actions and administrative controls) are specifically addressed by reference to the FPL Topical Quality Assurance Report. However, neither Section 2.0 nor Section 3.0 of Appendix B to the LRA describe how the Topical Quality Assurance Report specifically addresses the confirmation process for which credit is being sought. In a February 2, 2001, letter, the NRC staff requested that the applicant provide a description of how the Topical Quality Assurance Report specifically addresses the confirmation process in the context of the corrective action program. Subsequently, in a letter dated March 22, 2001, the applicant described that the confirmation process is part of the corrective action process, which is part of the Topical Quality Assurance Report that meets the requirements of 10 CFR Part 50, Appendix B. The applicant's response resolved this open item.

Based on the information provided in the LRA, as supplemented by the applicant's letter, the NRC staff has determined that the corrective actions, confirmation process, and administrative controls are addressed in the applicant's approved quality assurance program. The staff has also determined that all aging management programs within the scope of license renewal are subject to the requirements of the applicant's quality assurance program. This includes the safety-related and non-safety-related aging management programs within the scope of license renewal. The staff finds that the FPL Topical Quality Assurance Report contains the applicant's commitments for managerial and administrative controls, including a discussion of how the applicable requirements of Appendix B to 10 CFR Part 50 will be satisfied.

3.1.2.3 FSAR Supplement

The applicant has provided a summary description of the programs and activities for managing the effects of aging and the evaluation of time-limited aging analyses for the period of extended operation in UFSAR Chapter 16, which is also included in Appendix A to the LRA. The UFSAR Supplement provides a brief explanation of the new and existing programs that the applicant will use to manage the effects of aging. The explanation contains a summary of several important technical attributes, such as inspections and techniques used to identify aging effects. However, the quality assurance programs, which include three attributes (corrective actions, confirmation process, and administrative controls), were not described.

For non-safety-related structures and components that are subject to an AMR for license renewal, an applicant has an option to expand the scope of its 10 CFR Part 50, Appendix B, program to include these structures and components to address corrective actions, confirmation process, and administrative controls for aging management during the period of extended operation. In accordance with Appendix A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)," Section A.2.2, Item 2 to the SRP, the applicant should document a commitment to expand the scope of its 10 CFR Part 50,

Appendix B, quality assurance program to include non-safety-related structures and components in the UFSAR Supplement consistent with Section 2 of Appendix B to the LRA. Several aging management programs pertain to both safety-related and non-safety-related SSCs. Therefore, committing to the FPL Quality Assurance Program for all aging management programs is acceptable. The applicant may develop another approach to meet Branch Technical Position IQMB-1. This issue was discussed with the applicant during the scoping and screening audit and was listed as Confirmatory Item 3.1.2-1. By letter dated November 1, 2001 the applicant responded to issue. The applicant stated that two attributes, Corrective Actions and Administrative Controls, were identified as common to all programs and are described in LRA Appendix B, Section 2.0, as being under the guidance of the FPL Quality Assurance Program. Confirmatory Actions are described in each individual program by stating that the followup actions will be entered into the corrective action programs. Furthermore, the FPL Quality Assurance Program will be applied to all aging management programs. The FSAR Supplement Section 16.0 is being revised to include the following:

> "FPL has established and implemented a Quality Assurance Program to provide assurance that the design, procurement, modification and operation of nuclear power plants conform to applicable regulatory requirements. The FPL Quality Assurance Program, described in the FPL Topical Quality Assurance Report, is in compliance with the requirements of 10 CFR 50, Appendix B. The FPL Quality Assurance Program meets the requirements provided by regulatory guidance and industry standards as listed in Appendix C of the FPL Topical Quality Assurance Report. Corrective actions, confirmatory actions, and administrative controls apply to all aging management programs credited for license renewal and performed, or in the case of new programs, to be performed, in accordance with the FPL Quality Assurance Program."

The staff has reviewed the applicant response and concludes that there is reasonable assurance that the applicant has expanded the scope of its 10 CFR Part 50, Appendix B, quality assurance program to include all safety-related and non-safety-related structures, systems, and components within the scope of license renewal in the UFSAR Supplement consistent with Section 2 of Appendix B to the LRA.

3.1.2.4 Conclusion

The staff finds that the quality assurance attributes are consistent with 10 CFR 54.21(a)(3). The staff finds that the applicant's UFSAR Chapter 16 Supplement description as revised in their response dated November 12, 2001, to the staff's confirmatory issue 3.1.2-1 provides a sufficient description of the programs and activities for managing the effects of aging, and ensures both safety-related and non-safety-related structures, systems, and components within the scope of license renewal will be evaluated and managed in accordance with their 10 CFR Part 50 Appendix B Quality Assurance Program. Therefore, the applicant's quality assurance description for its aging management programs is acceptable and Confirmatory Item 3.1.2-1 has been satisfied.

3.1.3 Systems and Structural Monitoring Program

3.1.3.1 Summary of Technical Information in the Application

The applicant describes its systems and structural monitoring program in Section 3.2.15 of Appendix B to the LRA. The applicant credits this inspection program with assessing the overall condition of the Turkey Point Unit 3 and 4 buildings and structures, and identifies any ongoing degradation through a visual inspection process. The program monitors and assesses the condition of structures and structural components affected by aging, which may cause loss of material, cracking, flow blockage, and change of material properties. The staff reviewed the LRA to determine whether the applicant has demonstrated that the structural monitoring program will adequately manage aging effects throughout the period of extended operation, as required by 10 CFR 54.21(a)(3).

In Section 3.2.15 of Appendix B to the LRA, the applicant describes the systems and structural monitoring program credited for aging management, and provides for periodic visual inspections to monitor the condition of structures, systems, components, and commodities. The structures monitored include the auxiliary building, containment, control building, diesel-driven fire pump enclosure, discharge structure, electrical penetration rooms, emergency diesel generator buildings, fire protection monitoring station, intake structure, main steam and feedwater platforms, plant vent stack, spent fuel storage and handling structure, turbine building, turbine gantry cranes, and yard structures. There are 20 key systems monitored by this program including auxiliary building ventilation, auxiliary feedwater, condensate storage, chemical and volume control, component cooling water, and containment isolation. The applicant lists the specific structural components and systems, which are fabricated from either carbon steel, stainless steel, or concrete, and inspected as part of the systems and structures monitoring program in Sections 3.2 through 3.6 of Appendix B to the LRA.

The aging effects managed by the structural monitoring program are discussed in Section 3.6 of the LRA. The applicant credits this inspection program to manage loss of material, cracking, fouling, loss of seal, and change in material properties for the above listed 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 the inaccessible structural components.

The applicant states that the program will be enhanced by restructuring it to address inspection requirements to manage the aging effects in accordance with 10 CFR Part 54, modifying the scope of specific inspections, and improving documentation requirements. Commitment dates associated with the enhancement of this program are contained in Appendix A to the LRA.

3.1.3.2 Staff Evaluation

The staff's evaluation of the structural monitoring program focused on how the program manages aging effects through the effective incorporation of the following 10 elements: program 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.

The corrective actions and administrative controls for license renewal were not discussed as part of the program description because the applicant indicates that they are in accordance with the site-controlled quality assurance program pursuant to 10 CFR Part 50, Appendix B, and cover all structures and components that are subject to AMR. For the confirmation process element, the applicant states that degradations identified by this program are evaluated and entered into the corrective action program. The staff's evaluation of the quality assurance program, including the confirmation process, is provided separately in Section 3.1.2 of this SER. The remaining seven elements are discussed below.

[Program Scope] The applicant lists the structures, systems, components, and commodities that are covered by the systems and structural monitoring program in Section 3.2.15 of Appendix B to the LRA. In RAI 3.6.2.1-2, the staff asked the applicant to provide an aging management program for monitoring the condition of reinforced concrete components located above groundwater elevation and outside containment. The applicant responded that its aging management review of these concrete components identified no aging effects that could cause loss of intended function and, therefore, listed no aging management program for these components in the LRA. However, the applicant proposed to modify its ASME Section XI, Subsection IWL Inservice Inspection Program to manage the aging of containment structure concrete components located above groundwater elevation and to use these inspections as an indicator for the condition of reinforced concrete components outside containment. Subsequent communication between the staff and applicant culminated in a letter, dated October 30, 2001, in which the staff stated its position that all concrete structures and components within the scope of license renewal require aging management via a dedicated aging management program. In its supplemental response to RAI 3.6.2.1-2, dated November 1, 2001, the applicant committed to modify its systems and structural monitoring program in order to manage loss of material, cracking, and change in material properties for reinforced concrete components outside containment as well as containment internal structural concrete components. Once incorporated, as committed in this response, the staff considers this issue to be resolved.

In RAI 3.9.15-1 dated February 2, 2001, the staff asked the applicant to indicate how it will manage aging effects of structural components that are inaccessible for inspection, and to discuss how it intends to manage or monitor aging effects of inaccessible structural components when conditions in accessible areas may not indicate the presence of degradation in inaccessible areas. The applicant was also asked to provide a summary discussion of specific program attributes that will be enhanced to address inspection requirements to manage certain aging effects pursuant to 10 CFR Part 54. The applicant responded by letter dated April 19, 2001, stating that 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. This is described in the systems and structures monitoring program, Appendix B, Section 3.2.15, page B-84, of the LRA. The applicant states that since components in inaccessible areas have the same materials and environments as those in accessible areas, indications of degradation (or the lack of indications) in accessible areas is an effective way to manage components in inaccessible areas.

As described in the response to RAI 3.6.1.1-1, dated March 30, 2001, the applicant indicates that the systems and structures monitoring program is credited for managing aging of the inaccessible containment concrete below the groundwater. Aging effects are managed by performing visual inspections of the non-safety-related tendon access gallery concrete below groundwater to provide early indication of potential aging effects for the containment concrete.

Currently, inspections that are within the scope of the systems and structures monitoring program are performed under a variety of plant programs and processes. For the renewal term, the applicant plans to enhance these inspections by restructuring them to identify certain aging effects in accordance with 10 CFR Part 54, by adding specific structures and components that are not currently inspected under an existing program, and by improving documentation requirements. These enhancements will be incorporated prior to the end of the initial license term for Turkey Point, as described in Appendix A to the LRA, Section 16.2.15, page A-41.

With the above clarifications provided in response to the RAI, the staff finds that the scope of this program is acceptable, since it includes a walkdown inspection and aging effects assessment of all structures and components that are within the scope of license renewal. Therefor, RAI 3.9.15-1 is closed.

[Preventive Actions] The applicant stated that external surfaces of carbon steel and cast iron valves, piping, and fittings, and specific stainless steel piping welds are coated to minimize corrosion, as are surfaces of steel structures and supports. The applicant asserts that coatings minimize corrosion by limiting exposure to the environment; however, the applicant did not take credit for coatings in the determination of the aging effects requiring management. The applicant's approach is acceptable.

[Parameters Monitored or Inspected] The applicant states that surface conditions of structures, system components/piping (including those exposed to a wetted environment), and supports are monitored through visual examinations to determine the existence of external corrosion and the internal corrosion of certain ventilation equipment. Flexible connections are monitored for cracking due to embrittlement, and ventilation heat exchangers are monitored for fouling. 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 applicant further states that leakage inspections of valves, piping, and fittings at limited locations of the intake cooling water and waste disposal systems are utilized to detect the presence of internal corrosion. Additionally, visual inspection of external surfaces of certain ventilation systems is used to assess internal system conditions. Inspection of protective coatings on specific stainless steel piping welds in outdoor locations will be performed to determine coating degradation. Inspection of weatherproofing material for deterioration is also performed.

With respect to this attribute, the staff's RAI 3.9.15-2, dated February 2, 2001, stated that the applicant's parameter description is incomplete. The RAI asked the applicant to augment the discussion to demonstrate that the specific parameters that are monitored or inspected are selected to ensure that aging degradation leading to loss of intended functions will be detected, and the extent the degradation can be determined. The parameters monitored or inspected must be commensurate with industry-standard practice, and must also consider industry and plant-specific operating experience. For concrete structural elements, typical parameters to be monitored or inspected are structural cracking, spalling, scaling, erosion, corrosion of reinforcement bars, settlement, and deformation. For structural steel elements (including connections), typical parameters to be monitored or inspected are corrosion, cracking, erosion, discoloration, wear, pitting, gouges, dents, and other signs of surface irregularities.

In the applicant's response, dated April 19, 2001, the applicant stated that the systems and structures monitoring program, as described in Section 3.2.15 of Appendix B to the LRA, manages the aging effects of loss of material, cracking, fouling, loss of seal, and change in material properties to ensure that aging degradation leading to loss of intended functions will be detected. The program provides for periodic visual inspection of concrete and masonry structures, steel structures, and system commodities and components (e.g., piping, ductwork, electrical raceways, valves, heat exchangers, and electrical enclosures). The applicant further stated that the parameters monitored are selected based on industry and plant experience to ensure that aging degradation that could lead to loss of intended function will be identified and addressed. Concrete and masonry parameters monitored include exposed rebar, cracking, rust bleeding, spalling, scaling, other surface irregularities, and settlement. For steel structures, the parameters monitored include corrosion, flaking, pitting, gouges, cracking, other surface irregularities, and missing parts. For system commodities and components, the parameters monitored include corrosion, flaking, pitting, gouges, cracking, fouling, other surface irregularities, protective coating degradation on select stainless steel pipe welds, leakage at limited locations, and missing parts. The staff finds that the parameters that are monitored or inspected as described above are adequate and acceptable because they are directly related to the degradation of civil structures, systems, and components, and visual inspections and associated aging effects evaluations of these parameters are effective means to detect degraded conditions. Therefore, RAI 3.9.15-2 is closed. In addition, in its supplemental response to RAI 3.6.2.1-2, dated November 1, 2001, the applicant committed to the examination of external surfaces of concrete for cracking, loss of material, and change in material properties as well as the other conditions listed above.

[Detection of Aging Effects] The applicant states that aging effects due to loss of material, crack initiation, fouling, loss of seal, and change in material properties are detected by visual inspection of external surfaces (including internal surfaces of certain ventilation equipment) for evidence of corrosion, cracking, leakage, fouling, or coating damage. The staff's RAI 3.9.15-5, dated February 2, 2001, asked the applicant to provide the inspection methods, inspection schedule (frequency), and inspector qualifications for each structure/aging effect combination to ensure that aging degradation will be detected and quantified before there is loss of intended functions.

In its response dated April 19, 2001, the applicant indicated that as described in Section 3.2.15 of Appendix B to the LRA, the systems and structures monitoring program employs the visual inspection method. Structures and structural commodities are visually inspected on an area basis, and system commodities and components are visually inspected on a system basis. Conditions documented and evaluated via the corrective action program may employ other methods, such as volumetric examination, to determine the extent of degradation.

The applicant stated that the inspection schedule varies depending on the system, structure, or component being inspected. Generally, inspections will be performed on a frequency of 5 years or less; however, as documented in the response to RAI 3.4.1-2, dated March 22, 2001, some inspections of the intake cooling water (ICW) system will be performed on an 18-month interval. These frequencies are based on Turkey Point plant experience regarding degradation rates and the ability of a structure or component to accommodate degradation without a loss of intended function. The frequency of inspections may be adjusted as necessary based on future inspection results and industry experience. The applicant indicated that personnel responsible for the performance of inspections and the evaluation of inspection results are qualified in accordance with the engineering training program (ETP), which is accredited by the Institute of Nuclear Power Operations (INPO) and required by 10 CFR 50.120.

The applicant stated that the inspection methods, inspection schedules, and personnel qualifications described above provide reasonable assurance that aging degradation will be detected and evaluated before there is a loss of intended functions. The staff finds this section of the program acceptable. Therefore, RAI 3.9.15-5 is closed.

[Monitoring and Trending] The applicant's discussion did not appear to adequately address the monitoring and trending aspects of the program. Proactive monitoring and understanding of trending behavior is needed to monitor structural aging so that corrective actions can be taken prior to exceeding the acceptance criteria. The staff's RAI 3.9.15-4, dated February 2, 2001, asked the applicant to describe the monitoring and analysis activities to be included for each of the commodity groups to track the extent and rate of degradation and their relationship to the applicable acceptance criteria.

In its response dated April 19, 2001, the applicant stated that the systems and structures monitoring program is primarily credited for managing loss of material due to corrosion, as well as other aging effects identified in Section 3.2.15 of Appendix B to the LRA. Monitoring is accomplished through detailed system and structure material condition inspections, performed periodically in accordance with approved plant procedures. When degraded conditions are identified, they are evaluated and corrected via the corrective action program. Typically, this involves quantifying the extent of the condition, evaluating the capability of the structure or component to perform its intended function, and then designating appropriate corrective actions. The applicant indicated that the corrective action program includes periodic trending assessments and evaluations. When trends are identified, they are addressed under the corrective action program. Further evaluation is performed including identification and implementation of programmatic improvements, as required. Programmatic improvements may include adjustment of program scope, frequency, acceptance criteria, and/or corrective actions. This process ensures that applicable aging effects are adequately managed. The staff finds this section of the program acceptable. Therefore, RAI 3.9.15-4 is closed.

[Acceptance Criteria] In RAI 3.9.15-3, dated February 2, 2001, the staff asked the applicant to provide additional descriptions of the criteria used to assess or categorize the overall condition of the structures and systems that are monitored. In addition, the RAI asked the applicant to discuss Turkey Point-specific criteria that are used to assess the severity of observed degradations and determine whether corrective action(s) are needed. The RAI also asked the applicant to briefly describe walkdown procedures, checklists, or inspection forms that are provided to personnel who implement the systems and structures monitoring program.

In its response dated April 19, 2001, the applicant stated that detailed structural and system/equipment material condition inspections are performed in accordance with approved plant procedures. Existing procedures include detailed guidance for inspecting and evaluating the material condition of systems, structures, and components within the scope of the program. The guidance includes specific parameters to be monitored and criteria to be used for evaluating identified degradation. In addition, the procedures provide sample forms to be used to document the analysis and assessment, and a system checklist for documenting relevant information from a system walkdown.

Conditions identified through the systems and structures monitoring program are evaluated to determine if the condition(s) should be addressed under the FPL 10 CFR Part 50, Appendix B, corrective action program (i.e., deficient or unacceptable conditions). For example, the criterion for structural steel is loss of material exceeding $^{1}/_{32}$ of an inch, and the criterion for piping is any corrosion greater than uniform light surface corrosion. The applicant stated that the results of the inspections and testing are evaluated in accordance with the acceptance criteria in the appropriate corrective action and administrative procedures. The staff finds the above described approach reasonable and adequate. The staff also finds that this section of the program addressing acceptance criteria is acceptable. Therefore, RAI 3.9.15-3 is closed.

[Operating Experience and Demonstration] The applicant states that systems and piping/component support material condition inspections have been successfully performed at Turkey Point since the mid-1980s. The inspection requirements in support of the NRC's Maintenance Rule (10 CFR 50.65) have been in effect since 1996, and have proven effective at maintaining systems/structures material condition and detecting unsatisfactory conditions, and have resulted in effective corrective actions being taken. The applicant further states that the systems and structures monitoring program has been an ongoing program at Turkey Point and has been enhanced over the years to include the best practices recommended by INPO and other industry guidance. Additionally, the systems and structures monitoring program will continue to support implementation of the Maintenance Rule. The effectiveness of the systems and structures monitoring program is supported by the improved system and structure material conditions documented by internal as well as external assessments of the last several years. Additionally, the systems and structures monitoring program is the subject of periodic internal and external assessments to ensure effectiveness and continued improvement. Based upon the above, the applicant asserts that continued implementation of the systems and structures monitoring program provides reasonable assurance that the aging effects (loss of material, crack initiation, fouling, loss of seal, and change in material properties) will be managed such that systems and structures within the scope of license renewal will continue to perform their intended functions consistent with the CLB throughout the period of extended operation. The staff finds that this section of the program is acceptable.

3.1.3.3 Conclusion

The staff has reviewed the information in Section 3.2.15 of Appendix B to 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 managed by the systems and structures monitoring program will be adequately managed so that there is reasonable assurance that the commodities and components covered by this inspection program will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2 Reactor Coolant Systems

The LRA includes the following reactor coolant mechanical and structural components within the reactor coolant systems that require an AMR:

- reactor coolant piping (Class 1 and non-Class 1)
- regenerative and excess letdown heat exchangers
- pressurizers
- reactor vessels
- reactor vessel internals
- reactor coolant pumps
- steam generators

Results from AMR of these components are described in LRA Section 3.2, "Reactor Coolant Systems." The staff issued an RAI on February 2, 2001. The applicant provided the additional information by letter dated April 19, 2001.

3.2.1 Reactor Coolant Piping

The reactor coolant piping at Turkey Point consists of Class 1 and non-Class 1 components. In the LRA, the applicant provided separate descriptions of the AMR for these two classifications of piping.

3.2.1.1 Class 1 Piping

3.2.1.1.1 Summary of Technical Information in the Application

The applicant described its AMR of the Class 1 piping for license renewal in LRA Section 3.2.1.1, "Class 1 Piping," as supplemented by the April 19, 2001, response to the RAI. The staff reviewed this section of the LRA to determine whether the applicant has demonstrated that the effects of aging on the Class 1 piping will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Class 1 piping is included in topical report WCAP-14575, "License Renewal Evaluation: Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components." WCAP-14575 is not incorporated by reference in the LRA, but the Turkey Point AMR was compared to WCAP-14575, as described in Section 3.2.6.2 of this SER. The draft safety evaluation (SE) for WCAP-14575 was issued by letter dated February 10, 2000. The final SE for WCAP-14575 was issued by letter dated November 8, 2000, after the Turkey Point LRA was submitted to the NRC for review. However, all of the LRA action items identified in the final SE of WCAP-14575 were addressed either as applicant action items or open items by the applicant in Tables 2.3-2 and 2.3-3 of the LRA. Specifically, the open items that were identified in the draft SE of WCAP-14575 were either resolved, or added to the list of renewal applicant action items for the final SE. The applicant's responses are discussed and evaluated in Section 3.2.6.2 of this SER.

