Unit 1	Unit 2
11448-LRM-064B, Sh. 1	11548-LRM-067A, Sh. 2
11448-LRM-067A, Sh. 1	11548-LRM-068A, Sh. 3
11448-LRM-067A, Sh. 2	11548-LRM-068A, Sh. 4
11448-LRM-068A, Sh. 3	11548-LRM-071A, Sh. 2
11448-LRM-068A, Sh. 4	
11448-LRM-071A, Sh. 2	
11448-LRM-072D, Sh. 1	

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the CN system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the descriptions in the UFSARs to ensure they were representative of the CN system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR, to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties and that are not subject to replacement on the basis of qualified life or specified time period, was excluded from an AMR.

The staff did not identify any omissions. However, in a November 21, 2001, telecommunication with the applicant, the staff asked why valve bodies were not listed as a component group on NAS Table 2.3.4-3. The applicant clarified that the valves within the highlighted sections of the LRA drawings for the CN system are designated as feedwater (FW) on the basis of mark number designation and are evaluated accordingly in Section 2.3.4.4 of each LRA. During the same telecommunication, the staff asked whether the diversion of the condenser air ejector discharge on high radioactivity was an intended function. The applicant clarified that the diversion is not credited in the safety analyses nor otherwise safety-related for both NAS and SPS. The staff further asked whether the SPS main condenser served an intended function and whether the shell should be included in Table 2.3.4-3. The applicant clarified that the condenser shell is not in-scope; however, the condenser water boxes are in-scope for pressure boundary of the circulating water system as indicated in Table 2.3.3-5.

2.3.4.3.3 Conclusions

On the basis of its review of the information contained in Section 2.3.4.3 of each LRA, the supporting information in the UFSARs, and LRA drawings, and the applicant's responses to RAIs, as described above, the staff did not identify any omissions in the scoping of the CN system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the CN system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a), and 10 CFR 54.21(a)(1).

2.3.4.4 Feedwater

In the North Anna and Surry LRAs, Section 2.3.4.4, "Feedwater," the applicant describes the components of the feedwater (FW) system that are within the scope of license renewal and subject to an AMR. The feedwater system is further described in Section 10.4.3 of the North Anna UFSAR and Section 10.3.5 of the Surry UFSAR.

2.3.4.4.1 Summary of Technical Information in the Application

The feedwater (FW) system comprises main feedwater and auxiliary feedwater. Main feedwater provides treated-water to maintain inventory in the steam generators for the production of steam and to provide a heat sink for the reactor coolant system. Main feedwater components provide a flow path for auxiliary feedwater flow to the steam generator and provide isolation of main feedwater flow in response to plant transients. Auxiliary feedwater provides an emergency source of water to the steam generator for reactor heat removal. Auxiliary feedwater provides a heat sink during design basis accidents, including loss of power conditions. The system consists of three auxiliary feedwater pumps and associated components. The source of water is from the emergency condensate storage tank in the condensate system.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of each LRA. As described in the scoping methodology, the applicant identified the portions of the FW systems that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.4.4 of each LRA. Consistent with the methodology described in Section 2.1.5, "Screening Methodology," of each LRA, the applicant listed the FW system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.4-4 of each LRA. The tables also list the intended functions, and the LRA sections containing the AMR for the commodity groups.

The portion of the FW system subject to aging management review includes the components from the high-energy line break analysis boundary outside of the containment downstream to the steam generator feedwater nozzle, and the auxiliary feedwater pumps and discharge line components up to the feedwater piping connection. The auxiliary feedwater pumps lubricating oil and seal cooling components support the function of the pump and are also subject to aging management review. Additionally, backup compressed air components required for the function of selected feedwater isolation valves are subject to an aging management review. In the LRAs, Table 2.3.4-4, the applicant listed the following 11 component commodity groups as subject to an AMR: filters/strainers, flow elements, instrument valve assemblies, pipe, pump casings, pump lube oil coolers, restricting orifices, tanks, tubing, turbine casings, and valve bodies. In Table 2.3.4-4 of the NAS LRA, the applicant listed gas bottles and instrumentation as component commodity groups subject to an AMR for the applicable facility. The applicant identified maintaining pressure boundary integrity, filtration (filters/strainers only), and restricting flow (restricting orifices and flow elements) as intended functions for the SCs that are subject to an AMR for the NAS and SPS FW systems.