Although topical report WCAP-14575 is not incorporated by reference in the application, the results of the applicant's AMR were compared to those of the topical report in Tables 2.3-2 and 2.3-3 of the LRA. The applicant's review concluded that the Turkey Point Unit 3 and 4 reactor coolant Class 1 piping is bounded by the description of Class 1 piping contained in WCAP-14575 with regard to design criteria and features, materials of construction, fabrication techniques, installed configuration, modes of operation, and environments/exposures. Further, the applicant concluded that the component intended functions for reactor coolant Class 1 piping are inclusive of the intended functions identified in WCAP-14575. In addition to the functions identified in WCAP-14575, the applicant identified an additional function for the flow-restricting orifices and reducers. The applicant concluded that these orifices and reducers provide throttling to limit the maximum flow through a postulated line break in an attached non-Class 1 line to a value within the makeup capability of the chemical and volume control system. These orifices and reducers provide the code class break in the applicant's evaluation.

The applicant identified additional aging effects, specifically cracking due to stress corrosion and loss of mechanical closure integrity due to aggressive chemical attack and stress corrosion cracking (SCC), not identified in the evaluation of topical report WCAP-14575.

The applicant identified that the reactor coolant Class 1 piping components are exposed to an internal environment of treated water-primary, and external environments of containment air and potential borated water leaks, as described in Tables 3.0-1 and 3.0-2 of the LRA.

The application identifies that reactor coolant Class 1 piping components are constructed of stainless steel and low alloy steel, and notes that there are no Alloy 600 penetrations associated with reactor coolant Class 1 piping components. The piping components, and their intended functions, materials, and environments are summarized in Table 3.2-1 of the LRA.

The LRA identifies cracking, reduction in fracture toughness, and loss of mechanical closure integrity as aging effects requiring management during the license renewal period for Class 1 piping. Table 3.2-1 of the LRA summarizes the environment and material combinations requiring aging management, along with the programs and activities for aging management during the license renewal period.

Cracking due to flaw growth and stress corrosion is identified in the application as an aging effect requiring management for the period of extended operation. Cracking due to fatigue is identified in the application as a time-limited aging analysis (TLAA), and is addressed in LRA Section 4.3, "Metal Fatigue."

The LRA identifies that cracking due to growth of original manufacturing flaws is managed during the license renewal period through the ASME Section XI, Subsections IWB, IWC, and IWD inservice inspection (ISI) program, as supplemented by the one-time small bore piping inspection program. For cracking due to stress corrosion, the LRA identifies that specific design, fabrication, and construction measures were taken to minimize or eliminate susceptible material from reactor coolant Class 1 piping components, including preventing sensitized stainless steel from coming in contact with an aggressive environment. The LRA identifies that the chemistry control program provides additional assurance that SCC is managed.

The LRA identifies reduction in fracture toughness due to thermal embrittlement of Class 1 piping components fabricated from cast austenitic stainless steel (CASS). The LRA identifies affected components as the primary loop elbows, reactor coolant pump casings and closure flanges, and selected valves exceeding a temperature threshold criterion of 482 °F. Reduction in fracture toughness of the reactor coolant pump casings and closures is discussed in LRA Section 3.2.6, "Reactor Coolant Pumps."

The impact of thermal embrittlement on the primary loop elbows is evaluated in the primary loop leak-before-break (LBB) analysis, which has been identified as a TLAA by the applicant. This TLAA is described in LRA Section 4.7.3, "Leak-Before-Break for Reactor Coolant System Piping."

Consistent with the conclusions drawn in the NRC's safety evaluation for WCAP-14575, the applicant concludes that screening Class 1 CASS valves for susceptibility to thermal embrittlement is not required during the period of extended operation because the reduction in fracture toughness of these components should not have a significant impact on critical flaw size. The LRA further concludes that the ASME Section XI, Subsections IWB, IWC, and IWD ISI program provides assurance that reduction in fracture toughness due to thermal aging is managed, and that the intended function of the reactor coolant Class 1 CASS valves is maintained consistent with the CLB throughout the period of extended operation.

The LRA identifies that loss of mechanical closure integrity due to stress relaxation can be managed by periodic inservice inspections and leakage testing. The LRA identifies that the ASME Section XI, Subsections IWB, IWC, and IWD ISI program provides assurance that loss of mechanical closure integrity due to stress relaxation is managed, and that the intended function of reactor coolant Class 1 piping components is maintained consistent with the CLB throughout the period of extended operation.

The application identifies that loss of mechanical closure integrity due to aggressive chemical attack has been observed in the industry, and is the most common aging mechanism of concern for ferritic fasteners of stainless steel components. Mechanical closure bolting associated with reactor coolant Class 1 piping components is made of low alloy steel bolting material, and is subject to aggressive chemical attack from potential borated water leaks. The application identifies that the boric acid wastage surveillance program provides assurance that the aging mechanism of loss of mechanical closure integrity due to aggressive chemical attack is managed, and that the intended function of reactor coolant Class 1 piping components is

maintained consistent with the CLB throughout the period of extended operation.
The applicant identifies applicable industry and plant-specific operating experience in LRA Section 3.2.1.1.3, "Operating Experience." The LRA notes that no additional aging effects requiring management were identified from this review of operating experience beyond those previously identified in the LRA.

3.2.1.1.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Section 3.2.1, "Reactor Coolant Systems," (including Table 3.2-1) and pertinent sections of Appendices A and B to the LRA regarding the applicant's demonstration 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 for the Class 1 reactor coolant piping system.

As described in Section 3.2.1.1.1 of this SER, the final SE for WCAP-14575 was issued by letter dated November 8, 2000, after the Turkey Point LRA was submitted to the NRC for review. However, all of the open items that were identified in the draft SE were either resolved or added to the list of renewal applicant action items for the final SE. Therefore, the applicant addressed all renewal applicant action items that are included in the final SE report for WCAP-14575. There were six renewal applicant action items, and six open items from the draft SE for WCAP-14575. The action items, open items, applicant's responses, and staff's evaluations are provided in Section 3.2.6.2 of this SER. From its review of this information, the staff finds that the applicant's responses (Tables 2.3-2 and 2.3-3 of the LRA) to the renewal applicant action items and open items from the draft safety evaluation resolve the applicant action items in the final SE for WCAP-14575.

3.2.1.1.2.1 Aging Effects

The applicant identifies the following aging effects for the Class 1 reactor coolant piping system:

- cracking
- reduction in fracture toughness
- loss of mechanical closure integrity

On the basis of the description of the internal and external environments, materials used, and the applicant's review of industry and plant-specific experience, the NRC staff concludes that the applicant has identified the aging effects that are applicable for the Class 1 reactor coolant piping system.

3.2.1.1.2.2 Aging Management Programs

The applicant identifies existing and new programs for managing aging effects for the Class 1 reactor coolant piping system during the license renewal term. The following existing AMPs are identified in the application:

- ASME Section XI, Subsections IWB, IWC, and IWD ISI program
- boric acid wastage surveillance program
- chemistry control program

Staff evaluations of these existing programs are described in Sections 3.9.1, 3.9.3, and 3.1.1 of this SER, respectively.

A new AMP identified in the application is small bore Class 1 piping inspection. Staff evaluation of this new AMP is described in Section 3.8.7 of this SER.

On the basis of the evaluations of these AMPs in the SER sections identified above, the staff concludes that these AMPs are acceptable for managing the pertinent aging effects and providing assurance that the intended function of the reactor coolant Class 1 piping components will be maintained consistent with the CLB throughout the period of extended operation.

3.2.1.1.3 FSAR Supplement

The FSAR supplement sections pertinent to the Class 1 piping system include 16.1.7, "Small Bore Class I Piping Inspection," 16.2.1.1, "ASME Section XI, Subsections IWB, IWC, and IWD Inservice Inspection Program," 16.2.3, "Boric Acid Wastage Surveillance Program," and 16.2.4, "Chemistry Control Program." These programs and associated FSAR supplement sections are evaluated in Sections 3.8.7, 3.9.1, 3.9.3, and 3.1.1, respectively, of this SER.

3.2.1.1.4 Conclusion

The staff has reviewed the information in Section 3.2.1.1 of the LRA, as supplemented by the April 19, 2001, response to the RAI. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the Class 1 piping 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.

3.2.1.2 Non-Class 1 Piping

3.2.1.2.1 Summary of Technical Information in the Application

The applicant describes its AMR of the non-Class 1 piping for license renewal in LRA Section 3.2.1.2, "Non-Class 1 Piping," as supplemented by the April 19, 2001, response to the RAI. The staff reviewed this section of the LRA to determine whether the applicant has demonstrated that the effects of aging on the non-Class 1 piping will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Reactor coolant non-Class 1 piping components are not within the scope of topical report WCAP-14575. However, several reactor coolant non-Class 1 piping components are identified in the application as being within the scope of license renewal. The component intended function of these in-scope components is pressure boundary integrity. The reactor coolant non-Class 1 piping components requiring an AMR are listed in LRA Section 2.3.1.2.2, "Non-Class 1 Piping."

Reactor coolant non-Class 1 piping components are exposed to internal environments of air/gas, treated water, treated water-primary, and lubricating oil, as well as external environments of containment air and potential borated water leaks.

Reactor coolant non-Class 1 piping components are constructed of stainless steel, low alloy steel, carbon steel, admiralty brass, and 90/10 copper-nickel. Table 3.2-1 of the LRA provides the individual reactor coolant non-Class 1 piping components, as well as their intended functions, materials, and environments.

The application identifies cracking, loss of material, and loss of mechanical closure integrity as aging effects requiring management during the license renewal period. Table 3.2-1 of the application summarizes the environment and material combinations requiring aging management, along with the programs and activities for aging management during the license renewal period.

Cracking due to stress corrosion is identified in the application as an aging effect requiring management for the period of extended operation. Cracking due to fatigue is identified in the application as a TLAA, and is addressed in LRA Section 4.3.4.

For cracking due to stress corrosion, the LRA identifies that specific design, fabrication, and construction measures were taken to minimize or eliminate susceptible material from reactor coolant non-Class 1 piping components, including preventing sensitized stainless steel from coming in contact with an aggressive environment. The LRA identifies that the chemistry control program provides assurance that SCC is managed.

The LRA identifies that mechanisms that can cause loss of material for reactor coolant non-Class 1 piping components are general corrosion, crevice corrosion, pitting corrosion, microbiologically influenced corrosion (MIC), selective leaching, galvanic corrosion, and aggressive chemical attack.

General corrosion, crevice corrosion, pitting corrosion, MIC, and selective leaching have been identified as aging mechanisms for the internal surfaces of reactor coolant non-Class 1 piping components. The applicant stated that the chemistry control program is credited for managing the corrosion effects of the non-Class 1 piping components.

In addition, general corrosion and pitting corrosion have been identified as aging mechanisms for external surfaces of carbon steel components. The applicant states that although existing protective coatings applied to these surfaces have effectively protected them from corrosion effects, the systems and structures monitoring program is credited for managing the general corrosion and pitting corrosion for the external surfaces of the non-Class 1 piping components.

Galvanic corrosion has been identified as an aging mechanism between the reactor coolant pump lower bearing heat exchanger tube coil (copper alloy) and the component cooling water (CCW) supply piping (carbon steel), and between the reactor coolant pump upper bearing heat exchanger tubes (brass) and the carbon steel heat exchanger tube sheet. The applicant stated that although galvanic action is considered to be a corrosion mechanism, no adverse effect of galvanic corrosion has been identified for these material combinations and environments at Turkey Point. The applicant stated that the galvanic corrosion susceptibility inspection program is credited for managing the galvanic corrosion of the non-Class 1 piping components.

Aggressive chemical attack is corrosion that may be localized or general, and is caused by a corrodent that is particularly active on a specified material. Highly concentrated boric acid solutions or deposits of boric acid crystals may be very corrosive for carbon steel. Aggressive chemical attack is, therefore, identified as an aging mechanism for external surfaces of carbon steel components that are exposed to potential borated water leaks. The applicant states that the boric acid wastage surveillance program is credited for managing the loss of material due to aggressive chemical attack.

The LRA identifies that loss of mechanical closure integrity due to aggressive chemical attack has been observed in the industry and is the most common aging mechanism of concern for ferritic fasteners of stainless steel components. Mechanical closure bolting associated with reactor coolant non-Class 1 piping components is made of low alloy steel bolting material, and is subject to aggressive chemical attack from potential borated water leaks. The LRA identifies that the boric acid wastage surveillance program provides assurance that the aging mechanism of loss of mechanical closure integrity due to aggressive chemical attack is managed, and that the intended function of reactor coolant non-Class 1 piping components is maintained consistent with the CLB throughout the period of extended operation.

The applicant identifies industry and plant-specific operating experience in LRA Section 3.2.1.2.3, "Operating Experience." The application notes that no additional aging effects requiring management were identified from this review of operating experience beyond those previously identified in the application.

3.2.1.2.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Section 3.2.1 (including Table 3.2-1), pertinent sections of Appendices A and B to the LRA, and the applicant's responses to the staff's RAIs, regarding the applicant's demonstration 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 for the reactor coolant non-Class 1 piping system.

3.2.1.2.2.1 Aging Effects

The applicant identifies the following aging effects for the reactor coolant non-Class 1 piping components:

- cracking
- loss of material
- loss of mechanical closure integrity

The inner reactor vessel flange O-ring leak detection line tubing, fittings, and valves, and the reactor vessel head vent piping, fittings, and valves are located downstream of restricting orifices that limit reactor coolant flow in the case of a rupture in these items. In addition, the inner reactor vessel flange O-ring leak detection line is pressurized with a nitrogen environment during operation, as described in the April 19, 2001, response to RAI 3.2.1-1, thereby precluding cracking of the items in this line. On the basis of the restricting orifices and the nitrogen environment, the staff agrees with the applicant's conclusions regarding the applicable aging effects for these items.

On the basis of the description of the internal and external environments, materials used, the applicant's review of industry and plant-specific experience, and the applicant's RAI responses, the NRC staff concludes that the applicant has identified the aging effects that are applicable for the reactor coolant non-Class 1 piping components.

3.2.1.2.2.2 Aging Management Programs

The applicant identifies existing and new programs for managing the aging effects for the reactor coolant non-Class 1 piping components during the license renewal term. The LRA identifies the following existing AMPs:

- boric acid wastage surveillance program
- chemistry control program
- systems and structures monitoring program

Staff evaluations of these existing programs are described in Sections 3.9.3, 3.1.1, and 3.1.3, respectively, of this SER.

A new AMP identified in the application is the galvanic corrosion susceptibility inspection program. Staff evaluation of this new AMP is described in Section 3.8.5 of this SER.

On the basis of the evaluations of these AMPs in the SER sections identified above, the staff concludes that these AMPs are acceptable for managing the pertinent aging effects and providing assurance that the intended function(s) of the reactor coolant non-Class 1 piping components will be maintained consistent with the CLB throughout the period of extended operation.

3.2.1.2.3 FSAR Supplement

The FSAR supplement sections pertinent to the non-Class 1 piping system include 16.1.5, "Galvanic Corrosion Susceptibility Inspection Program," 16.2.3 "Boric Acid Wastage Surveillance Program," 16.2.4, "Chemistry Control Program," and 16.2.15, "Systems and Structures Monitoring Program." These programs and associated FSAR supplement sections are evaluated in Sections 3.8.5, 3.9.3, 3.1.1, and 3.1.3, respectively, of this SER.

3.2.1.2.4 Conclusions

The staff has reviewed the information in Section 3.2.1.2 of the LRA, as supplemented by the April 19, 2001, responses to the RAI. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the non-Class 1 piping 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.

3.2.2 Regenerative and Excess Letdown Heat Exchangers

The regenerative and excess letdown heat exchangers are a part of chemical and volume control. They are addressed in this section, however, because they are within the reactor coolant system (RCS) pressure boundary. The regenerative and excess letdown heat exchangers are described in UFSAR Section 9.2.

3.2.2.1 Summary of Technical Information in the Application

The applicant describes its AMR of the regenerative and excess letdown heat exchangers for license renewal in LRA Section 3.2.2, "Regenerative and Excess Letdown Heat Exchangers," as supplemented by the April 19, 2001, responses to the RAI. The staff reviewed this section of the LRA to determine whether the applicant has demonstrated that the effects of aging on the regenerative and excess letdown heat exchangers will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The regenerative heat exchangers have a multiple shell and U-tube design, each consisting of three heat exchangers interconnected in series by piping and mounted on a common support frame. The heat exchangers are designed to recover heat from the letdown stream by heating the charging stream, thus minimizing reactivity effects due to injection of cold water and minimizing thermal stress on the charging line penetrations in the reactor coolant loop piping. The letdown stream flows through the shell of the heat exchangers, and the charging stream flows through the tubes.

The excess letdown heat exchangers have a U-tube design. Their function is to cool reactor coolant letdown flow equivalent to that portion of the nominal seal injection flow that enters the RCS through the labyrinth of the reactor coolant pump (RCP) seals. They may be used when the normal letdown path is temporarily out of service or for supplementing the maximum letdown during heatup. The letdown is a four-pass flow through the tubes, while CCW system flow is a single pass through the shells.

In Section 2.3.1.3 of the LRA, the applicant states that the intended functions of the regenerative and excess letdown heat exchangers are pressure boundary integrity and heat transfer.

Aging Effects

The regenerative and excess letdown heat exchangers are exposed to internal environments of treated water and treated water-primary, and external environments of containment air and potential borated water leaks (see Tables 3.0-1 and 3.0-2 of the LRA).

The regenerative and excess letdown heat exchangers are constructed of stainless steel, low alloy steel, and carbon steel. The heat exchanger components and their intended functions, materials, and environments are summarized in Table 3.2-1 of the LRA.

In Section 3.2.6 of the LRA, the applicant identifies the following aging effects for the regenerative and excess letdown heat exchangers:

- stress corrosion cracking
- loss of material due to corrosion and aggressive chemical attack
- loss of mechanical closure integrity (by stress relaxation and/or aggressive chemical attack)
- fouling

In Section 3.2.2.2.1 of the LRA, the applicant states that specific design, fabrication, and construction measures were taken to minimize or eliminate material susceptible to SCC in the regenerative and excess letdown heat exchangers. In addition, to reduce the susceptibility of regenerative and excess letdown heat exchangers materials to SCC, Turkey Point prevents sensitized stainless steels from coming in contact with an aggressive environment.

In Section 3.2.2.2.2 of the LRA, the applicant identifies several forms of corrosion and aggressive chemical attack as aging mechanisms that can cause loss of material for the regenerative and excess letdown heat exchangers. Specifically, these forms of corrosion are general, crevice, pitting, galvanic, and MIC. The applicant notes that the regenerative heat exchangers are an all welded, stainless steel construction and not subject to loss of material. The applicant states that general corrosion has been identified as an aging mechanism for internal carbon steel surfaces of the excess letdown heat exchangers. MIC has been identified as an aging mechanism for the stainless steel tube sheets and the outside diameter of the stainless steel tubing of the excess letdown heat exchangers. These parts are exposed to CCW that contains dissolved oxygen.

Section 3.2.2.2.2 of the LRA also identifies galvanic corrosion as an aging mechanism for the internal surfaces of the carbon steel shells of the excess letdown heat exchangers at the vicinity of their contact point with the stainless steel tube sheets. Although galvanic action is considered to be a corrosion mechanism, no adverse effect of galvanic corrosion has been identified for these material combinations and environments at Turkey Point.

The LRA states that the external carbon steel surfaces of the excess letdown heat exchanger shells are exposed to the containment air environment, and are typically wetted with condensation when operating. General corrosion, crevice corrosion, pitting corrosion, and MIC were identified by the applicant as aging mechanisms for external carbon steel surfaces of the excess letdown heat exchangers. Aggressive chemical attack was identified by the applicant as an aging mechanism for the excess letdown heat exchanger external surfaces that are exposed to potential borated water leaks.

Section 3.2.2.2.3 of the LRA states that loss of mechanical closure integrity can result from aggressive chemical attack. Loss of mechanical closure integrity due to aggressive chemical attack has been observed in the industry, and is the most common aging mechanism of concern for ferritic fasteners of stainless steel components. The LRA notes that mechanical closure bolting associated with the excess letdown heat exchangers is made of low alloy steel bolting material, and is subject to aggressive chemical attack from potential borated water leaks. In addition, there are no bolted mechanical closures associated with the regenerative heat exchangers.

Section 3.2.2.2.4 of the LRA identifies biological fouling as an aging mechanism affecting the excess letdown heat exchanger tubing that is exposed to CCW. Particulate fouling has been identified as an aging mechanism for the regenerative and excess letdown heat exchanger tubing.

Industry Experience

The applicant performed a review of industry operating history and NRC generic communications to validate the set of aging effects that require management. Specifically, the applicant reviewed the following industry correspondence for regenerative and excess letdown heat exchangers operating experience:

- NRC Bulletin 79-17, "Pipe Cracks in Stagnant Borated Water Systems at PWR Plants"
- NRC Circular 76-06, "Stress Corrosion Cracks in Stagnant, Low-Pressure Stainless Piping Containing Boric Acid Solution at PWRs"
- NRC Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants"
- NRC Information Notice 79-19, "Pipe Cracks in Stagnant Borated Water Systems at PWR Plants"
- SAND 93-7070, "Aging Management Guideline for Commercial Nuclear Power Plants — Heat Exchangers"

No aging effects requiring management were identified from the above documents beyond those already identified in Section 3.2.2.2 of the LRA.

Plant-Specific Experience

The applicant reviewed Turkey Point Unit 3 and 4 operating experience to validate the identified aging effects requiring management. This review included a survey of Turkey Point non-conformance reports, licensee event reports, and condition reports for any documented instances of regenerative and excess letdown heat exchanger component aging, in addition to interviews with responsible engineering personnel. No aging effects requiring management were identified from this review beyond those identified in Section 3.2.2.2 of the LRA.

3.2.2.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Section 3.2.2 (including Table 3.2-1) and pertinent sections of Appendices A and B to the LRA, regarding the applicant's demonstration 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 for the regenerative and excess letdown heat exchangers.

3.2.2.2.1 Aging Effects

The applicant states that the applicable aging effects include the following:

- stress corrosion cracking
- loss of material due to corrosion and aggressive chemical attack

- loss of mechanical closure integrity (by stress relaxation and/or aggressive chemical attack)
- fouling

By letter dated February 2, 2001, the staff requested additional information regarding the excess letdown heat exchangers. The April 19, 2001, RAI response stated that there have been three occurrences on each unit of minor leakage of borated water at the tube sheet flange gasket of the excess letdown heat exchangers. Inspections performed as part of the boric acid wastage surveillance program identified this leakage, which was characterized by boric acid residue or the presence of wetness on the exterior surfaces of the heat exchanger cover. Therefore, the leakage did not affect the intended function of the heat exchangers. Corrective actions to address this leakage included replacing the gaskets and inspecting and replacing fasteners, as required. On the basis of the timely identification of this borated water leakage, no enhancements to the boric acid wastage surveillance program were deemed necessary. No leakage from the excess letdown heat exchangers has been reported since 1995. In order to address this potential for loss of material and loss of mechanical closure integrity due to aggressive chemical attack, periodic inspections performed under the boric acid wastage surveillance program are credited for managing these aging effects.

In Section 5.4 of Appendix C, the LRA indicates that high-yield stress materials and contaminants, such as lubricants containing molybdenum disulfide (MoS_2), have caused cracking of bolting in the industry. In RAI 3.2.2-2, dated February 2, 2001, the staff requested additional information on how yield strength and elimination of contaminants will be addressed during the period of extended operation. In the April 19, 2001, RAI response, the applicant reiterated that high stress in conjunction with an aggressive environment can cause cracking of certain bolting materials due to SCC. As identified in NRC IE Bulletin 82-02 and Generic Letter 91-17, cracking of bolting in the industry has occurred due to SCC. These instances of SCC have primarily been attributed to the use of high-yield strength bolting materials, excessive torquing of fasteners, and contaminants, such as the use of lubricants containing MoS_2. In its responses to NRC IE Bulletin 82-02, dated July 15, 1983, and March 9, 1984, for Units 4 and 3, respectively, the applicant verified that (1) specific maintenance procedures are in place that address bolted closures of the reactor coolant pressure boundary with a nominal diameter of 6 inches or greater; (2) the procedures in use address detensioning and retensioning practices and gasket installation and controls; (3) threaded fastener lubricants used in the reactor coolant pressure boundary have specified maximum allowable limits for chloride and sulfur content to minimize susceptibility to SCC environments; and (4) maintenance crew training on threaded fasteners is performed.

In order for SCC to occur, the three conditions that must exist are a susceptible material, high-tensile stresses, and a corrosive environment. In its RAI response, the applicant stated that the potential for SCC of fasteners at Turkey Point is minimized by utilizing ASTM A193 Gr. B7 bolting material, and limiting contaminants, such as chlorides and sulfur, in lubricants and sealant compounds. Additionally, sound maintenance bolt torquing practices are used to control bolting material stresses. The use of ASTM A193 Gr. B7 bolting specifies a minimum yield strength of 105 ksi, which is well below the 150 ksi threshold value specified in EPRI NP-5769, "Degradation of Bolting in Nuclear Power Plants," dated April 1988. Bolting fabricated in accordance with this standard could be expected to have yield strengths less than 150 ksi. However, since the maximum yield strength is not specified for this bolting material, assurance cannot be provided that the yield strength of the bolting would not exceed 150 ksi.

For these cases, the combination of specifying ASTM A193 Gr. B7 bolting material, control of bolt torquing, and control of contaminants will ensure that SCC will not occur. These actions have been effective in eliminating the potential for SCC of bolting materials. The results of a review of the Turkey Point condition report (1992 through 2000) and metallurgical report (1987 through 2000) databases support this conclusion, in that no instances of bolting degradation due to SCC were identified. Additionally, review of NRC generic communications did not identify any recent bolting failures attributed to SCC. Therefore, cracking of bolting material due to SCC is not considered an aging effect requiring management at Turkey Point.

On the basis of the description of the regenerative and excess letdown heat exchangers internal and external environments, materials used in the fabrication of various regenerative and excess letdown heat exchanger components, the Turkey Point experience, the applicant's survey of industry and plant-specific experience, and the applicant's RAI responses, the NRC staff concludes that the applicant has identified the aging effects that are applicable for the regenerative and excess letdown heat exchanger.

3.2.2.2.2 Aging Management Programs

The applicant identifies existing and new programs for managing the aging effects for the regenerative and excess letdown heat exchanger during the license renewal term. The following existing AMPs will be continued during the period of extended operation:

- boric acid wastage surveillance program
- chemistry control program
- systems and structures monitoring program

Staff evaluations of these existing programs are described in Sections 3.9.3, 3.1.1 and 3.1.3, respectively, of this SER.

A new AMP identified in the application is the galvanic corrosion susceptibility inspection program. Staff evaluation of this new program is described in Section 3.8.5 of this SER.

On the basis of the evaluations of these AMPs in the SER sections identified above, the staff concludes that these AMPs are acceptable for managing the pertinent aging effects and providing assurance that the intended function(s) of the regenerative and excess letdown heat exchangers will be maintained consistent with the CLB throughout the period of extended operation.

3.2.2.3 FSAR Supplement

On the basis of the staff's evaluation described above, the summary description of the AMPs for the regenerative and excess letdown heat exchangers contained in Appendix A to the LRA is acceptable.

3.2.2.4 Conclusions

The staff has reviewed the information in Section 3.2.2 and Appendices A and B to the LRA, as supplemented by the April 19, 2001, responses to the RAI. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the regenerative and excess letdown heat exchangers 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.

3.2.3 Pressurizers

3.2.3.1 Summary of Technical Information in the Application

The applicant described its AMR of the pressurizers for license renewal in LRA Section 3.2.3, "Pressurizers," as supplemented by the April 19, 2001, responses to the RAI. The staff reviewed this section of the LRA to determine whether the applicant has demonstrated that the effects of aging on the pressurizers will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Components of the Turkey Point Unit 3 and 4 pressurizers that are subject to aging management are identified in Table 3.2-1 to the Turkey Point LRA. The LRA identifies that a plant-specific aging management evaluation was performed for components in the pressurizers of Turkey Point, Units 3 and 4, and states that the plant-specific aging management evaluation for the pressurizers was compared to the aging management evaluation for Westinghouse-designed pressurizers, as described in topical report WCAP-14574, "License Renewal Evaluation: Aging Management Evaluation for Pressurizers." With respect to the comparison with WCAP-14574, the LRA states that the pressurizers at Turkey Point, Units 3 and 4, are bounded by the description of pressurizers in WCAP-14574 with respect to design criteria and features, modes of operation, intended functions, and environments/exposures.

Materials and Environments

Section 3.2.3.1 of the LRA identifies that the pressurizers are exposed to treated primary water on internal surfaces, and to containment air on external surfaces. The LRA clarifies that the external surfaces of the pressurizers may be exposed to borated water if leaks occur from the primary boundary. Section 3.2.3.1 of the LRA also identifies that the materials for pressurizer components correspond to those described in WCAP-14574, with the exception of the pressurizer shells, which are fabricated from ASTM A-302, Grade B low alloy steel instead of the SA-533 Grade A, Class 2 quenched and tempered steel.

Aging Effects

The LRA identifies that the following aging effects require aging management for pressurizer components that are within the scope of license renewal:

- cracking
- loss of material
- loss of mechanical closure integrity

The LRA states that cracking may be subdivided into the following aspects that require management during the proposed periods of extended operations: (1) growth of existing flaws, (2) cracks induced by stress corrosion, and (3) cracks induced by fatigue. In so doing, the LRA adds growth of existing flaws in pressurizer components as an aging effect that requires management. The applicant also identifies that loss of material on the external surfaces of the pressurizer may result from aggressive chemical attack if borated water leaks from the internal environment of the pressurizer. The LRA identifies that this aggressive attack may result in a loss of mechanical closure integrity if the aggressive attack occurs on ferritic fasteners of stainless steel components or low alloy steel bolting materials. The LRA also identifies that loss of mechanical closure integrity may also occur as a result of stress relaxation.

The aging effects requiring management and the programs and activities to manage the aging effects for each applicable environment and material combination are provided in Table 3.2-1 of the LRA. The LRA also states that the descriptions of the individual AMPs for managing the aging effects are provided in Appendix B to the LRA, and are based on the 10 program attributes described in Appendix B to the LRA. This is in contrast to basing the AMPs on six program attributes as defined in Table 4-1 of WCAP-14574.

Operating Experience

The LRA provides a list of the NRC's generic communications that were reviewed as part of the aging management evaluation for the pressurizers described in Section 3.2.3.3 of the LRA. In addition, the applicant indicates that it performed a review of plant-specific operating experience to validate that its aging management evaluation had encompassed all possible aging effects requiring aging management. Specifically, the applicant reviewed (1) non-conformance reports, (2) licensee event reports, and (3) Turkey Point condition reports. The applicant indicates that no additional effects requiring aging management were identified as a result of its review of either pertinent NRC generic communications or plant-specific operating experience.

3.2.3.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Section 3.2.3 (including Table 3.2-1) and pertinent sections of Appendices A and B to the LRA for Turkey Point Units 3 and 4, regarding the applicant's demonstration 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 for the pressurizers. During the staff's review of the AMR for the Turkey Point pressurizers, the staff determined that a majority of the applicant action items summarized in the staff's final SER on WCAP-14574 were already addressed in the LRA, but four required further clarification. The evaluation that follows is based on the staff's review of Section 3.2.3 and Table 3.2-1 of the LRA, pertinent portions of Appendices A and B to the LRA, and the applicant's April 19, 2001, RAI responses.

Action Items from Previous Staff Evaluation of WCAP-14574

As stated in Section 3.2.3.1 of this SER, the applicant indicated that the results of its AMR for the Turkey Point pressurizers were compared to the AMR in WCAP-14574. During the staff's review of the AMR for the Turkey Point pressurizers, the staff determined that four of the applicant action items summarized in the staff's SER on WCAP-14574 were applicable to the AMR for the Turkey Point pressurizers. The staff requested that the applicant address these action items (RAIs 3.2.3-1 to 3.2.3-4) to demonstrate that its AMRs for the pressurizers are consistent with the assumptions in the topical report. As discussed below, the staff finds that the applicant's responses to these RAIs resolve these action items:

Applicant Action Item 1 (RAI 3.2.3-1):

The topical report concluded that general corrosion is not significant for the internal surfaces of Westinghouse-designed pressurizers and that no further evaluations of general corrosion are necessary. In its SER on WCAP-14574 the staff concurred that hydrogen overpressure would be a sufficient means of mitigating the aggressive corrosive effect of oxygen in creviced geometries on the internal pressurizer surfaces. The staff therefore requested applicants for license renewal to provide a basis demonstrating that their water chemistry control programs will provide for a sufficient level of hydrogen overpressure to manage general corrosion of the internal surfaces of their pressurizer.

Response: In its April 19, 2001, RAI response, the applicant indicated that hydrogen concentrations in the RCS are strictly maintained within specified limits by taking periodic measurements of the hydrogen concentrations as part of the applicant's water chemistry control program, and adjusting the hydrogen overpressure in the volume control tanks accordingly.

The staff concludes that this response is sufficient to ensure that loss of material due to crevice corrosion will not be significant for the internal surfaces of the pressurizers during the license renewal period. Therefore, the staff concludes that loss of material due to crevice corrosion is not an aging effect that needs to be managed during the license renewal period, consistent with the staff's conclusions in the final SER on WCAP-14574.

Applicant Action Item 2 (RAI 3.2.3-2):

In its SER on WCAP-14574 the staff concurred with the topical report finding that the potential to develop SCC in the bolting materials will be minimized if the yield strength of the material is held to less than 150 ksi, or the hardness is less than 32 on the Rockwell C hardness scale; however, the staff concluded that conformance with the minimum yield strength criteria in ASME Specification SA–193 Grade B7 does not preclude a quenched and tempered low-alloy steel from developing SCC, especially if the acceptable yield strength is greater than 150 ksi. To verify that SCC would not be an applicable aging effect for the SA–193 Grade B7 bolting material, the staff requested that the applicant provide a confirmatory statement that the acceptable yield strengths for the quenched and tempered low-alloy steel bolting materials (e.g., SA–193, Grade B7 materials) are in the range of 105–150 ksi.

Response: In its April 19, 2001, RAI response, the applicant indicated that although procurement of the bolting materials to ASTM Standard Specification A–193 would provide assurance of a 105 ksi minimum yield strength for the SA–193 Grade B7 bolting materials, it could not provide assurance that the yield strength for bolting materials would be less than 150 ksi.

The applicant also indicated that SCC of bolting materials has been primarily attributed to use of high-yield strength bolting materials, excessive torquing of the fasteners for these bolts, and the introduction of contaminants such as the use of lubricants containing molybdenum disulfide. The applicant stated that the combined practices of procuring the pressurizer bolting materials to SA–193, Grade B7, controlling torquing of these bolts through use of approved plant procedures, and controlling introduction of contaminants by limiting the chloride and sulfide levels of lubricants used in bolting applications is effective in limiting the potential for SCC to develop in the bolting materials.

The applicant also indicated that a review of its condition report and metallurgical report databases and the NRC's generic communications support the conclusion that no instances of bolting degradation due to SCC have been identified in the industry. These findings, when combined with the practices identified in the previous paragraph, support the conclusion that SCC of SA–193 Grade B7 pressurizer bolting materials is not an aging effect that needs to be managed during the license renewal period.

The staff concludes that these bases are sufficient to ensure that SCC is not an aging effect that requires management for the pressurizer SA–193 Grade B7 bolting materials, and therefore, does not need to be managed for the pressurizer bolting materials during the license renewal period. This finding is consistent with the staff's findings for these materials for license renewal in NUREG-1705 and NUREG-1733, for the Calvert Cliffs and Oconee Nuclear Power Stations, respectively.

Applicant Action Item 3 (RAI 3.2.3-3):

In its SER on WCAP-14574, the staff was concerned that IGSCC in the heat-affected zone material of Type 304 stainless steel supports that are welded to the pressurizer cladding could grow as a result of thermal fatigue into the adjacent pressure boundary during the license renewal term. The staff considered that these welds would not require aging management in the extended operating periods if applicants could provide a reasonable justification that sensitization has not occurred in these welds during the fabrication of these components. Therefore, the staff requested applicants to provide a discussion of how the implementation of its plant-specific procedures and quality assurance requirements, if any, for the welding and testing of these austenitic stainless steel components would give reasonable assurance that sensitization has not occurred in these welds and their associated heat-affected zones.

Response: In its response to RAI 3.2.3-3, the applicant indicated that it could not preclude the possibility of sensitized areas in stainless steel weldments that join internal Type 304 stainless steel supports to the cladding of the pressurizer shells. In a letter dated August 13, 2001, the applicant clarified that the scope of the AMR for the pressurizer shells (page 3.2-64 of LRA Table 3.2-1) includes the weldments of internal supports to the cladding, and that cracking due to stress corrosion is therefore identified as an aging effect that will require management for these stainless steel weldments during the extended periods of operation for the Turkey Point Units. Aging management for these weldments is provided by the Chemistry Control Program and appropriate ASME Section XI inspection requirements, which is acceptable to the staff.

Applicant Action Item 4 (RAI 3.2.3-4):

In its SER on WCAP-14574, the staff identified that applicants would need to address whether erosion is a plausible aging effect for Westinghouse-designed pressurizer surge nozzle thermal sleeves, spray nozzle thermal sleeves, surge nozzle safe-ends, and spray nozzle safe-ends, and stated that if erosion is plausible, then an AMP would be required to manage this effect.

Response: In its April 19, 2001, RAI response, the applicant indicated that it had conducted an AMR of the Turkey Point pressurizer surge nozzle thermal sleeves, spray nozzle thermal sleeves, surge nozzle safe-ends, and spray nozzle safe-ends, and had determined that these materials are fabricated from austenitic stainless steel. In its response the applicant also indicated that stainless steel materials are considered to be resistant to erosion. The applicant, therefore, stated that loss of material from the pressurizer surge nozzle thermal sleeves, surge nozzle safe ends, spray nozzle thermal sleeves, and spray nozzle safe ends was therefore not an aging effect that would require management during the periods of extended operation for the Turkey Point units.

The staff concurs with the applicant's conclusion that austenitic stainless steel materials are erosion-resistant materials. Since the pressurizer surge nozzle thermal sleeves, surge nozzle safe ends, spray nozzle thermal sleeves, and spray nozzle safe ends are either fabricated from austenitic stainless steel materials or clad on their internal surfaces with austenitic stainless steel materials, the staff concurs that erosion is not an aging effect that requires management for the surfaces of the pressurizer surge nozzle thermal sleeves, surge nozzle safe ends, spray nozzle thermal sleeves, and spray nozzle safe ends that will be exposed to the internal borated water environment during the license renewal period.

3.2.3.2.1 Materials and Environment

The staff has reviewed the applicant's overview of the materials of fabrication for the pressurizers, and concurs with the applicant's conclusion that the materials for fabrication of the pressurizer components are bounded by the materials of fabrication listed in Section 2.3.2 of WCAP-14574, with the exception of the pressurizer shells, which were fabricated from ASTM A-302, Grade B ferritic steel instead of SA-533 Grade A, Class 2 ferritic steel. Section 3.2.3 of the LRA concludes that the difference in the materials for the pressurizer shells does not constitute a significant deviation because the materials are essentially the same.

ASME SA-533 Grade A, Class 2 quenched and tempered steel and ASTM A-302 Grade B low alloy steel are structural steels that have been commonly used for the fabrication of pressure vessels in nuclear applications. Table 3.2.3.2.1-1 below provides a comparison of the alloying content requirements and tensile property requirements for these materials.

Table 3.2.3.1.2-1
Comparison of Alloying Content and Material Property Requirements
for ASTM A-302 Grade B Low Alloy Steel Materials and
ASME SA-533 Grade A, Class 2 Quenched and Tempered Steel Materials

Steel ID	Heat Analysis Alloy Content Requirements (Weight Percent) [a]						Material Property Requirements	
	C	Mn	P	S	Si	Mo	Min. Yield Strength (ksi)	Tensile Strength (ksi)
A-302 Grade B	0.25 [b]	1.15–1.50	0.035	0.040	0.15–0.40	0.45–0.60	50	80–100
SA-533 Grade A, Class 2	0.25	1.15–1.50	0.035	0.040	0.15–0.40	0.45–0.60	70	90–115

Notes: a. Maximum allowable alloying content unless an allowable alloying range is specified.
b. Specification for plates greater than 2 inches in thickness.

A review of Table 3.2.3.1.2-1 indicates that the alloying and tensile requirements for ASME SA-533 Grade A, Class 2 steel and ASTM A-302 Grade B steel are not significantly different. Since both of these steel materials have been used in nuclear pressure vessel applications, and since the alloying and tensile property requirements are not significantly different, the staff concludes that use of ASTM A-302 Grade B low alloy steel for fabrication of the pressurizer shells does not make the pressurizers beyond the scope of the materials evaluated in topical report WCAP-14574.

Section 3.2.3.1 of the LRA summarizes the internal and external environments for the pressurizer pressure boundary components. These environments include treated water-primary on the internal surfaces of the pressurizers, and containment air on the external surfaces of the pressurizers. The applicant also identifies that the external surfaces have the potential to be exposed to the borated-primary coolant if leaks occur through the pressure boundary.

The staff concludes that Section 3.2.3.1 of the LRA provides a sufficient description of the pressurizer environment, and is therefore acceptable.

3.2.3.2.2 Aging Effects

Section 3.2.3.2 of the LRA identifies that the following aging effects are the only aging effects for the pressurizers that require aging management during the proposed periods of extended operation: (1) cracking, including managing growth of pre-existing flaws, cracking due to stress corrosion, and cracking due to fatigue; (2) loss of material due to aggressive chemical attack; and (3) loss of mechanical closure integrity. By stating that the plant-specific pressurizer aging evaluation is bounded by the evaluation stated in WCAP-14574, the applicant implies that the following aging effects do not require aging management during the periods of extended operation:

- general corrosion of exposed internal pressurizer pressure boundary surfaces
- crevice corrosion of the internal surfaces of the pressure boundary components
- stress corrosion cracking of SA-193 Grade B7, low alloy steel bolting materials
- SCC of type 304 stainless steel supports that are welded to the pressurizer cladding

- irradiation embrittlement of pressurizer structural shell materials
- thermal aging of pressurizer pressure boundary components
- loss of material in pressurizer pressure boundary components due to wear
- loss of material in pressurizer pressure boundary components due to erosion
- loss of material in pressurizer pressure boundary components due to erosion/corrosion

In its final SER of WCAP-14574, the staff concurred with the finding that the pressurizer pressure boundary components would not be degraded by general corrosion, loss of material due to wear, loss of material due to erosion/corrosion, or degradation due to creep.

3.2.3.2.3 Operating Experience

In Section 3.2.3.3 of the LRA, the applicant indicates that it reviewed pertinent NRC generic communications and plant-specific operating experience in order to validate that its aging management evaluation had encompassed all possible effects requiring aging management for the pressurizer components falling under the scope of license renewal. The plant-specific operating experience included non-conformance reports, licensee event reports, and condition reports. The applicant did not indicate whether or not it had reviewed nonconformance reports, licensee event reports, and nonconformance reports issued by other WOG-member facilities. The applicant indicated that no additional effects requiring aging management were identified as a result its review of either pertinent NRC generic communications or plant-specific operating experience.

In WCAP-14574, the WOG indicated that SCC had occurred in two instrumentation nozzles to the pressurizer of the Surry Nuclear Power Station, Unit 1. The root cause analysis for the degradation of the Surry pressurizer instrumentation nozzles is documented in Virginia Electric and Power Company Licensee Event Reports (LERs) 50-280/95-007-00 and 50-280/95-007-01, dated October 9, 1995, and February 23, 1996, respectively. WCAP-14574 stated that cracking had occurred in the pressurizer cladding of the Haddam Neck Nuclear Power Plant in 1990. This cracking is documented in a letter from Connecticut Yankee Atomic Power Company to the U.S. Nuclear Regulatory Commission Document Control Desk, "Haddam Neck Plant Pressurizer Inspection Results" (March 1992).

In RAI 3.2.3-5, the staff requested that the applicant propose an AMP to verify that thermal fatigue-induced cracking in the pressurizer cladding has not propagated through the clad into the ferritic base metal or weld metal materials beneath the clad. In its April 19, 2001, RAI response, the applicant described the following bases for its findings on its AMPs:

(1) The pressurizer shell designs consider fatigue usage factors throughout the operating lifetimes of Turkey Point, Units 3 and 4, and include adequate margins.

(2) Since these fatigue analyses are expected to preclude the formation of fatigue cracks in the pressurizer cladding, and since fracture mechanics evaluations of observed cracks indicate that the cracks do not grow significantly over the plant's lifetime, an AMP is not necessary to manage postulated fatigue-induced cracking of the pressurizer cladding.

(3) While a specific AMP is not required for the pressurizer cladding, the ASME Section XI ISI program is credited for managing the potential for the pressurizer surge nozzles, which are the limiting pressurizer locations from a fatigue usage perspective, to crack as a result of fatigue.

It needs to be stated that the applicant does not always credit the Turkey Point Unit 3 and 4 ISI programs as being aging programs that will manage the cracking during the extended operating terms. However, the fact that the applicant may not be crediting the ISI program for managing cracking during license renewal does not mean that the applicant will be omitting the inspections of the pressurizer components that are required to be inspected under the current ISI programs for the units. The applicant will continue to perform all required ISI inspections of pressurizer components in conformance with 10 CFR 50.55a and Section XI of the ASME Code during the extended operating terms for the units. When taken in context with the information in Items 1 through 3 above, the applicant has provided a reasonable assurance that fatigue-induced cracking of the pressurizer cladding will be managed during the proposed term of extended operation, even though the applicant has not formally credited the Section XI ISI programs as managing this effect in the LRA analysis for the pressurizers. This is acceptable to the staff.

3.2.3.2.4 Aging Management Programs

In Section 3.2.3.4 of the LRA, the applicant states that, as a result of its review of industry information, NRC generic communications, and operating experience, no additional aging effects beyond those listed in Section 3.2.3.3 of the LRA and those summarized in Table 3.2-1 for the pressurizer components need be evaluated during the license renewal period. The applicant also indicated that the aging effects identified in Section 3.2.3.2 of the LRA would be managed through implementation of the following existing programs:

- ASME Section XI, Subsections IWB, IWC, and IWD ISI program
- boric acid wastage surveillance program
- chemistry control program

Staff evaluations of these existing programs are described in Sections 3.9.1, 3.9.3, and 3.1.1 of this SER, respectively.

On the basis of the evaluations of these AMPs in the SER sections described above, the staff concludes that these AMPs are acceptable for managing the pertinent aging effects and providing assurance that the intended function(s) of the pressurizers will be maintained consistent with the CLB throughout the period of extended operation.

3.2.3.3 FSAR Supplement

On the basis of the staff's evaluation described above, the summary descriptions of the AMPs for the pressurizers contained in Appendix A to the LRA are acceptable.

3.2.3.4 Conclusion

The staff has reviewed the information in Section 3.2.3 of the LRA, as supplemented by the April 19, 2001, and August 13, 2001, responses to the RAI. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the pressurizers 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.

3.2.4 Reactor Vessels

The reactor vessel (RV) components in the internal environment consist of the closure head domes, closure head flanges, upper shell flanges, upper shells, primary inlet and outlet nozzles, primary nozzle safe ends, intermediate and lower shell welds, circumferential welds, bottom head toruses and domes, control rod drive mechanism rod travel housings/latch housings/flanges/housing tubes, head vent pipes, O-ring leak monitor tubes, core support lugs, instrumentation tubes and safe ends, bottom-mounted instrumentation guide tubes and seal table fittings.

The RV components in the external environment consist of the closure head domes (includes lifting lugs), closure head flanges, upper shells, primary inlet and outlet nozzles, intermediate and lower shells, upper shell flanges, refueling seal ledges, primary nozzle safe ends, nozzle support pads, bottom head toruses, bottom head domes, control rod drive mechanism rod travel housings/latch housings/flanges/housing tubes/ventilation shroud support rings, head vent pipes, O-ring leak monitor tubes, instrumentation tubes and safe ends, bottom-mounted instrumentation guide tubes, bottom-mounted instrumentation flux thimble tubes, seal tables and fittings, and closure studs, nuts, and washers.

3.2.4.1 Summary of Technical Information in the Application

The applicant described its AMR of the RVs for license renewal in LRA Section 3.2.4, "Reactor Vessels," as supplemented by the April 19, 2001, responses to the RAI. The staff reviewed this section of the LRA to determine whether the applicant has demonstrated that the effects of aging on the RVs will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The applicant states that the RV components that are subject to an AMR include the shell and closure head, nozzles, interior attachments, and bolted closures. In addition, the applicant has included the bottom-mounted instrumentation tubing, thimble tubes, and seal tables within the scope of license renewal for Turkey Point, Units 3 and 4.

In Section 2.3.1.5 of the LRA, the applicant states that the intended functions of the RV components include pressure boundary integrity and structural support.

Materials and Environments

RV components are exposed to internal environments of treated water—primary and air/gas (o-ring leak monitor tubes), and external environments of containment air, treated water-primary (bottom mounted instrumentation guide tubes), and potential borated water leaks. The applicant states that the RV components are constructed of stainless steel, low alloy steel, carbon steel, and Alloy 600.

Aging Effects Requiring Management

In Section 3.2.4 of the LRA, the applicant identifies the following internal and external aging effects that require management during the period of extended operation for the RVs:

- cracking
- reduction in fracture toughness
- loss of material
- loss of mechanical closure integrity

The RV components, their intended functions, the materials and environments are summarized in Table 3.2-1 of the LRA.

[Cracking] Cracking due to flaw growth and stress corrosion is an aging effect requiring management for the period of extended operation. At Turkey Point, cracking due to fatigue (including RV underclad cracking) is identified as a TLAA. The staff's evaluation of fatigue is provided in Section 4.3 of this SER.

Growth of original manufacturing flaws over time by service loading can cause cracking. Detection and evaluation of flaws is important in maintaining the structural integrity of the RV pressure boundary. ASME Section XI inservice examinations of components are intended to detect significant flaw growth and development. These examinations provide assurance that significant flaws do not exist, or a large flaw subject to crack growth would be detected so that it could be characterized, evaluated, and repaired, if necessary.

SCC is a localized, non-ductile failure caused by a combination of stress, susceptible material, and an aggressive environment. Specific design, fabrication, and construction measures were taken to minimize or eliminate susceptible material from the RVs. In addition, to reduce the susceptibility of RV materials to SCC, Turkey Point prevents sensitized stainless steels from coming in contact with an aggressive environment. The chemistry control program provides assurance that SCC will be managed and that the intended function of the RVs will be maintained consistent with the CLB throughout the period of extended operation.

Primary water SCC of the control rod drive mechanism (CRDM) housing tubes is a recognized industry issue. The RV head Alloy 600 penetration inspection program has been specifically designed to address primary water SCC of CRDM housing tubes. The RV head Alloy 600 penetration inspection program, in conjunction with the ASME Section XI, Subsections IWB, IWC, and IWD ISI program and the chemistry control program, provide assurance that the intended function of the CRDM housing tubes is maintained consistent with the CLB throughout the period of extended operation. Note that the RVs are the only reactor coolant system components with Alloy 600 penetrations at Turkey Point.

SCC is an aging mechanism for RV closure studs and nuts. Visual, surface, and volumetric inspections performed as part of the ASME Section XI, Subsections IWB, IWC, and IWD ISI program have been proven to be effective for managing the aging effects of SCC and provide assurance that the intended function(s) of the RV closure studs and nuts will be maintained consistent with the CLB throughout the period of extended operation.

SCC of the external surfaces of the bottom-mounted instrumentation guide tubes has been previously experienced at Turkey Point. The boric acid wastage surveillance program provides assurance that the intended function(s) of the bottom mounted instrumentation guide tubes will be maintained consistent with the CLB throughout the period of extended operation.

[Reduction in Fracture Toughness] Fracture toughness of RV materials is primarily reduced by irradiation in the beltline region of the RV. Reduction in fracture toughness of RV beltline materials is an aging effect that requires management during the license renewal period. Several TLAAs associated with reduction in fracture toughness are addressed in Section 4.2 of the LRA. These TLAAs include pressurized thermal shock (PTS), upper-shelf energy (USE), and pressure-temperature (P-T) limit curves for heatup and cooldown. The RV integrity program ensures that the time-dependent parameters used in the TLAA evaluations will remain valid throughout the license renewal period.

[Loss of Material] Loss of material is an aging effect requiring management for the period of extended operation. The aging mechanisms that can cause loss of material for RVs are general corrosion, mechanical wear, fretting wear, and aggressive chemical attack.

General corrosion has caused leakage of CRDM canopy seal welds. Canopy seal weld leaks are effectively managed through a combination of system pressure tests, performed in accordance with the requirements of the ASME Section XI, Subsections IWB, IWC, and IWD ISI program, and the boric acid wastage surveillance program. These programs provide assurance that the intended function(s) of these RV components will be maintained consistent with the CLB throughout the period of extended operation.

Loss of material due to wear is an aging effect requiring management for the reactor closure studs, stud holes, nuts and washers, and core support lugs. Examinations performed as part of the existing ASME Section XI, Subsections IWB, IWC, and IWD ISI program provide assurance that the intended function(s) of these RV components will be maintained consistent with the CLB throughout the period of extended operation.

Fretting wear is an aging mechanism that affects the bottom-mounted instrumentation thimble tubes. The evaluation performed for thimble tube thinning has been identified as a TLAA, and the staff's evaluation of this TLAA is provided in Section 4.7 of this SER. On the basis of that evaluation, thimble tube N-05 requires aging management in accordance with 10 CFR 54.21(c)(1)(iii). The thimble tube inspection program provides assurance that the intended function(s) of the RV bottom-mounted instrumentation thimble tubes will be maintained consistent with the CLB throughout the period of extended operation.

[Loss of Mechanical Closure Integrity] Loss of mechanical closure integrity can result from stress relaxation and/or aggressive chemical attack.

Loss of mechanical closure integrity due to stress relaxation is a relevant aging effect that requires management. This aging effect can be managed by periodic ISIs and leakage testing. The ASME Section XI, Subsections IWB, IWC, and IWD ISI program provides assurance that loss of mechanical closure integrity due to stress relaxation will be managed, and that the intended function(s) of the RVs will be maintained consistent with the CLB throughout the period of extended operation.

Loss of mechanical closure integrity due to aggressive chemical attack has been observed in the industry, and is the most common aging mechanism of concern for ferritic fasteners of stainless steel components. Mechanical closure bolting associated with the RVs is made of low alloy steel bolting material, and is subject to aggressive chemical attack from potential borated water leaks. The boric acid wastage surveillance program provides assurance that the aging mechanism of loss of mechanical closure integrity due to aggressive chemical attack will be managed, and the intended function(s) of the RVs will be maintained consistent with the CLB throughout the period of extended operation.

Industry Experience

The applicant performed a review of industry operating history and NRC generic communications to validate the set of aging effects that require management. Specifically, the applicant reviewed the following industry correspondence for the RV's operating experience:

- NRC Bulletin 88-09, "Thimble Tube Thinning in Westinghouse Reactors"
- NRC Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants"
- NRC Generic Letter 92-01, "Reactor Vessel Structural Integrity"
- NRC Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations"
- NRC Information Notice 87-44, "Thimble Tube Thinning in Westinghouse Reactors"
- NRC Information Notice 96-32, "Implementation of 10 CFR 50.55a(g)(6)(ii)(A), 'Augmented Examination of Reactor Vessel'"

No aging effects requiring management were identified from the above documents beyond those already identified in Section 3.2.4.2 of the LRA.

Plant-Specific Experience

The applicant reviewed Turkey Point Unit 3 and 4 operating experience to validate the identified aging effects requiring management. This review included a survey of Turkey Point nonconformance reports, licensee event reports, and condition reports for any documented instances of RV component aging, in addition to interviews with responsible engineering personnel. Outside diameter-initiated SCC of bottom-mounted instrumentation guide tubes and loss of material due to general corrosion of canopy seal welds has been experienced at Turkey Point. Accordingly, AMPs were identified, as discussed above, to manage these effects. No other aging effects requiring management were identified from this review beyond those identified in Section 3.2.4.2 of the LRA.

3.2.4.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Section 3.2.4 (including Table 3.2-1) and Appendix B to the LRA, regarding the applicant's demonstration 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 for the RVs.

3.2.4.2.1 Aging Effects

The applicant states that the applicable aging effects include the following:

- cracking
- reduction in fracture toughness
- loss of material
- loss of mechanical closure integrity

On the basis of the description of the RV internal and external environments, materials used in the fabrication of various RV components, the Turkey Point experience, and the applicant's survey of industry and plant-specific experience, the NRC staff concludes that the applicant has identified the aging effects that are applicable for the RVs.

3.2.4.2.2 Aging Management Programs

As discussed above, the following existing AMPs will be continued during the period of extended operation:

- ASME Section XI, Subsections IWB, IWC, and IWD ISI program
- boric acid wastage surveillance program
- chemistry control program
- RV head Alloy 600 penetration inspection program
- RV integrity program
- thimble tube inspection program

The staff's review of the AMPs listed above may be found in Sections 3.9.1.1, 3.9.3, 3.1.1, 3.9.12, 3.9.13, and 3.9.16, respectively, of this SER.

The applicant indicates that VT-3 examinations will be used to detect cracking of the core support lugs. The staff did not believe that the VT-3 examinations were sufficient to detect cracking. Therefore, the staff requested that the applicant provide details of a plant-specific AMP to detect cracking of the core support lugs. In its April 19, 2001, response to the RAI, the applicant indicated that the Turkey Point ASME Section XI Subsections IWB, IWC, and IWD ISI program currently performs an enhanced VT-3 visual examination on the core support lugs.

This enhanced visual examination employs the same resolution requirements as that required by ASME Section XI for VT-1 examinations. The applicant indicated that for the period of extended operation, the ASME Section XI Subsections IWB, IWC, and IWD ISI program will be enhanced to require ASME Section XI VT-1 examinations of the core support lugs. The staff found the applicant's response to be acceptable for detection of cracking of the core support lugs.

On the basis of the evaluations of these AMPs in the SER sections identified above, the staff concludes that these AMPs are acceptable for managing the pertinent aging effects and providing assurance that the intended function(s) of the RV components will be maintained consistent with the CLB throughout the period of extended operation.

3.2.4.3 FSAR Supplement

On the basis of the staff's evaluation described above, the summary descriptions of the AMPs for the reactor vessels contained in Appendix A to the LRA are acceptable.

3.2.4.4 Conclusions

The staff has reviewed the information in Section 3.2.4, "Reactor Vessels," and Appendices A and B to the LRA, as supplemented by the April 19, 2001, response to the RAI. The staff concludes that the applicant has demonstrated that the effects of aging associated with the RVs will be adequately managed such that there is reasonable assurance that the intended function(s) will be maintained consistent with the CLB throughout the period of extended operation.

3.2.5 Reactor Vessel Internals

3.2.5.1 Summary of Technical Information in the Application

The applicant described its AMR of the RV internals for license renewal in LRA Section 3.2.5, "Reactor Vessel Internals," as supplemented by the April 19, 2001, response to the RAI. The staff reviewed this section of the LRA to determine whether the applicant has demonstrated that the effects of aging on the RV internals will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The components that comprise the RV internals and are within the scope of license renewal and therefore, subject to an AMR are listed in Table 3.2-1 of the LRA, along with their identified intended functions, materials, and environmental exposures.

The Westinghouse Owners Group topical report WCAP-14577 is not incorporated by reference in the LRA. However, the application states that the RV internals are bounded by the description in the topical report with regard to design criteria and features, modes of operation, intended functions, and environmental exposures. The Turkey Point RV internals are constructed of stainless steel, Alloy 600, and Alloy X-750, and the materials, fabrication techniques and installed configuration are consistent with the respective components contained in the topical report.

The LRA indicates that fatigue is the only TLAA that applies to RV internals, as addressed in Section 4.3.1 of the LRA.

The following RV internals aging effects require management during the extended period of operation:

- cracking
- reduction in fracture toughness
- loss of material
- loss of mechanical closure integrity
- loss of preload
- dimensional change

The programs and activities that manage the aging effects for each applicable environment and material combination are listed in Table 3.2-1 of the LRA.

Each of the aging effects requiring management is described in the LRA with regard to RV internals component affectations and the proposed AMPs. The following AMPs are identified in the LRA:

- ASME Section XI, Subsection IWB, IWC, and IWD ISI program
- chemistry control program
- reactor vessel internals inspection program

The latter is a new program developed for the license renewal period, and the other two are existing programs.

The LRA provides a summary of the industry and plant-specific operating experience that the applicant reviewed to validate the set of aging effects that require management. On the basis of the review of the identified operating experience, the licensee did not identify any additional aging effects requiring management for the extended period of operation beyond those listed in Table 3.2-1 of the LRA.

On the basis of the evaluations provided in Appendix B to the LRA for the programs identified, the applicant concluded that aging effects will be adequately managed so that the intended functions of the RV internals components listed in Table 3.2-1 of the LRA will be maintained consistent with the CLB throughout the period of extended operation.

3.2.5.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Section 3.2.1 (including Table 3.2-1) and pertinent sections of Appendix B to the LRA, regarding the applicant's demonstration 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 for the RV internals.

The staff has reviewed the RV internals technical information provided in Section 3.2.5 of the LRA for Turkey Point, Units 3 and 4. The staff requested additional information needed to complete its review and prepare an SE based on the RAI responses and the balance of the technical information provided in Section 3.2.5 of the LRA. The applicant subsequently met with the staff twice to provide additional information and clarifications prior to forwarding its response to the RAI.

Action Items from Previous Staff Evaluation of WCAP-14577

As described in Section 3.2.5.1 of this SER, the final SER for WCAP-14577, "License Renewal Evaluation: Aging Management Evaluation for Reactor Internals," was issued by letter dated February 10, 2001, after the Turkey Point LRA was submitted to the NRC for review. In response to RAI 3.2.5-4, by letter dated April 19, 2001, the applicant provided a response to the applicant action items in the final SER for WCAP-14577. As discussed below, the staff finds that the applicant's responses resolve the applicant action items from the final SER for WCAP-14577:

Applicant Action Item 1:

To ensure applicability of the results and conclusions of WCAP-14577 to the applicant's plant(s), the license renewal applicant is to verify that the critical parameters for the plant are bounded by the topical report. Further, the renewal applicant must commit to programs described as necessary in the topical report to manage the effects of aging during the period of extended operation on the functionality of the RV components. Applicants for license renewal will be responsible for describing any such commitments and proposing the appropriate regulatory controls. Any deviations from the AMPs described in this topical report as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the RV internal components or other information presented in the report, such as materials of construction, must be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).

Response: LRA Subsections 2.3.1.6 (page 2.3-10) and 3.2.5 (page 3.2-29) provide a summary of the comparison of the critical parameters and attributes of Turkey Point to WCAP-14577 and describe the WCAP applicability to Turkey Point.

Applicant Action Item 2:

A summary description of the programs and activities for managing the effects of aging and the evaluation of TLAAs must be provided in the license renewal FSAR supplement in accordance with 10 CFR 54.21(d).

Response: Programs necessary to manage the effects of aging for the Turkey Point RV internals are the RV internals inspection program, the ASME Section XI, Subsection IWB, IWC, and IWD ISI program, and the chemistry control program. Summary descriptions of these programs are provided in the LRA FSAR Supplement, Appendix A, Subsections

16.1.6 (page A-34), 16.2.1 (page A-34), and 16.2.4 (page A-36), respectively. As stated in LRA Subsection 3.2.5 (page 3.2-29), the only TLAA applicable to the Turkey Point RV internals is fatigue. A summary description of the fatigue TLAA evaluation is provided in the LRA FSAR Supplement, Appendix A, Subsection 16.3.2 (page A-44).

Applicant Action Item 3:

For the holddown spring, applicants for license renewal are expected to address intended function, AMR, and appropriate AMP(s).

Response: The information on the holddown springs is provided in LRA Subsection 3.2-5 (pages 3.2-29 through 3.2-36) and in Table 3.2-1 (page 3.2-78).

Applicant Action Item 4:

The license renewal applicant must address AMR, and appropriate AMP(s), for guide tube support pins.

Response: The information on the guide tube support pins is provided in LRA Subsection 3.2-5 (pages 3.2-29 through 3.2-36) and in Table 3.2-1 (page 3.2-77).

Applicant Action Item 5:

The license renewal applicant must explicitly identify the materials of fabrication of each of the components within the scope of the topical report. The applicable aging effect should be reviewed for each component based on the materials of fabrication and the environment.

Response: Upon further review of the plant-specific RV internals materials and environments, FPL has identified the following:

- The lower support castings identified in LRA Table 3.2-1 (page 3.2-78) are forgings.
- The bottom-mounted instrumentation columns identified in LRA Table 3.2-1 (page 3.2-76) are cast stainless steel.
- The lower support columns identified in LRA Table 3.2-1 (page 3.2-76) are cast stainless steel.
- The upper support column bases (new line item for LRA Table 3.2-1 on

  page 3.2-77) are cast stainless steel, but not exposed to a fluence greater than 10^{21} n/cm^2.
- The lower support forgings will be exposed to a fluence in excess of 10^{21} n/cm^2, as discussed in the response to RAI 3.2.5-1.

With the exception of the changes discussed above, the specific materials of fabrication and environments for all parts of the Turkey Point RV internals that require AMR are identified in LRA Subsection 3.2.5.1 (page 3.2-30) and in Table 3.2-1 (pages 3.2-76 through 3.2-79). Changes to Table 3.2-1 as a result of the above are included in the following tables. *[NOTE: The revisions to Table 3.2-1 are not duplicated here - see letter dated April 19, 2001.]*

Applicant Action Item 6:

The license renewal applicant must describe its aging management plans for loss of fracture toughness in cast austenitic stainless steel reactor vessel internals (RVI) components, considering the synergistic effects of thermal aging and neutron irradiation embrittlement in reducing the fracture toughness of these components.

Response: Considering the response to item (5) above, the only CASS RV internals components within the scope of license renewal are the lower support columns, the bottom-mounted instrumentation columns, and the upper support column bases. Of these components, only the lower support columns will be subjected to fluences of greater than 10^{21} n/cm^2. Accordingly, synergistic effects of thermal aging and irradiation embrittlement in reducing the fracture toughness will be a consideration for the lower support columns. As noted in item (5) above and in LRA Table 3.2-1 (pages 3.2-76 through 3.2-79), reduction in fracture toughness will be managed by the RV internals inspection program, as described in LRA Appendix B, Subsection 3.1.6 (page B-21).

Applicant Action Item 7:

The license renewal applicant must describe its aging management plans for void swelling during the license renewal period.

Response: Aging management plans regarding dimensional change due to void swelling of the Turkey Point RV internals are discussed in LRA Subsection 3.2.5.2.6 (page 3.2-33). These plans are included in the RV internals inspection program, which is described in LRA Appendix B, Subsection 3.1.6 (page B-21).

Applicant Action Item 8:

Applicants for license renewal must describe how each plant-specific AMP addresses the following elements: (1) scope of the program, (2) preventive actions, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.

Response: The programs necessary to manage the effects of aging of the Turkey Point RV internals are the RV internals inspection program, the ASME Section XI, Subsection IWB, IWC, and IWD ISI program, and the chemistry control program. The descriptions of these programs, provided in LRA Appendix B, Subsections 3.1.6 (page B-21), 3.2.1.1 (page B-27), and 3.2.4 (page B-47), respectively, address the 10 elements identified. Two elements, corrective action and administrative controls, are common to all programs and are described in LRA Appendix B Section 2.0 (page B-5).

Applicant Action Item 9:

The license renewal applicant must address plant-specific plans for management of cracking (and loss of fracture toughness) of RVI components, including any plans for augmented inspection activities.

Response: Aging management plans to address cracking and reduction in fracture toughness of the Turkey Point RV internals are discussed in LRA Subsections 3.2.5.2.1 (page 3.2-30) and 3.2.5.2.2 (page 3.2-31), respectively. The programs necessary to manage cracking and reduction in fracture toughness are the RV internals inspection program, the ASME Section XI, Subsection IWB, IWC, and IWD ISI program, and the chemistry control program. The descriptions of these programs are provided in LRA Appendix B, Subsections 3.1.6 (page B-21), 3.2.1.1 (page B-27), and 3.2.4 (page B-47), respectively. The RV internals inspection program includes inspection activities for cracking and reduction in fracture toughness.

Applicant Action Item 10:

The license renewal applicant must address plant-specific plans for management of age-related degradation of baffle/former and barrel/former bolting, including any plans for augmented inspection activities.

Response: Aging management plans to address loss of mechanical closure integrity of the Turkey Point baffle/former and barrel/former bolting are discussed in LRA Subsection 3.2.5.2.4 (page 3.2-33). Note that these plans also consider information provided in WCAP-14577, Revision 1, "License Renewal Evaluation: Aging Management for Reactor Internals," submitted to the NRC by the WOG on October 9, 2000. The program necessary to manage loss of mechanical closure integrity of this bolting is the RV internals inspection program. The description of this program is provided in LRA Appendix B, Subsection 3.1.6 (page B-21). The RV internals inspection program includes augmented inspection activities as they apply to loss of mechanical closure integrity of the baffle/former and barrel/former bolting.

Applicant Action Item 11:

The license renewal applicant must address the TLAA of fatigue on a plant-specific basis.

Response: A description of the plant-specific fatigue TLAA evaluation performed for Turkey Point is provided in LRA Section 4.3 (pages 4.3-1 through 4.3-13). Also, refer to response to RAI 3.2.5-7.

The following summarizes the February 2, 2001, RAIs and the information, clarification, and April 19, 2001, responses provided by the applicant with regard to Section 3.2.5:

(1) In Section 3.2.5 of the LRA, the applicant states that the RV internals components for Turkey Point, Units 3 and 4, are bounded by the description in topical report WCAP-14577, with regard to their intended functions and within the scope of license renewal, as discussed in Subsection 2.3.1.6 of the LRA. However, this raised a potential contradiction between this information and other renewal application text with regard to the holddown ring having an intended function. Contrary to the staff's position in its final SER, topical report WCAP-14577, Rev. 1, indicates that the holddown ring does not have an intended core support function. The staff requested that the LRA include the holddown ring in the discussion in Section 2.3.1.6, which lists the components that comprise the RV internals, or provide the basis for its exclusion.

During the initial RAI followup meeting with the staff, the applicant provided a clarification, stating that the applicant does not agree with the topical report on this issue, and included the holddown ring in Table 3.2-1 of the LRA as having a core support intended function. The staff withdrew the RAI question.

(2) In Section 3.2.5 of the LRA, the applicant indicates that the Turkey Point RV internals components with fluence greater than 10^{21} n/cm^2 do not include the lower support casting. In RAI 3.2.5-1, the staff requested that the applicant provide the maximum fluence expected for the lower support casting during the license renewal period and the basis for that expectation.

In the RAI 3.2.5-1 followup discussions and response, FPL indicated that the lower support casting was subsequently identified as a forging, and will likely be exposed to a fluence greater than 10^{21} n/cm^2 at the end of the extended period of operation. This is expected to produce some reduction in fracture toughness, as well as increased susceptibility to irradiation-assisted SCC. The LRA will be revised to include the lower support forging in the list of components that are potentially susceptible to reduction in fracture toughness due to irradiation embrittlement. The LRA will also be revised to indicate that the only cast austenitic stainless steel components in the RV internals are the lower support columns, the bottom-mounted instrumentation columns, and the upper support column bases.

(3) The RV internals baffle assembly contains three categories of baffle bolts that are designated as former/baffle bolts, barrel former/bolts and baffle/baffle bolts. In RAI 3.2.5-2, the staff requested that the applicant clarify or provide the basis for not including the baffle/baffle bolts in the baffle assembly bolting described in Sections 3.2.5.2.2 and 3.2.5.2.4 and Table 3.2-1 of the LRA.

In the response to RAI 3.2.5-2, the applicant indicated that the Turkey Point baffle assembly baffle/baffle bolts (baffle plate edge bolts) perform no structural function and are not required to perform an intended function. The WOG developed a methodology as part of the baffle bolt cracking inspection program to evaluate acceptable baffle assembly bolting patterns under faulted conditions. Applications of this methodology have identified acceptable bolting patterns without taking credit for baffle/baffle bolts.

(4) In Section 3.2.5.2.1 of the LRA, the applicant indicates that susceptibility has been observed at fluence as low as $1x10^{21}$ n/cm^2 in laboratory studies on Type 304 stainless steel in PWR environments. Further, the applicant indicates that Type 316 stainless steel is less susceptible, and that field information suggests that greater exposures are required for the development of susceptibility. In RAI 3.2.5-3, the staff requested that the applicant identify the field information that suggests that greater exposures are required for the development of susceptibility.

In its response to RAI 3.2.5-3, the applicant identified the field information resources that it referred to in Section 3.2.5.2.1, as material contained in four proceedings of symposiums and conferences that occurred prior to 1998. The response also provided some new limited fluence information on Type 316 and 347 stainless steel bolts obtained during baffle bolt cracking inspections conducted on four WOG plants in 1999.

(5) In Section 3.2.5.2.4 of the LRA, the applicant states that significant data, information, and industry experience relative to the aging of baffle bolting is provided in WCAP-14577 and is not duplicated in the LRA. In RAI 3.2.5-4, the staff requested that the applicant review the staff RAIs, the associated owners group responses, and address the applicability and need for inclusion with regard to the Turkey Point Unit 3 and 4 LRA. The staff also requested that the applicant provide responses to the renewal applicant action items provided in the final SER for WCAP-14577.

In the RAI 3.2.5-4 response, the applicant indicated that it reviewed and addressed the NRC topical report WCAP-14577 RAIs and associated WOG responses in the Turkey Point AMR performed on the RV internals. The applicant identified applicable information included in the Turkey Point LRA that addressed these RAIs and their responses, including References 2.3-9 on page 2.3-43 and 3.2-8 on page 3.2-53 of the LRA. The applicant also provided responses to the Renewal Applicant Action Item for WCAP-14577, as previously described in this section.

(6) The response to Action Item (6) to RAI 3.2.5-4 addresses the staff's concern regarding the applicant's LRA reference to WCAP-14577, Revision 0, dated June 1997, as the source for significant data, information, and industry experience relative to the aging of baffle bolting, in lieu of WCAP-14577, Revision 1, dated October 2000. The staff is concerned with the use of the earlier topical report revision for aging management plans to address loss of mechanical closure of baffle former bolting, because Revision 0 provides limited and dated domestic plant baffle bolting degradation experience. This version indicates that there have been no historical incidents that involve baffle/former bolting degradation in domestic plants. By contrast, Revision 1 provides significant data, information, and industry experience relative to the aging of baffle bolting in domestic plants that was developed during 1998 through mid-2000. The Action Item (6) response indicated that aging management plans to address the loss of mechanical closure of Turkey Point baffle/former and barrel/ former bolting are discussed in LRA Section 3.2.5.2.4 (page 3.2-33), and noted that these plans also consider the information provided in WCAP-14577, Revision 1, dated October 2000. Based on this information contained in the response to RAI 3.2.5-4, the applicant has committed to revise the reference to WCAP-14577 Revision 0 to specify WCAP-14577 Revision 1, which contains the significant data, information, and industry experience relative to the aging of baffle bolting that is addressed in Subsection 3.2.5.2.4.

(7) In Section 3.2.5.2.6 of the LRA, the applicant discusses the RV internals material dimensional changes and cites references indicating that the material may be subject to various levels of dimensional changes resulting from void swelling under certain conditions. One reference cited in the discussion concludes that at the approximate RV internal end-of-life dose of 100 displacements per atom, swelling would be less than 2% at irradiation temperatures between 572 °F and 752 °F. In the discussion, the LRA indicates that field service experience in PWR plants has not shown any evidence of swelling and, at present, there have been no indications from the different RV internals bolt removal programs, or from any of the other inspection and functional evaluations (e.g., refueling), that there are any discernible adverse effects attributable to swelling. In RAI 3.2.5-5, the staff requested that the applicant identify some specific examples of field service experience, bolt removal programs, and other inspections and functional evaluations with detailed descriptions of the examinations, inspections, and evaluations that have been performed to support the conclusion that there is not any evidence of, or any discernible effects attributable to swelling. In RAI 3.2.5-5, the staff further requested that the applicant describe the change in loading on the baffle bolt, and its impact on the bolt integrity that would occur if the thickness of the baffle material located under the bolt head were subjected to a 2% or less dimensional change due to swelling.

In its response to RAI 3.2.5-5, the applicant reported that field service material swelling experience is derived from refueling outages and ISIs performed on industry plants since their startup. The absence of gap closures and physical distortion caused by localized dimensional increases is indicative of the absence of significant material swelling. Data on swelling are currently being evaluated as part of the industry's baffle bolt cracking evaluation program. Several bolts removed from Westinghouse plants during the 1999 baffle bolt cracking inspections were subject to detailed hot-cell micrographics examination, and some void swelling formations were observed. The measured volumetric changes were less than 0.03 percent. The applicant also obtained the following information from F.A. Garner to clarify the question of bolt integrity when subject to loading resulting from a 2% swelling of baffle plate material under the bolt head:

The stresses developed by void formation will be limited by irradiation creep. Void swelling and irradiation creep have an interrelated relationship to the local stress state. Irradiation creep exists prior to the onset of swelling, and will relieve any applied or thermally induced stresses. Once swelling begins, a new and much larger component of creep develops that is directly proportional to the instantaneous swelling rate. Therefore, any swelling-induced stress will be relaxed at a rate proportional to the swelling rate. This leads to a maximum stress well below 200 MPA, regardless of the local swelling rate. The yield stress can never be exceeded for a typical bolt application. The stress is maintained as long as the swelling rate difference is minimal.

In the RAI 3.2.5-5 response, the applicant concluded that the field service experience, and hot-cell evaluations indicate that the localized swelling is much less than 2%, and reasonable extrapolations to the end of life suggest that it will remain small. In LRA Table 3.2-1, the applicant indicates that the RV internals components requiring management for dimensional changes due to void swelling have yet to be determined. In its April 19, 2001, response to RAI 3.8.6-1, the applicant indicated that the EPRI Materials Reliability Project (MRP) has a task underway to issue a "white paper" on void swelling that will include available data and effects on RV internals. The applicant committed to evaluate these results and factor them into the RV internals inspection program.

(8) The LRA uses 1 x 10^{21} n/cm^2 (E>0.1 MeV) as a fluence threshold for neutron embrittlement of stainless steel used in RV components. In RAI 3.2.5-6, the staff requested that the applicant provide data to support this position, or revise the LRA to expand the list of potentially susceptible components to include those at lower fluences.

In its response to RAI 3.2.5-6, the applicant provided data generally at higher irradiation temperatures than those that apply to RV internals components. The staff does not agree with the applicant's conclusion regarding a fluence threshold for neutron embrittlement of stainless steel used in RV components. However, the applicant's approach to managing neutron embrittlement of RV internals components (as described in Section 3.1.6 of the LRA) does provide adequate management of this degradation mechanism. The staff's evaluation of this program is provided in Section 3.8.6 of the SER.

(9) In Section 3.2.5 of the LRA, the applicant states that, "Turkey Point's TLAA identification effort also identified fatigue as the only TLAA applicable to the RV internals. Fatigue of the RV internals is addressed in Subsection 4.3.1." In RAI 3.2.5-7, the staff requested that the applicant provide a list of the TLAAs associated with fatigue used in verifying that the structural integrity of the RV internals were evaluated and determined to remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

In the RAI 3.2.5-7 followup discussions and response, the applicant indicated that an extensive review of the Turkey Point CLB was performed to identify TLAAs requiring evaluation for license renewal. Their review is documented in a detailed engineering evaluation that includes a description of the TLAA identification process, evaluation results, and summary tables. This evaluation is available on site for NRC review. A fatigue evaluation was performed on the Turkey Point RV internals in support of the thermal power uprate of the units in the mid-1990s (Turkey Point Units 3 and 4 Operating License Amendment 191/185, issued September 25, 1996). Further, the applicant indicated that the existing 40-year design cycles and cycle frequencies were determined to be conservative and bounding for the period of extended operation.

3.2.5.2.1 Aging Effects

The applicant identifies the following aging effects for the RV internals:

- cracking
- reduction in fracture toughness
- loss of material
- loss of mechanical closure integrity
- loss of preload
- dimensional change

Based on the description of the internal and external environments, materials used, and the applicant's review of industry and plant-specific experience, the NRC staff concludes that the applicant has identified the aging effects that are applicable for the RV internals.

3.2.5.2.2 Aging Management Programs

The applicant identifies existing and new programs for managing aging effects for the RV internals during the license renewal term. Specifically, the LRA identifies the following existing AMPs:

- ASME Section XI, Subsections IWB, IWC, and IWD ISI program
- chemistry control program

Staff evaluations of these existing programs are provided in Sections 3.9.1.1 and 3.1.1 of this SER.

A new AMP identified in the application is RV internals inspection program. Staff evaluation of this new AMP is provided in Section 3.8.6 of this SER.

On the basis of the evaluations of these AMPs in the SER sections identified above, the staff concludes that these AMPs are acceptable for managing the pertinent aging effects and providing assurance that the intended function(s) of the RV internals components will be maintained consistent with the CLB throughout the period of extended operation.

3.2.5.3 FSAR Supplement

The FSAR supplement sections pertinent to the RV internals include 16.1.6, "Reactor Vessel Internals Program," 16.2.1.1," ASME Section XI, Subsections IWB, IWC, and IWD Inservice Inspection Program," and 16.2.4, "Chemistry Control Program." These programs and associated FSAR supplement sections are evaluated in Sections 3.8.6, 3.9.1.1, and 3.1.1, respectively, of this SER.

3.2.5.4 Conclusion

The staff has reviewed the information in LRA Section 3.2.5, "Reactor Vessel Internals," as supplemented by the April 19, 2001, responses to the RAI. The staff concludes that the applicant has demonstrated that the effects of aging associated with the RV internals will be adequately managed such that there is reasonable assurance that the intended function(s) will be maintained consistent with the CLB throughout the period of extended operation.

3.2.6 Reactor Coolant Pumps

Each of the three reactor coolant loops for Turkey Point, Units 3 and 4, contains a vertically mounted, single-stage centrifugal reactor coolant pump (RCP) that employs a controlled leakage seal assembly. The RCPs provide the motive force for circulating the reactor coolant through the reactor core, piping, and steam generators. The RCPs used at Turkey Point are Westinghouse Model 93.

3.2.6.1 Summary of Technical Information in the Application

The applicant describes its AMR of the RCPs for license renewal in LRA Section 3.2.6, "Reactor Coolant Pumps," as supplemented by the April 19, 2001, response to the RAI. The staff reviewed this section of the LRA to determine whether the applicant has demonstrated that the effects of aging on the RCPs will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

In Section 2.3.1.7 of the LRA, the applicant states that the intended function of the RCPs for license renewal is to maintain reactor coolant system pressure boundary integrity. The RCP components that support this intended function and are subject to an AMR include the pump casing, cover, pressure-retaining bolting, and integral thermal barrier heat exchanger. Non-Class 1 piping, instrumentation, and other components attached to the RCPs are addressed in Section 2.3.1.2.2 of the LRA.

The RCP is included in WCAP-14575, "License Renewal Evaluation: Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components." WCAP-14575 is not incorporated by reference in the LRA, but the Turkey Point AMR was compared to WCAP-14575 with the results presented below. The draft safety evaluation for WCAP-14575 was issued by letter dated February 10, 2000. The final safety evaluation for WCAP-14575 was issued by letter dated November 8, 2000, after the Turkey Point LRA was submitted to the NRC for review. However, all of the renewal applicant action items that are in the final safety evaluation are addressed either as applicant action items or open items in Tables 2.3-2 and 2.3-3 of the LRA. Specifically, the open items that were identified in the draft safety evaluation were either resolved or added to the list of renewal applicant action items for the final safety evaluation. The applicant's responses are discussed in Section 3.2.6.2 of this SER.

The design and operation of the RCPs were reviewed using the process described in Section 2.3.1.1.1 of the LRA. This review confirmed that the Turkey Point Unit 3 and 4 RCPs are bounded by the description contained in WCAP-14575, with regard to design criteria and features, materials of construction, fabrication techniques, installed configuration, modes of operation, and environments/exposures. The component intended functions for the RCPs are consistent with the intended functions identified in WCAP-14575. The applicant has determined that cracking due to stress corrosion and loss of mechanical closure integrity due to aggressive chemical attack are additional aging effects, not included in WCAP-14575, that require management during the license renewal term.

CASS Class 1 components at Turkey Point consist of the reactor coolant primary loop elbows, RCP casings and closure flanges, and selected valves exceeding a temperature threshold criterion of 482 °F. Reduction in fracture toughness of the reactor coolant CASS primary loop elbows and valves is discussed in Section 3.2.1 of the LRA.

Aging Effects

RCPs are exposed to an internal environment of treated water-primary, and external environments of containment air and potential borated water leaks. The integral thermal barrier heat exchangers are exposed to an internal environment of treated water and treated water-primary, and an external environment of containment air and potential borated water leaks (see Tables 3.0-1 and 3.0-2 of the LRA).

The RCP and integral thermal barrier heat exchanger components are constructed of stainless steel and low alloy steel. The RCP and integral thermal barrier heat exchanger components, intended functions, materials of construction, and environments are summarized in Table 3.2-1 of the LRA.

In Section 3.2.6 of the LRA, the applicant identified the following aging effects for the components of the RCPs that are subject to an AMR:

- SCC
- reduction in fracture toughness of CASS items due to thermal aging embrittlement
- loss of material due to MIC
- loss of mechanical closure integrity (by stress relaxation and/or aggressive chemical attack)
- fouling

Cracking due to fatigue is identified as a TLAA and is addressed in Sections 4.3.1 and 4.3.4. of the LRA.

In Section 3.2.6.2.1 of the LRA, the applicant states that specific design, fabrication, and construction measures were taken to minimize or eliminate material susceptible to SCC in the RCPs. In addition, to reduce the susceptibility of RCP materials to SCC, Turkey Point prevents sensitized stainless steels from coming in contact with an aggressive environment.

In Section 3.2.6.2.2 of the LRA, the applicant states that the only RCP components subject to reduction in fracture toughness due to thermal embrittlement are austenitic stainless steel castings. Consistent with the conclusions drawn in the NRC final SER for WCAP-14575, the applicant stated that CASS RCP casings and closure flanges do not require an AMP to manage thermal embrittlement beyond the examinations programmatically required by ASME Section XI as modified by Code Case N-481.

Section 3.2.6.2.3 of the LRA identifies MIC as an aging mechanism that can cause loss of material for the RCP integral thermal barrier heat exchanger.

In Section 3.2.6.2.4 of the LRA, the applicant states that loss of mechanical closure integrity can result from stress relaxation and/or aggressive chemical attack. In addition, the applicant states that loss of mechanical closure integrity due to aggressive chemical attack has been observed in the industry and is the most common aging mechanism of concern for ferritic fasteners of stainless steel components.

In Section 3.2.6.2.5 of the LRA, the applicant states that aging mechanisms that can result in fouling of the RCP integral thermal barrier heat exchanger tubing include biological fouling and particulate fouling. Biological fouling has been identified as an aging effect for tubes exposed to CCW. Particulate fouling has been identified as an aging effect for heat transfer surfaces of the RCP integral thermal barrier heat exchangers.

Industry Experience

The applicant performed a review of industry operating history and a review of NRC generic communications to validate the set of aging effects that require management. The industry correspondence that was reviewed for RCP operating experience includes the following:

- NRC Bulletin 79-17, "Pipe Cracks in Stagnant Borated Water Systems at PWR Plants"
- NRC Circular 76-06, "Stress Corrosion Cracks in Stagnant, Low-Pressure Stainless Piping Containing Boric Acid Solution at PWRs"
- NRC Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants"
- NRC Information Notice 79-19, "Pipe Cracks in Stagnant Borated Water Systems at PWR Plants"
- NRC Information Notice 86-108, "Degradation of Reactor Coolant System Pressure Boundary Resulting From Boric Acid Corrosion"
- NRC Information Notice 92-86, "Unexpected Restriction to Thermal Growth of Reactor Coolant Piping"
- NRC Information Notice 93-61, "Excessive Reactor Coolant Leakage Following a Seal Failure in a Reactor Coolant Pump or Reactor Recirculation Pump"
- NRC Information Notice 93-84, "Determination of Westinghouse Reactor Coolant Pump Seal Failure"
- NRC Information Notice 93-90, "Unisolatable Reactor Coolant System Leak Following Repeated Application of Leak Sealant"
- NRC Information Notice 97-31, "Failures of Reactor Coolant Pump Thermal Barriers and Check Valves in Foreign Plants"

No aging effects requiring management were identified from the above documents beyond those already identified in section 3.2.6.2 of the LRA. Note that a summary of industry experience associated with RCPs is provided in WCAP-14575.

Plant-Specific Experience

The applicant reviewed Turkey Point Unit 3 and 4 operating experience to validate the identified aging effects requiring management. This review included a survey of Turkey Point non-conformance reports, licensee event reports, and condition reports for any documented instances of RCP component aging, in addition to interviews with responsible engineering personnel. No aging effects requiring management were identified from this review beyond those identified in Section 3.2.6.2.

Aging Management Programs

In Section 3.2.6.4 of the LRA, the applicant identifies the following existing AMPs for the RCPs:

- ASME Section XI, Subsections IWB, IWC, and IWD ISI program
- boric acid wastage surveillance program
- chemistry control program

The applicant concludes that these programs will manage the applicable aging effects so that the intended function(s) of the components of the RCPs will be maintained consistent with the CLB, under all design loading conditions throughout the period of extended operation.

3.2.6.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Sections 3.2.6 (including Table 3.2-1), and pertinent sections of Appendix B of the Turkey Point Units 3 and 4 LRA, regarding the applicant's demonstration that the effects of aging will be adequately managed so that the intended function would be maintained consistent with the CLB throughout the period of extended operation for the RCPs.

As mentioned in Section 3.2.6.1 of this report, the final SER for WCAP-14575, "License Renewal Evaluation: Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components," was issued by letter dated November 8, 2000, after the Turkey Point LRA was submitted to the NRC for review. However, all of the open items that were identified in the draft safety evaluation were either resolved, or added to the list of renewal applicant action items for the final safety evaluation. Therefore, the applicant addressed all renewal applicant action items that are included in the final safety evaluation report for WCAP-14575. There were six renewal applicant action items, and six open items from the draft safety evaluation for WCAP-14575. The action items, open items, applicant's responses, and staff's evaluations are given below.

Action Items From Previous Staff Evaluation of WCAP-14575

As discussed below, the staff finds that the applicant's responses (Tables 2.3-2 and 2.3-3 of the LRA) to the renewal applicant action items and open item from the draft safety evaluation resolve the 10 action items in the final safety evaluation for WCAP-14575.

> Applicant Action Item 1: The license renewal applicant is to verify that its plant is bounded by the technical report. Further, the renewal applicant is to commit to programs described as necessary in the technical report to manage the effects of aging during the period of extended operation on the functionality of the reactor coolant system piping. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the AMPs within this technical report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor coolant system piping and associated pressure boundary components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).

Response: As summarized in sections 2.3.1.2 and 2.3.1.7 of the LRA, the Turkey Point Unit 3 and 4 Class 1 piping and RCPs are bounded by the topical report with regard to design criteria and features, materials of construction, fabrication techniques, installed configuration, modes of operation, and environments/exposures. Programs necessary to manage the effects of aging are described in Sections 3.2.1 and 3.2.6 of the LRA, and are summarized in Table 3.2-1 of the LRA. Program commitments to manage the effects of aging for Class 1 piping and RCPs are described in Appendix B to the LRA and are summarized in the proposed UFSAR supplement provided in Appendix A to the LRA. Deviations from the AMPs included in the topical report are described in Sections 3.2.1 and 3.2.6 of the LRA. The staff found this response to be acceptable.

Applicant Action Item 2: Summary description of the programs and evaluation of TLAAs are to be provided in the license renewal FSAR supplement in accordance with 10 CFR 54.21(d).

Response: A summary of the programs identified to manage the effects of aging for Class 1 piping and RCPs is included in the proposed UFSAR supplement in Appendix A to the LRA. A markup of the UFSAR sections affected by the TLAA evaluations is also included in the proposed UFSAR supplement. The staff found this response to be acceptable.

Applicant Action Item 3: Applicants must provide a description of all insulation used on austenitic stainless steel nuclear steam supply system (NSSS) piping to ensure the piping is not susceptible to stress-corrosion cracking from halogens.

Response: During construction, the Class 1 piping was insulated in accordance with the applicable Westinghouse equipment specification. The specification listed specific trade names that were approved, by Westinghouse, for use on austenitic stainless steel. As described in the Turkey Point UFSAR, Section 4.2.5 "...external corrosion resistant surfaces in the reactor coolant system are insulated with low halide or halide free insulating material...". During 1979 the insulation on the reactor coolant piping was changed to reflective insulation. The insulation is made of austenitic stainless steel. Any non-metallics comply with NRC Regulatory Guide 1.36, "Nonmetallic Thermal Insulation for Austenitic Stainless Steel," dated October 1973. Subsequent additions of insulation were done in accordance with the applicable Bechtel specification, which also imposes the requirements of Regulatory Guide 1.36. Since all the insulation that was used on the reactor coolant piping is low halide or halide free, the piping is not susceptible to SCC initiated by such halides. The staff found this response to be acceptable.

Applicant Action Item 4: The license renewal applicant should describe how each plant-specific AMP addresses the following 10 elements: (1) scope of the program, (2) preventive actions, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8)confirmation process, (9) administrative controls, and (10) operating experience.

Response: Programs necessary to manage the effects of aging for Class 1 piping and RCPs address the 10 elements identified. These programs are described in Appendix B of the LRA. The staff found this response to be acceptable.

Applicant Action Item 5: The license renewal applicant should perform additional fatigue evaluations or propose an AMP to address the components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP 14575.

Response: The applicant has performed a plant-specific fatigue evaluation for Turkey Point Unit 3 and 4 Class 1 piping and RCPs. This evaluation is included in Section 4.3. The staff found this response to be acceptable.

Applicant Action Item 6: The staff recommendation for the closure of Generic Safety Issue (GSI)-190, "Fatigue Evaluation of Metal Components for 60-Year Plant Life" is contained in a memorandum from Ashok Thadani to William Travers, dated December 26, 1999. The license renewal applicant should address the effects of the coolant environment on component fatigue life as AMPs are formulated in support of license renewal. The evaluation of a sample of components with high-fatigue usage factors using the latest available environmental fatigue data is an acceptable method to address the effects of the coolant environment on component fatigue life.

Response: The applicant has performed a plant-specific evaluation for Turkey Point Unit 3 and 4 Class 1 piping and RCPs with regard to environmental effects on fatigue. This evaluation is included in Section 4.3.5.

The following six items were open items in the draft safety evaluation for WCAP-14575:

Item 1: WOG should complete the specific revisions to the subject topical report that it has committed to perform in response to the staff's requests for additional information discussed in Section 3.1 of the safety evaluation. As described by WOG in its letter to the staff, dated July 19, 1999, these planned modifications are limited to Section 2.3.2.2, "Branch Line Restrictors," Section 2.3.2.4, "Thermal Barrier and RCP Seals," and the "Summary" sections of the topical report.

Response: The Turkey Point Class 1 piping AMR includes branch line restrictors and their associated license renewal component intended function of throttling. The AMR of the Class 1 piping is addressed in section 3.2.1 and summarized in Table 3.2-1 of the LRA. The Turkey Point position regarding RCP seals is summarized in Section 2.3.1.7 of the LRA. The staff found this response to be acceptable.

Item 2: WOG should complete the updated review of generic communications and revise Section 3.1 of the topical report to describe the process used by the WOG to perform the review and to capture any additional items not identified by the original review.

Response: The applicant has completed an updated review of generic communications for applicability to Class 1 piping and RCPs. All generic communications applicable to aging effects are summarized in Sections 3.2.1 and 3.2.6 of the LRA. The staff found this response to be acceptable.

Item 3: The topical report indicates that thermal aging-related cracking of austenitic steel castings is an aging effect that the WOG considers potentially significant for the reactor coolant system piping and associated components. Thermal aging does not cause cracking; it causes a reduction in the fracture toughness of the material. The reduction in fracture toughness of the material results in a reduction in the critical flaw size that could lead to component failure. The WOG should revise the topical report, accordingly.

Response: The applicant's AMR methodology identifies reduction in fracture toughness as the aging effect related to thermal aging. Reduction in fracture toughness for Class 1 piping and RCPs is addressed in Sections 3.2.1 and 3.2.6 of the LRA. The staff found this response to be acceptable.

Item 4: Components that have delta ferrite levels below the susceptibility screening criteria have adequate fracture toughness and do not require supplemental inspection. As a result of thermal embrittlement, components that have delta ferrite levels exceeding the screening criterion may not have adequate fracture toughness and do require additional evaluation or examination. WOG should address thermal-aging issues in accordance with the staff's comments in Section 3.3.3 of this evaluation.

Response: As noted above for Item 3, reduction in fracture toughness for Class 1 piping and RCPs is addressed in Sections 3.2.1 and 3.2.6 of the LRA. The applicant's methodology is consistent with the staff's comments. The staff found this response to be acceptable.

Item 5: WOG should propose to perform additional inspection of small-bore reactor coolant system piping, that is, less than 4-inch-size piping, for license renewal to provide assurance that potential cracking of small-bore reactor coolant system piping is adequately managed during the period of extended operation.

Response: The AMR and specific program commitments for Class 1 small bore piping are addressed in Section 3.2.1 and summarized in Table 3.2-1 of the LRA. Specifically, the applicant committed to perform a one-time inspection in order to confirm that cracking is not occurring in small bore piping (less than 4 inches in diameter). The staff found this response to be acceptable.

Item 6: WOG should revise AMP-3.6 to include an assessment of the margin on loads in conformance with the staff guidance provided in Reference 11. In addition, AMP-3.6 should be revised to indicate if the CASS component is repaired or replaced per ASME Code, Section XI IWB-4000 or IWB-7000, then a new leak-before-break (LBB) analysis based on the material properties of the repaired or replaced component (and accounting for its thermal aging through the period of extended operation, as appropriate), is required to confirm the applicability of LBB. The inservice examination/flaw evaluation option is, per the basis on which the NRC staff has approved LBB in the past, insufficient to reestablish LBB approval. The original Turkey Point (LBB) analysis was performed consistent with the criteria specified in NUREG-1061, Volume 3, and utilized the modified limit load method as specified in the draft Standard Review Plan, Section 3.6.3. The NRC review and safety evaluation of the original Turkey Point LBB analysis is documented in the June 23, 1995, NRC letter to Florida Power and Light.

Response: The revised Turkey Point LBB analysis, which addresses the extended period of operation, utilizes a methodology consistent with the original LBB analysis. If Class 1 piping CASS components are repaired or replaced, Turkey Point design control procedures would require a new LBB analysis based on replacement material properties. The staff found this response to be acceptable.

3.2.6.2.1 Aging Effects

The applicant states that the applicable aging effects include the following:

- SCC
- reduction in fracture toughness of CASS items due to thermal aging embrittlement
- loss of material due to MIC
- loss of mechanical closure integrity (by stress relaxation and/or aggressive chemical attack)
- fouling

On the basis of the description of the RCP internal and external environments, materials used in the fabrication of various RCP components, the Turkey Point experience, and the applicant's survey of industry and plant-specific experience, the NRC staff concludes that the applicant has identified the aging effects that are applicable for the RCPs.

3.2.6.2.2 Aging Management Programs

The applicant identifies existing and new programs for management of aging effects for the RCPs during the license renewal term. The existing AMPs identified in the application are:

- ASME Section XI, Subsections IWB, IWC, and IWD ISI program
- boric acid wastage surveillance program
- chemistry control program

Staff evaluations of these existing programs are described in Sections 3.9.1, 3.9.3, and 3.1.1 of this SER, respectively.

On the basis of the evaluations of these AMPs in the SER sections described above, the staff concludes that these AMPs are acceptable in managing the pertinent aging effects and providing assurance that the intended function of the RCPs is maintained consistent with the CLB throughout the period of extended operation.

3.2.6.3 FSAR Supplement

On the basis of the staff's evaluation described above, the summary descriptions of the AMPs for the RCPs described in Appendix A to the LRA is acceptable.

3.2.6.4 Conclusions

The staff has reviewed the information in Section 3.2.6, "Reactor Coolant Pumps," as supplemented by the April 19, 2001, response to RAI, and Appendices A and B to the LRA. The staff concludes that the applicant has demonstrated that the effects of aging associated with the RCPs will be adequately managed such that there is reasonable assurance that the intended function(s) will be maintained consistent with the CLB throughout the period of extended operation.

3.2.7 Steam Generators

Turkey Point, Units 3 and 4, each have three steam generators. One is installed in each reactor coolant loop. Each steam generator is a vertical shell and tube heat exchanger, which transfers heat from a single-phase fluid at high temperature and pressure (the reactor coolant) in the tube side, to a two-phase (steam-water) mixture at lower temperature and pressure in the shell side.

The reactor coolant enters and exits the tube side of each steam generator through nozzles located in the lower hemispherical head. The reactor coolant system fluid flows through inverted U-tubes connected to the tube sheet. The lower head is divided into inlet and outlet chambers by a vertical partition plate extending from the lower head to the tube sheet. The steam-water mixture is generated on the secondary, or shell side, and flows upward through moisture separators and dryers to the outlet nozzle at the top of the vessel, providing essentially dry, saturated steam. Manways are provided to permit access to both sides of the lower head and to the U-tubes and moisture separating equipment on the shell side of the steam generators.

3.2.7.1 Summary of Technical Information in the Application

The applicant described its AMR of the steam generators for license renewal in Section 3.2.7, "Steam Generators," of the LRA, as supplemented by the April 19, 2001, response to the RAI. The staff reviewed this section of the LRA to determine whether the applicant has demonstrated that the effects of aging on the steam generators will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The applicant identified steam generator components that are subject to an AMR in Table 3.2-1 of the LRA. These components include channel heads, primary inlet and outlet nozzles, primary inlet and outlet nozzle safe ends, tube sheets, U-tubes, divider plates, steam generator tube plugs, primary manways, upper and lower shells, elliptical heads, transition cones, feedwater and steam outlet nozzles, steam flow limiters, blowdown piping nozzles and secondary side shell penetrations, secondary closure covers, tube bundle wrappers, wrapper support systems, tube support plates, antivibration bars, support pads, seismic lugs, and primary and secondary bolting.

Intended Functions

The applicant determined the following intended functions to be applicable to the Turkey Point Unit 3 and 4 steam generators:

- maintain primary pressure boundary
- maintain secondary pressure boundary
- provide heat transfer from the primary fluid to the secondary fluid
- provide secondary side flow distribution and throttling
- provide structural support

Aging Effects

The steam generators are exposed to internal environments of treated water - primary and treated water - secondary, and external environments of containment air and potential borated water leaks. The steam generator components are constructed of stainless steel, carbon steel, alloy steel, Alloy 600, and Alloy 690. The steam generator components, their intended functions, the materials, and environments are summarized in Table 3.2-1 of the LRA.

Aging Management Programs

Aging effects for the steam generator components subject to an AMR, as given in the LRA, are the following:

- cracking
- loss of material
- loss of mechanical closure integrity

The aging effects requiring management are managed by the following programs:

- ASME Section XI, Subsections IWB, IWC, and IWD ISI program
- boric acid wastage surveillance program
- chemistry control program
- steam generator integrity program

Operating Experience

A review of industry operating history and a review of NRC generic communications were performed to validate the set of aging effects that require management. Turkey Point Unit 3 and 4 operating experience was also reviewed to validate the identified aging effects requiring management. This review included a survey of Turkey Point non-conformance reports, licensee event reports, and condition reports for any documented instances of steam generator component aging, in addition to interviews with responsible engineering personnel.

The Turkey Point Unit 3 and 4 steam generators (with the exception of the channel heads and steam domes) were replaced in 1982 and 1983. This replacement was due to significant degradation of the original mill annealed Alloy 600 tubing and deterioration of the carbon steel support plates. Cracking of feedwater nozzles due to fatigue has been experienced at Turkey

Point and was discussed in the applicant's description of cracking (Section 3.2.7.2.1 of the LRA). No additional aging effects requiring management were identified from this review beyond those identified in Section 3.2.7.2 of the LRA.

3.2.7.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in Section 3.2.7 (including Table 3.2-1), pertinent sections of Appendix B of the Turkey Point Units 3 and 4 LRA and the applicant's April 19, 2001, response to the staff's February 2, 2001, RAI, regarding the applicant's demonstration that the effects of aging will be adequately managed so that the intended function would be maintained consistent with the CLB throughout the period of extended operation for the steam generators.

The staff's review of the applicant's LRA for aging effects that apply to the steam generators includes the review of aging management during the period of extended operation for the following internal and external aging effects: (1) cracking, (2) loss of material, and (3) loss of mechanical closure integrity.

As stated in Table 3.2-1 of the LRA, cracking is managed by the ASME Section XI ISI programs, chemistry control and the steam generator integrity program; loss of material is managed by the chemistry control program; and loss of mechanical closure integrity is managed by the boric acid wastage surveillance program and the ASME Section XI ISI programs. Staff evaluations of these existing programs are described in Sections 3.1.1 ("Chemistry Control Program"), 3.9.1 ("ASME Section XI ISI Programs"), 3.9.3 ("Boric Acid Wastage Surveillance Program") and 3.9.14 ("Steam Generator Integrity Program"). On the basis of the evaluations of these AMPs in the SER sections described above and the following evaluation, the staff finds that these AMPs are acceptable in managing the pertinent aging effects consistent with the CLB throughout the period of extended operation.

Section 3.2.7.2.1 of the LRA states that, at Turkey Point, cracking due to fatigue is identified as a TLAA and is analytically addressed in Section 4.3.1 of the LRA. The staff's evaluation of fatigue is presented in Section 4.3 of this SER.

In Section 3.2.7.2.2 (Loss of Material) of the LRA, the aging mechanisms that can cause loss of material for the steam generators are listed. However, industry operating experience indicated that erosion (aging mechanism) could cause the loss of section thickness (aging effect) of a component, and this aging effect is not addressed in the application. One example of this aging effect is the loss of section thickness of the feedwater impingement plate supports in the Harris Nuclear Plant steam generators. In RAI 3.2.7-1, the staff requested that the applicant provide the plant-specific AMP for this aging effect in general for the steam generators and other components in the plant within the scope of license renewal for the period of extended operation. In response to this RAI, the applicant stated that the feedwater impingement plate design at the Harris Nuclear Plant is not present in the Turkey Point Plant steam generators. The Turkey Point steam generator tube support system is stainless steel and is not susceptible to erosion. Other steam generator components are inspected for loss of material due to erosion as part of the steam generator integrity program. The applicant further stated that the only components requiring aging management for loss of material due to erosion are the emergency containment coolers (ECCs). The ECCs are evaluated in Section 3.3.1 of this SER. The staff finds that the applicant's treatment of this aging effect is reasonable.

The applicant identified "loss of mechanical closure integrity" as the aging effect requiring management for primary bolting. Section 3.2.7.2.3 of the LRA identifies stress relaxation and/or aggressive chemical attack as two potential causes of a loss of mechanical closure integrity. However, industry operating experience indicates that a loss of mechanical closure integrity can also result from SCC. Section 5.4 of Appendix C to the LRA discusses the "loss of mechanical closure integrity" aging effect. The last paragraph of Section 5.4 briefly discusses SCC; however, the applicant did not thoroughly describe the actions taken to prevent SCC in primary bolting. In RAI 3.2.7-3, the staff requested that the applicant more thoroughly describe the actions taken (e.g., the use of non-susceptible material and/or the use of non-aggressive lubricants) to prevent SCC in primary bolting. In addition, since operating experience has shown that some alloy steels with lower yield strengths are susceptible to SCC, the staff requested the applicant identify the range of yield strengths used at Turkey Point, Units 3 and 4, and the susceptibility of those material strengths. In response to this RAI, the applicant thoroughly described the actions taken to address the concern of loss of mechanical closure integrity of primary bolting due to SCC.

The applicant also discussed the actual bolting material used at Turkey Point, Units 3 and 4, and indicated that the bolting is expected to have yield strengths less than 150 ksi based on the use of ASTM A-193 Grade B7 bolting at Turkey Point, Units 3 and 4. However, because the maximum yield strength is not specified for this bolting material, the applicant stated that assurance cannot be provided that the yield strength of the bolting would not exceed 150 ksi. (Bolting with a yield strength above 150 ksi could potentially be susceptible to SCC.) The applicant pointed to maintenance practices that control bolt torquing and contaminants that have been effective in eliminating the potential for stress corrosion of bolting materials. In addition, the applicant reviewed industry and Turkey Point operating experience and did not identify any recent bolting failures attributed to SCC. The applicant concluded that cracking of bolting material due to SCC at Turkey Point is not considered an aging effect requiring management.

Several NRC generic communications (e.g., NRC IE Bulletin 82-02, "Degradation of Threaded Fasteners in the Reactor Coolant Pressure Boundary of PWR Plants" and NRC Generic Letter 91-17, "Generic Safety Issue 29, 'Bolting Degradation or Failure in Nuclear Power Plants'") provide information on industry operating experience associated with the degradation of primary bolting, but are not referenced by the applicant in Section 3.2.7.3.1 of the LRA. In RAI 3.2.7-3, the staff requested the applicant explain why these generic communications were not identified as reference documents and whether the information contained within was assessed for Turkey Point, Units 3 and 4. In addition, NRC Information Notice (IN) 97-88, "Experiences During Recent Steam Generator Inspections," was also not identified as a reference in Section 3.2.7.3.1 of the LRA. In RAI 3.2.7-5, the staff requested that the applicant discuss why the IN was not listed as a reference for the Turkey Point Unit 3 and 4 LRA. In response to these RAIs, the applicant stated that these generic communications were inadvertently omitted from the LRA and had been assessed for Turkey Point, Units 3 and 4.

3.2.7.3 FSAR Supplement

The staff has confirmed that the FSAR supplement contains an appropriate summary description of the programs and activities for managing the effects of aging for the Turkey Point plant steam generators.

3.2.7.4 Conclusion

The staff has reviewed the information in Section 3.2.7, "Steam Generators," Appendices A and B to the LRA as supplemented by the April 19, 2001, response to the RAI. Based on the staff's evaluation of aging effects and AMPs the staff concludes that the applicant has demonstrated that the effects of aging associated with the steam generators will be adequately managed such that there is reasonable assurance that the intended function(s) will be maintained consistent with the CLB throughout the period of extended operation.

3.3 Engineered Safety Features Systems

In LRA, Sections 2.3.2, "Engineered Safety Features Systems," and 3.3, "Engineered Safety Features Systems," the applicant describes the scoping and AMR for the engineered safety features (ESFs) systems. Appendices A, B, and C to the LRA also contain supplementary information relating to the AMR of the ESFs systems. The staff reviewed Sections 2.3.2 and 3.3, 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 ESFs system structures and components (SCs) that are determined to be within the scope of license renewal and subject to an AMR.

The Turkey Point ESFs systems include the following seven systems:

- emergency containment cooling
- containment spray
- containment isolation
- safety injection
- residual heat removal
- emergency containment filtration
- containment post-accident monitoring and control

In 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 ESFs system SCs in Section 2.3.2 of the LRA. The staff's evaluation of the scoping methodology and the ESFs system SCs included within the scope of license renewal and subject to an AMR is documented in Sections 2.1 and 2.3.2 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 Appendix C to the LRA, the applicant describes the processes used to identify the applicable aging effects for the SCs that are subject to an AMR. In Appendix D to the LRA, the applicant states that no changes to the Turkey Point Technical Specifications (TSs) have been identified. A discussion of each system follows.

3.3.1 Emergency Containment Cooling System

3.3.1.1 Summary of Technical Information in the Application

The applicant describes its AMR of the emergency containment cooling system for license renewal in Section 2.3.2.1, "Emergency Containment Cooling," 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 emergency containment cooling system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The emergency containment cooling system is designed to remove sufficient heat to maintain the containment below its structural design pressure and temperature during a loss-of-coolant accident or main steam line break. In addition, the emergency fan cooling units continue to remove heat after the maximum hypothetical accident and reduce containment pressure to atmospheric. Heat removed from the containment is transferred to component cooling water. Emergency containment cooling consists of three fan cooling units that are located above the refueling floor, around the inside of each containment.

The emergency containment cooling components subject to an AMR include the emergency fan cooler units (pressure boundary only) and the associated heat exchanger coils. The intended functions of the emergency containment cooling components subject to an AMR include pressure boundary integrity and heat transfer. A complete list of the emergency containment cooling components requiring an AMR, the component intended functions, and the applicable AMPs is provided in Table 3.3.1 of the LRA.

3.3.1.2 Staff Evaluation

3.3.1.2.1 Effects of Aging

The components in the emergency containment cooling system are fabricated from carbon steel and admiralty brass exposed to an internal environment of treated water. The components include emergency containment cooler headers, tubes, and housings. The aging effects of these materials in the treated water environment are identified in Table 3.3-1 of the LRA. The treated water environment is CCW for this application. The applicable internal aging effects in the treated water environment include loss of material and fouling. A discussion of the aging effects for carbon steel and admiralty brass components in a treated water environment is provided below.

The loss of material due to general corrosion for carbon steel components exposed to treated water is the result of a chemical or electrochemical reaction between the material and the environment when both oxygen and moisture are present. Carbon steels are susceptible to external general corrosion in all areas with the exception of those exposed to a controlled, air-conditioned environment, and those applications where the metal temperature is greater than 212 °F.

The loss of material due to pitting corrosion for carbon steel components and admiralty brass components in a treated water environment is also an aging effect requiring management. Pitting corrosion is a form of localized attack that results in depressions in the metal. For treated water systems, oxygen is required for the initiation of pitting corrosion with contaminants, such as halogens or sulfates. Pitting corrosion occurs when passive films in local areas attack passive materials. Once a pit penetrates the passive film, galvanic conditions occur because the metal in this pit is anodic relative to the passive film. Maintaining adequate flow rates over this exposed surface of a component can inhibit pitting corrosion. However, stagnant or low flow conditions are assumed to exist in all systems where dead legs of piping, such as vents or drains exist.

The loss of material due to galvanic corrosion for carbon steel and admiralty brass in a treated water environment is an aging effect requiring management, when coupled with material having higher electrical potential. The loss of material due to galvanic corrosion can occur only when materials with different electrochemical potentials are in contact within an aqueous environment. Generally the effects of galvanic corrosion are precluded by design. In galvanic couples involving brass and carbon steel materials, the lower potential (more anodic) material would be preferentially attacked.

Loss of material due to erosion is an aging effect requiring management for the inside diameter of the admiralty brass tubes of the coolers due to their operation above the nominal design flow during certain plant conditions. Emergency containment cooler tube wear was identified as a TLAA and is discussed in Section 4.7.2 of the Application. A one time inspection for minimum tube wall thickness will be conducted in accordance with the Emergency Containment Coolers Inspection described in Appendix B.

The loss of material due to microbiologically influenced corrosion (MIC) is an aging effect requiring management for carbon steel and admiralty brass in a treated water environment. MIC is a form of localized, corrosive attack accelerated by the influence of microbiological activity due to the presence of certain organisms. Microbiological organisms can produce corrosive substances, as a byproduct of their biological processes, that disrupt the protective oxide layer on the component materials and lead to a material depression similar to pitting corrosion.

The loss of material due to selective leaching is an aging effect requiring management for admiralty brass in a treated water environment. Selective leaching (also known as dealloying) is the dissolution of one element from a solid alloy by corrosion processes. The most common form of selective leaching is dezincification with the removal of zinc from susceptible brass. The addition of small amounts of alloying elements such as phosphorus, arsenic, and antimony is effective in inhibiting this attack in copper-zinc alloys. Therefore, selective leaching of brass applies only to "uninhibited" materials.

Biological and particulate fouling of admiralty brass is an aging effect requiring management in treated water environments. Fouling may be due to an accumulation of particulates or macro-organisms. Fouling is an aging effect that could cause the loss of heat transfer as an intended function at Turkey Point. Biological fouling can also lead to environmental conditions conducive to MIC.

The components in the emergency containment cooling system are also fabricated from carbon steel exposed to an internal environment of air/gas. The components include the emergency containment cooler housings. The aging effects of these materials in the air/gas environment are identified in Table 3.3-1 of the LRA. The applicable internal aging effects in the air/gas environment include loss of material. The loss of material due to general and pitting, corrosion is an aging effect requiring management for carbon steel in atmospheric air/gas environments.

The components in the emergency containment cooling system are also fabricated from carbon steel and admiralty brass exposed to an external environment of containment air and borated water leaks. The components include emergency containment cooler headers, tubes (outside diameter), housings and bolting. The aging effects of these materials in the external environment are identified in Table 3.3-1 of the LRA. The aging effects of these materials in the containment air and borated water leaks are loss of material and loss of mechanical closure integrity.

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

Based on the description of the emergency containment cooling system components in the internal and external environments, and the materials used in the fabrication of the various components, the staff determined that the applicant has identified the applicable aging effects consistent with published literature and industry experience.

3.3.1.2.2 Aging Management Programs

To manage the aging effects for the carbon steel emergency containment cooler headers exposed to treated water, the applicant identified the following AMPs:

- chemistry control program
- galvanic corrosion susceptibility inspection program

To manage the aging effects for the admiralty brass emergency containment cooler tubes (inside diameter) exposed to treated water, the applicant identified the following AMPs:

- chemistry control program
- emergency containment cooler inspection

To manage the aging effects for carbon steel emergency containment cooler housings exposed to air/gas, the applicant identified the following AMP:

- systems and structures monitoring program

To manage the aging effects for emergency containment cooler headers exposed to containment air and borated water leaks, the applicant identified the following AMPs:

- systems and structures monitoring program

- boric acid wastage surveillance program

To manage the aging effects for the emergency containment cooler housings exposed to containment air and borated water leaks, the applicant identified the following AMPs:

- systems and structures monitoring program
- boric acid wastage surveillance program

To manage the aging effects for 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 of the emergency containment cooling system components, and determined that the applicant adequately identified the AMPs to manage the applicable aging effects of this system. Refer to Sections 3.1.1, 3.1.3.3, 3.8.3, 3.8.5, and 3.9.3 of this SER for the review of these AMPs.

3.3.1.3 Conclusion

The staff has reviewed the information in Sections 2.3.2.1 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 cooling 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.

3.3.2 Containment Spray

3.3.2.1 Summary of Technical Information in the Application

The applicant describes its scoping and AMR of the containment spray system for license renewal in Section 2.3.2.2, "Containment Spray," 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 spray system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The containment spray system is designed to remove sufficient heat to maintain the containment below its design pressure and temperature during a loss-of-coolant accident or main steam line break. The containment spray system is composed of two motor-driven horizontal centrifugal pumps, each discharging to two spray lateral headers located near the top of the containment structure. The system also utilizes the residual heat removal (RHR) pumps and heat exchangers for the long-term recirculation phase of containment spray, as described in subsection 2.3.2.5 of the LRA. Additionally, the containment spray system provides a source of water for the emergency containment filtration spray. The components associated with this function are included in the scope of the emergency containment filtration.

The containment spray components subject to an AMR include the pumps and valves (pressure boundary only), heat exchangers, cyclone separators, piping, tubing, fittings, orifices, and spray nozzles. The intended functions for the containment spray components subject to an AMR include pressure boundary integrity, spray, throttling, filtration, and heat transfer. A complete list of the containment spray components requiring an AMR and the component intended functions are provided in Table 3.3-2 of the LRA. The AMR for containment spray is discussed in Section 3.3 of the LRA.

3.3.2.2 Staff Evaluation

3.3.2.2.1 Effects of Aging

For the containment spray system, the applicant stated that stainless steel pumps, valves, piping, fittings, tubing and other components are exposed to treated borated water, treated water or air/gas. As discussed in Table 3.3-2 of the LRA, for the stainless steel components exposed to treated borated water, loss of material is the applicable aging effect. In the Florida Power and Light (FPL) letter L-2001-60, dated March 30, 2001, the applicant provided additional technical discussions that justified that the aging effect of crack initiation and growth due to stress-corrosion cracking (SCC) for stainless steel components is not an applicable aging effect for the containment spray system. For the stainless steel components exposed only to treated water, such as, the containment spray pump seal water heat exchanger tubes (outside diameter), tube coil bands and clips, loss of material and fouling are applicable aging effects. Loss of material alone is the applicable aging effect for carbon steel, brass and cast iron components that are exposed to treated borated water. For carbon steel valves, piping, and fittings and bronze spray nozzles that are exposed to air/gas, there is no aging effect.

There are no aging effects for containment spray system components exposed to "indoor-not air-conditioned" and the containment air environments on stainless steel, brass and bronze. For containment spray pump seal water heat exchanger shells and covers made of cast iron exposed to an "indoor-not air-conditioned" environment or borated water leaks, the applicable aging effect is loss of material. For valves, piping, and fittings, made of carbon steel and exposed to borated water leaks or the containment air environment, loss of material is the applicable aging effect. For carbon steel bolting exposed to borated water leaks the aging effect is loss of mechanical closure integrity.

Based on the description of the containment spray 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.

3.3.2.2.2 Aging Management Programs

To manage the aging effects for the stainless steel pumps, valves, piping, fittings, tubing and other components exposed to treated borated water, treated water or air/gas, the applicant identified the following AMP:

- chemistry control program

To manage the aging effects on the stainless steel components exposed to treated water, such as the containment spray pump seal water heat exchanger tubes (outside diameter), tube coil bands and clips, the applicant identified the following AMP:

- chemistry control program

To manage the aging effects for the brass and cast iron components exposed to treated borated water, the applicant identified the following AMPs:

- chemistry control program
- galvanic corrosion susceptibility inspection program

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

- chemistry control program
- galvanic corrosion susceptibility inspection program
- containment spray system piping inspection program

To manage the aging effects for cast iron containment spray pump seal water heat exchanger shells and covers and carbon steel valves, piping, and fittings exposed to an "indoor-not air-conditioned" environment or a containment air environment, the applicant identified the following AMP:

- systems and structures monitoring program

To manage the aging effects for cast iron containment spray pump seal water heat exchanger shells and covers and carbon steel valves, piping, and fittings exposed to borated water leaks, the applicant identified the following AMP:

- 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 of the containment spray system components, and determined that the applicant adequately identified the AMPs to manage the applicable aging effects of this system. Refer to Sections 3.1.1, 3.1.3, 3.8.5, 3.9.3, and 3.9.5 of this SER for the review of these AMPs.

3.3.2.3 Conclusion

The staff has reviewed the information in Sections 2.3.2.2 and 3.3 of the LRA and the applicant's response to the staff's RAI. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the containment spray 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.

3.3.3 Containment Isolation

3.3.3.1 Summary of Technical Information in the Application

The applicant describes its scoping and AMR of the containment isolation system for license renewal in Section 2.3.2.3, "Containment Isolation," 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 isolation system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The containment isolation system is an ESF that provides for the closure or integrity of containment penetrations to prevent leakage of uncontrolled or unmonitored radioactive materials to the environment. All containment penetrations and associated containment isolation valves and components that ensure containment integrity, regardless of where they are described, require an AMR. Breathing air, nitrogen and hydrogen, and containment purge are the process systems for which the only license renewal intended function is containment isolation. The flow diagrams listed in Table 2.3-4 of the LRA display the evaluation boundaries for the portions of breathing air, nitrogen and hydrogen, and containment purge that are within the scope of license renewal.

The breathing air, nitrogen and hydrogen, and containment purge components within the scope of license renewal and subject to an AMR include valves (pressure boundary only), piping, tubing, fittings, and debris screens (containment purge). The intended functions for breathing air, nitrogen and hydrogen, and containment purge components requiring an AMR and the component intended functions are listed in Table 3.3-3 of the LRA. The AMR for containment isolation is discussed in Section 3.3 of the LRA.

3.3.3.2 Staff Evaluation

3.3.3.2.1 Effects of Aging

Containment Purge Systems

The components in the containment purge systems are fabricated from carbon and stainless steel exposed to an internal environment of air/gas. The components include valves, piping, tubing, fittings, debris screen gratings and debris screen banding. The applicant did not identify any aging effects of these materials in the air/gas environment, as indicated in Table 3.3-3 of the LRA. The applicant's position was found to be acceptable because the staff agreed that there are no aging effects associated with carbon and stainless steel components exposed to air/gas that could cause a component to lose its ability to perform an intended function during the period of extended operation.

The components in the containment purge systems are also fabricated from carbon and stainless steel exposed to external environments of outdoor, containment air, and borated water leaks. The components include valves, piping, tubing, fittings, and bolting. The applicant identified loss of material and loss of mechanical closure integrity as the aging effects requiring management for the carbon and stainless steel components exposed to these external environments.

The loss of material due to general and pitting corrosion, is the aging effect requiring management for carbon steel components exposed to the outdoor environment. The loss of material due to aggressive chemical attack is an aging effect requiring management for carbon steel susceptible to potential borated water leaks. The loss of mechanical closure integrity due to aggressive chemical attack is an aging effect requiring management for mechanical closure carbon and low alloy steel bolting susceptible to potential borated water leaks.

A detailed description of the aging effects associated with the loss of material due to general and pitting corrosion is provided above in Section 3.3.1.2.1 of this SER. The descriptions in Section 3.3.1.2.1 of this SER are also applicable to carbon steel components exposed to external environments.

The loss of mechanical closure integrity due to aggressive chemical attack is an aging effect that requires management of mechanical closure carbon steel and low alloy steel bolting that is susceptible to potential borated water leaks. For a general discussion of aging mechanisms associated with loss of mechanical closure integrity see the Auxiliary Systems Section 3.4.16.2.

Breathing Air Systems

The components in the breathing air systems are fabricated from stainless steel exposed to an internal environment of air/gas. The components include valves, piping, and fittings. The applicant did not identify any aging effects of this material in the air/gas environment, as indicated in Table 3.3-3 of the LRA. The applicant's position was found to be acceptable because the staff agreed that there are no aging effects associated with stainless steel components exposed to air/gas that could cause a component to lose its ability to perform an intended function during the period of extended operation.

The components in the breathing air systems are also fabricated from carbon and stainless steel exposed to external environments of containment air, indoor-not air-conditioned, and borated water leaks. The components include valves, piping, fittings, and bolting. The applicant did not identify any aging effects of stainless steel in the containment air and indoor-not air-conditioned environment, as indicated in Table 3.3-3 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 stainless steel components exposed to the containment air and indoor-not air-conditioned environment that could cause a component to lose its ability to perform an intended function during the period of extended operation. The applicant identified loss of mechanical closure integrity due to aggressive chemical attack as an aging effect requiring management for the carbon steel components exposed to the borated water leaks environment. The staff agreed that the loss of mechanical closure integrity is an aging effect associated with bolted mechanical closures that can result from the loss of pre-load due to cyclic loading, gasket creep, thermal or other effects, cracking, or loss of bolting material.

Nitrogen and Hydrogen Systems

The components in the nitrogen and hydrogen systems are fabricated from carbon steel and stainless steel exposed to an internal environment of air/gas. The components include valves, tubing, piping, and fittings. The applicant did not identify any aging effects of this material in the air/gas environment, as indicated in Table 3.3-3 of the LRA. The applicant's position was found to be acceptable because the staff agreed that there are no aging effects associated with stainless steel and carbon steel components exposed to air/gas that could cause a component to lose its ability to perform an intended function during the period of extended operation.

The components in the nitrogen and hydrogen systems are also fabricated from carbon and stainless steel exposed to external environments of containment air, indoor-not air-conditioned, and borated water leaks as indicated in Table 3.3-3 of the LRA. The components include valves, piping, tubing, fittings, and bolting. The applicant did not identify any aging effects of stainless steel components in the containment air and indoor-not air-conditioned environment. The applicant's position was found to be acceptable because the staff agreed that there are no aging effects associated with the stainless steel components exposed to the containment air and indoor-not air-conditioned environment that could cause a component to lose its ability to perform an intended function during the period of extended operation. The applicant identified the loss of material for carbon steel components in the external environments of containment air, indoor-not air-conditioned, and borated water leaks. The staff agreed that the loss of material due to general and pitting corrosion is an aging effect requiring management for carbon steel in containment air. In addition, the staff agreed that loss of material due to general and pitting corrosion is an aging effect requiring management for carbon steel components exposed to an indoor-not air-conditioned environment. The applicant identified loss of mechanical closure integrity due to aggressive chemical attack as an aging effect requiring management for the carbon steel components exposed to the borated water leaks environment. For a general discussion of aging mechanisms associated with loss of mechanical closure integrity, see the Auxiliary Systems Section 3.4.16.2.

Based on the description of the containment isolation 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 these systems.

3.3.3.2.2 Aging Management Programs

Containment Purge Systems

To manage the aging effects of the carbon steel valves, piping and fittings exposed to the external environments of the outdoor and containment air, the applicant identified the following AMP:

- systems and structures monitoring program

To manage the aging effects of the carbon steel valves, piping and fittings exposed to the external environments of borated water leaks, the applicant identified the following AMP:

- boric acid wastage surveillance program

To manage the aging effects of the carbon steel bolting in the external environment of borated water leaks, the applicant identified the following AMP:

- boric acid wastage surveillance program

Breathing Air Systems

No aging effects were identified for the stainless steel components of the breathing air systems. To manage the aging effects of the carbon steel bolting in the environment of borated water leaks, the applicant identified the following AMP:

- boric acid wastage surveillance program

Nitrogen and Hydrogen Systems

To manage the aging effects of the carbon steel valves, piping and fittings in the external environments of containment air and indoor-not air-conditioned environments, the applicant identified the following AMP:

- systems and structures monitoring program

To manage the aging effects of the carbon steel valves, piping and fittings in the external environment of borated water leaks, the applicant identified the following AMP:

- boric acid wastage surveillance program

To manage the aging effects of the carbon steel bolting in the 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 containment isolation system components, and determined that the applicant adequately identified the AMPs to manage the applicable aging effects of this system. Refer to Sections 3.1.3 and 3.9.3 of this SER for the review of these AMPs.

3.3.3.3 Conclusion

The staff has reviewed the information in Sections 2.3.2.3 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 isolation 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.

3.3.4 Safety Injection

3.3.4.1 Summary of Technical Information in the Application

The applicant describes its AMR of the safety injection (SI) system for license renewal in Section 2.3.2.4, "Safety Injection," 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 SI system will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

In Section 3.3.1 of the Turkey Point LRA, FPL identifies that the SI system for Turkey Point, Units 3 and 4, is subject to internal environments of treated water-borated, treated water, lubricating oil, and air/gas. FPL clarifies the scope of the definitions for these internal environments in Table 3.0-1 of the Turkey Point LRA. In Section 3.3.1 of the Turkey Point LRA, FPL identifies that the SI system for Turkey Point, Units 3 and 4, is subject to the external environments of outdoor, indoor-not air conditioned, containment air, and potential borated water leak environments. FPL defines the scope for these external environments in Table 3.0-2 of the Turkey Point LRA. Table 3.3-4 of the Turkey Point LRA clarifies which of these environments apply to the respective SI components that are within the scope of license renewal.

In Table 3.3-4 of the Turkey Point LRA, FPL identifies that the tanks, pumps, heat exchangers, piping, tubing, and associated components and commodity groups for the SI system are constructed of either stainless steel, carbon steel, cast iron, gray cast iron Inconel, and brass materials.

In Section 3.3.2 of the Turkey Point LRA, FPL identifies that the SI system is subject to the following aging effects: loss of material for components fabricated from carbon steel, stainless steel, brass or cast iron materials; cracking for certain stainless steel components; loss of material and fouling for stainless steel heat exchanger tubing and cast iron thrust bearing coolers; and loss of mechanical closure integrity for mechanical closure bolts that are fabricated from carbon steel. Table 3.3-4 of the Turkey Point LRA further summarizes the aging effects that apply to the specific SI components that fall within the scope of license renewal.

3.3.4.2 Staff Evaluation

In Table 3.3-4 of the Turkey Point LRA, FPL identifies which of the internal and external environments identified in Section 3.3.1 of the LRA for the SI system apply to the respective SI components that fall within the scope of license renewal. In Table 3.3-4 of the Turkey Point LRA, FPL also identifies the materials of fabrication for the SI components that are within the scope of license renewal.

The staff concurs with FPL's determination of the environments that could induce the aging effects for the SI components identified in the LRA, and with FPL's identification of the materials of fabrication for the SI components.

3.3.4.2.1 Aging Effects

Section 3.3.4.2.2 of this SE, and Section 3.3.2 and Table 3.3-4 provides a summary of the aging effects that may affect the intended functions of the SI components during periods of extended operation for the Turkey Point nuclear units. In a letter dated March 30, 2001 (L-2001-60), FPL provided additional technical discussions that justified that the aging effects identified in Section 3.3.2 and Table 3.3-4 of the LRA. FPL letter L-2001-60, dated March 30, 2001, contained the following information relative to the aging effects identified for the SI components:

- Provided FPL's responses to the staff's RAIs on the SI system as it relates to license renewal of the Turkey Point units (i.e., provided the responses to RAIs Nos. 3.3.4-1, 3.3.4-2, and 3.3.4-3).

- Informed the staff that there are no SI components fabricated from welded cast iron materials, and that therefore cracking would not be an aging effect that would require management for the SI pump thrust bearing coolers and SI shaft seal heat exchanger shells during the extended periods of operation for the Turkey Point units.

- Clarified that cracking is a potential effect that would require management during the extended periods of operation for the non-stress-relieved heat-affected zones of weld joints on the external surfaces of large-bore, thin-walled stainless steel SI piping located in trenches and outdoors.

- Clarified that, since the necessary conditions for SCC of austenitic stainless steels and nickel-based alloys in contact with treated water are concentrations of halogens above 150 parts-per billion (ppb) and sulfates above 100 ppb, and elevated system operating temperatures above 140 °F, and since the SI system is normally in the standby condition at temperatures less than 140 °F, cracking of the internal surfaces of the SI system in contact with borated treated water is not an aging effect requiring management during the extended periods of operation for the Turkey Point units.

- Stated that cracking in the tube shields of heat exchangers can result from either flow-induced vibrational fatigue or SCC.

- Provided a reference, "Corrosion of Metals in Marine Environments," J.A. Beavers, K.H. Koch, and W.E. Berry, Metals and Ceramics Information Center Report (July 1986), to support the FPL conclusion that copper-based alloys exhibit excellent corrosion resistance in treated water systems.

- Clarified that, since copper alloy materials exhibit excellent resistance to SCC in treated water, SCC of brass tube shields to the SI pump shaft heat exchangers is not an aging effect that requires managing during the periods of extended operation for the Turkey Point units.

- Clarified that, since high cycle fatigue failures of components subject to flow-induced vibration would have already been reported during the early part of the 40-year licensed term for the Turkey Point units, and since FPL's review of U.S. operating history did not identify instances of cracking in tube shields, flow-induced vibrational fatigue of brass tube shields to the SI pump shaft heat exchangers is not an aging effect that requires managing during the periods of extended operation for the Turkey Point units.

The information in Section 3.3.2 and Table 3.3-4 of the Turkey Point LRA, as amended by the contents of FPL's responses in letter L-2001-60 to the staff RAIs 3.3.4-1, 3.3.4-2, and 3.3.4-3, demonstrates that FPL has sufficiently evaluated the SI components as exposed to the internal and external environmental conditions for the components and has sufficiently identified those aging effects that could affect the intended functions of the SI components during periods of extended operation for the Turkey Point nuclear units. The scope of RAIs 3.3.4-1, 3.3.4-2, and 3.3.4-3 on the SI system is based on whether FPL has identified those SI components that could potentially be susceptible to cracking within the extended operating terms for the SI units. FPL's responses to the RAIs demonstrate that FPL has performed a sufficient evaluation to identify which of the SI components falling within the scope of license renewal have the potential to crack during the extended operating terms for the units. FPL's justification for omitting cracking as an applicable aging effect for the SI components is based on any of the following bases or combinations thereof:

- Operating conditions for the SI system preclude cracking from being an applicable aging effect for a particular SI component.

- Environmental conditions will be controlled to a sufficient level to preclude cracking from being an applicable aging effect for a particular SI component.

- Material properties for the SI component material, when combined with industry experience provide sufficient justification to omit identifying cracking as an applicable aging effect for the SI component.

For those SI components that have not been identified as being susceptible to cracking within the extended operating periods, FPL has provided sufficient evaluation and justification to omit cracking as a potential aging effect for these components. The staff therefore finds FPL's identification of the applicable aging effects for the SI components to be acceptable.

3.3.4.2.2 Aging Management Programs

Table 3.3-4 of the Turkey Point LRA includes the following programs that will be used to manage the aging effects that are identified as being applicable to the SI components that fall within the scope of license renewal:

- boric acid wastage surveillance program
- chemistry control program
- field-erected tanks internal inspection program
- galvanic corrosion susceptibility program
- systems and structures monitoring program

For those SI components that have been identified as having the potential to crack within the extended operating terms for the Turkey Point units, FPL does not always credit the ISI program as being one of the AMPs that will manage cracking during the extended operating term. However, the fact that FPL may not be crediting the ISI as a program for managing cracking during license renewal does not mean that FPL will be omitting the inspections of the SI system that are required under its current ISI program. FPL will still perform all ISIs of the SI system required to be conducted under 10 CFR 50.55a and Section XI of the ASME Code during the initial 40-year license operating terms for the units.

The staff reviewed the information provided in the LRA for the AMPs used by the applicant to manage the aging of the ISI system components, and determined that the applicant adequately identified the AMPs to manage the applicable aging effects of this system. Refer to Sections 3.1.1, 3.1.3, 3.8.4, 3.8.5, and 3.9.3 of this SER for the review of these AMPs.

3.3.4.3 Conclusion

FPL has performed an evaluation of the SI system as it relates to identifying and managing the applicable aging effects for the SI components within the scope of license renewal. FPL's evaluation of the components in SI system as provided in Section 3.3 and Table 3.3.4 of the Turkey Point LRA, as amended by the responses to RAIs 3.3.4-1, 3.3.4-2, and 3.3.4-3 in FPL letter no. L-2001-60, demonstrates that FPL has identified those aging affects that are applicable to the SI components and that will require management during the extended periods of operation. Table 3.3.4 clearly identifies how these aging effects will be managed during the periods of extended operation for the Turkey Point units. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the SI 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.

3.3.5 Residual Heat Removal

3.3.5.1 Summary of Technical Information in the Application

The applicant describes its AMR of the residual heat removal (RHR) system for license renewal in Section 2.3.2.5, "Residual Heat Removal," 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 RHR system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The RHR system delivers borated water to the reactor coolant systems during the injection phase of a design-basis accident. Following a loss-of-coolant accident, the RHR system cools and recirculates water that is collected in the containment recirculation sumps and returns it to the reactor coolant, containment spray, and SI systems to maintain reactor core and containment cooling functions. In addition, during normal plant operations, the RHR system removes residual and sensible heat from the core during plant shutdown, cooldown, and refueling operations.

The RHR components subject to an AMR include pumps and valves (pressure boundary only), heat exchangers, orifices, piping, tubing, and fittings. The intended functions for the RHR system components subject to an AMR include pressure boundary integrity, heat transfer, and throttling. A complete list of the RHR components requiring an AMR and the component intended functions are provided in Table 3.3-5 of the LRA. The AMR for the RHR system is discussed in Section 3.3 of the LRA.

In Section 3.3.1, "Materials and Environments," of the Turkey Point LRA, FPL identifies that the engineered safety features systems for Turkey Point, Units 3 and 4, is subject to the internal environments of treated water-borated, treated water, lubricating oil and air/gas. FPL clarifies the scope of the definitions for these internal environments in Table 3.0-1 of the Turkey Point LRA. In Section 3.3.1 of the Turkey Point LRA, FPL identifies that the engineered safety features systems for Turkey Point, Units 3 and 4, is subject to the external environments of outdoor, indoor-not air conditioned, containment air, embedded/encased, and potential borated water leakage. FPL defines the scope for these external environments in Table 3.0-2 of the Turkey Point LRA. Table 3.3-5 of the Turkey Point LRA clarifies which of these environments are applicable to the respective RHR components that are within the scope of license renewal.

In Table 3.3-5 of the Turkey Point LRA, FPL identifies that the pumps; valves; piping; and heat exchangers shells, baffles, and tubing; and associated components and commodity groups for the RHR system are constructed of either stainless steel or carbon steel materials.

In Section 3.3.2, "Aging Effects Requiring Management," of the Turkey Point LRA, FPL identifies that the RHR system is subject to the following aging effects: loss of material for components fabricated from carbon steel or stainless steel; cracking for certain stainless steel components; loss of material, cracking and fouling for stainless steel heat exchanger tubing; and loss of mechanical closure integrity for mechanical closure bolts that are fabricated from carbon steel. Table 3.3-5 of the Turkey Point LRA further summarizes the aging effects that apply to the specific RHR components that fall within the scope of license renewal.

3.3.5.2 Staff Evaluation

In Table 3.3-5 of the Turkey Point LRA, FPL identifies which of the internal and external environments identified in Section 3.3.1 of the LRA for the RHR system are applicable to the respective RHR components falling under the scope of license renewal. In Table 3.3-5 of the Turkey Point LRA, FPL also identifies the materials of fabrication for the RHR components within the scope of license renewal.

The staff concurs with FPL's determination of the environments that could induce the aging effects for the RHR components identified in the LRA, and with FPL's identification of the materials of fabrication for the RHR components.

3.3.5.2.1 Aging Effects

Section 6.0, "Aging Effects Requiring Management for Internal Environments," of Appendix C to the LRA lists and discusses the aging effects requiring management for each of the internal environments in the Turkey Point nuclear units; Section 7.0, "Aging Effects Requiring Management for External Environments," of Appendix C lists and discusses the aging effects requiring management for each of the external environments in the Turkey Point nuclear units. Section 5.0, "Potential Aging Effects," of Appendix C discusses the environmental, material, and loading parameters governing these aging effects. Section 3.3.2 of the Turkey Point LRA provides a general summary of the aging effects that may affect the intended functions of the RHR systems during periods of extended operation for the Turkey Point nuclear units. Table 3.3-5 narrows the scope of Section 3.3.2 by identifying which specific aging effects identified in Section 3.3.2 apply to the specific RHR components that fall within the scope of license renewal. The combined summaries in Section 3.3.2, Table 3.3-5, and Sections 5.0, 6.0, and 7.0 of Appendix C provide a sufficient basis as to how FPL determined which aging effects apply to the specific RHR components that fall within the scope of license renewal.

Based on the description of the RHR system components in the internal and external environments, and the materials used in fabricating the various components, the staff finds that the applicant has adequately identified the aging effects that apply to this system.

3.3.5.2.2 Aging Management Programs

Section 3.3.4, "Conclusion," of the Turkey Point LRA states that the following AMPs will be used to manage the applicable aging effects for the Turkey Point Engineered Safety Features systems:

- boric acid wastage surveillance program
- chemistry control program
- containment spray system piping inspection program
- field erected tanks internal inspection program
- emergency containment cooler inspection
- galvanic corrosion susceptibility program
- periodic surveillance and preventive maintenance program
- systems and structures monitoring program

Table 3.3-5 of the LRA identifies which of these programs will be used to manage the aging effects identified as needing management for the specific RHR components that are within the scope of license renewal. Section 5.0 of Appendix C to the LRA discusses potential aging effects that may need to be managed during the periods of extended operation for Turkey Point non-ASME-Class 1 components. Section 6.0 of Appendix C discusses the aging effects requiring management for internal environments. For those RHR components that have been identified having the potential to crack within the extended operating terms for the Turkey Point units, FPL does not always credit the ISI program as being one of the aging programs that will manage the cracking during the extended operating terms. However, FPL will continue to perform all ISIs of the RHR required to be conducted under 10 CFR 50.55a and Section XI of the ASME Code during the initial 40-year licensed operating terms for the units.

The staff reviewed the information provided in the LRA for the AMPs used by the applicant to manage the aging effects of the RHR system components, and determined that the AMPs identified above are acceptable to manage the applicable aging effects. Refer to Sections 3.1.1, 3.1.3, 3.8.3, 3.8.4, 3.8.5, 3.9.3, 3.9.5, and 3.9.11 of this SER for the review of these AMPs.

3.3.5.3 Conclusion

The staff has reviewed the information in Sections 2.3.2.5 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 RHR 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.

3.3.6 Emergency Containment Filtration

3.3.6.1 Summary of Technical Information in the Application

The applicant describes its AMR of the emergency containment filtration system for license renewal in Section 2.3.2.6, "Emergency Containment Filtration," 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 emergency containment filtration system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

The emergency containment filtration system serves to reduce the iodine concentration in the containment atmosphere following a loss-of-coolant accident with failed fuel, to levels ensuring that the offsite dose will not exceed the guidelines of 10 CFR Part 100 at the site boundary, and to assist in limiting the dose to the control room operators to less than the limits specified by 10 CFR Part 50, Appendix A, General Design Criterion 19. The emergency containment filtration system consists of three filter units, each containing a moisture separator, a high-efficiency particulate filter bank, an impregnated charcoal filter bank, and a fan. Included in the scope of the emergency containment filtration are components carrying water from the containment spray to the emergency containment filtration for filter spray. The filter spray provides cooling of the filter in the unlikely event of a post-accident fan trip.

The emergency containment filtration components subject to an AMR include the filter units and valves (pressure boundary only), piping, tubing, fittings, and spray nozzles. The intended functions for the emergency containment filtration components subject to an AMR include pressure boundary integrity and spray. A complete list of the emergency containment filtration components requiring an AMR and the component intended functions are provided in Table 3.3-6 of the LRA. The AMR for this system is discussed in Section 3.3 of the LRA.

3.3.6.2 Staff Evaluation

3.3.6.2.1 Effects of Aging

The components in the emergency containment filtration system are fabricated from carbon steel, brass, copper, and stainless steel in an internal environment of air/gas and stainless steel exposed to an internal environment of treated water. The components include emergency containment filter housings, floodjet spray nozzles, piping/fittings, valves, and tubing. The aging effects of these materials in the internal environments of air/gas and treated water are identified in Table 3.3-6 of the LRA. The treated water environment is borated water for this application. The applicable aging effect in the air/gas and treated water environment includes loss of material. A discussion of the aging effects for the carbon steel, brass, copper, and stainless steel components exposed to the internal environments of air/gas and treated water is provided below.

The applicant did not identify any aging effects for the brass, copper, and stainless steel emergency containment filtration system components exposed to an internal environment of air/gas, 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 brass, copper, and stainless steel components exposed to air/gas that could cause a component to lose its ability to perform an intended function during the period of extended operation.

The loss of material for carbon steel components exposed to an internal environment of air/gas is an aging effect requiring management due to general and pitting corrosion.

Stainless steel exposed to an internal environment of treated water is assumed susceptible to the loss of material due to pitting corrosion in the presence of halogens in excess of 150 ppb or sulfates in excess of 100 ppb when dissolved oxygen is in excess of 100 ppb.

The components in the emergency containment filtration system exposed to the external environments of containment air or borated water leaks are fabricated from carbon steel, brass, copper, and stainless steel. These components include the emergency containment filter housings, floodjet spray nozzles, piping/fittings, valves, and tubing. The aging effects of these materials in the external environments of containment air and borated water leaks are identified in Table 3.3-6 of the LRA. The applicable aging effects in the containment air and borated water leaks include loss of material and loss of mechanical closure integrity, respectively. A discussion of the aging effects for the carbon steel, brass, copper, and stainless steel components exposed to the external environments of containment air and borated water leaks is provided below.