2.3.4.4.2 Staff Evaluation

The staff reviewed Section 2.3.4.4 of the NAS and SPS LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the FW system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information presented in Section 2.3.4.4 of the LRA, the applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the FW system that are within the scope of license renewal. The staff verified that those portions of the FW system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.4.4 of each LRA. To verify that the applicant did include the applicable portions of the FW systems within the scope of license renewal, the staff focused its review on those portions of the FW systems that were not identified within the scope of license renewal to verify that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs to identify any additional system intended functions that were not identified in each LRA and verified that these additional intended functions did not meet the scoping requirements of 10 CFR 54.4.

As a result of this review, the NRC staff requested additional information in a letter to the applicant dated November 26, 2001. The applicant responded to the NRC staff's RAIs in a letter to the NRC dated February 5, 2002, as discussed below:

- The NRC staff requested that the applicant explain the exclusion of SPS flow elements 1-FW-FE-1476, -1486, and -1496 and 2-FW-FE-2476, -2486, contained in 14-inch main feedwater lines, from the scope of license renewal. The applicant was requested to address the safety-related sensing intended function (flow restriction for measurement purposes - reactor power measurement; feedwater flow for various actuations) and any other license renewal intended function, and the need to subject the flow elements to an AMR. The applicant responded that the non-safety-related feedwater flow elements are used to develop safety-related flow signals as inputs to the reactor protection system. These components have the intended function to restrict flow, which includes the flow detection intended function. The applicant added these flow elements to the scope of license renewal and performed an aging management review. The aging management review results are consistent with those presented in Table 3.4-4 of the Surry application for the Flow Elements component group. The applicant also stated that the piping adjacent to these flow elements is not required to remain intact to support the intended function of the flow elements since the safety signal is generated on low flow. However, the applicant has modified the scope of license renewal for Surry and North Anna to include non-safety-related SSCs that have a spatial relationship with safety-related SSCs and whose failure could impact the performance of an intended safety function. Therefore, the piping and components adjacent to these flow elements are included in this expanded scope of license renewal.

- The staff also asked why the exhaust lines from the auxiliary feedwater pump turbine casings, which vent to atmosphere, and any bolting attaching these lines are not also within the scope and subject to an AMR in each LRA. The applicant responded that although these non-safety-related exhaust lines do not directly support any safety-related functions, the scope of license renewal for Surry and North Anna was modified to include non-safety-related SSCs that have a spatial relationship with safety-related SSCs, and whose failure could impact the performance of an intended safety function. This modified scope includes the 6-inch turbine exhaust lines attached to the auxiliary turbine feedwater pump turbine casings. The exhaust lines will be managed for loss of material using the Work Control Process aging management activity. In its initial response, dated February 5, 2002, the applicant did not indicate whether or not bolting in these exhaust lines was being within the scope of license renewal. The applicant provided a draft RAI response via e-mail on May 10, 2002. The applicant's e-mail response to staff's questions is docketed. In its response, the applicant stated that the bolting associated with the auxiliary feedwater pump turbine exhaust lines are within the scope of license renewal along with the piping. The applicant also noted that bolting is not uniquely identified as a component when the bolting material is the same as the piping/component material as described in the LRA in Appendix C, Section C2.2. The staff did not identify any additional omissions.

The staff determined that the applicant had properly identified the SCs that are subject to AMR from among those portions of the FW system that are identified within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the FW system in Table 2.3.4-4 of the LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the FW system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-4 of the LRA:

Unit 1	Unit 2
11715-LRM-070A, Sh. 3	12050-LRM-070A, Sh. 3
11715-LRM-074A, Sh. 1	12050-LRM-074A, Sh. 1
11715-LRM-074A, Sh. 3	12050-LRM-074A, Sh. 3
11715-LRM-074A, Sh. 4	12050-LRM-074A, Sh. 4
11715-LRM-074B, Sh. 1	12050-LRM-074B, Sh. 1

In the SPS LRA, the applicant identified the portions of the FW system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-4 of the LRA:

Unit 1	Unit 2
11448-LRM-064A, Sh. 4	11548-LRM-064A, Sh. 4
11448-LRM-068A, Sh. 1	11548-LRM-068A, Sh. 1
11448-LRM-068A, Sh. 3	11548-LRM-068A, Sh. 3
11448-LRM-068A, Sh. 4	11548-LRM-068A, Sh. 4

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the FW system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the descriptions in the UFSARs to ensure they were representative of the FW system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR, to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties, and are not subject to replacement on the basis of qualified life or specified time period, was excluded from an AMR.

As a result of this review, the NRC staff requested additional information in a letter to the applicant dated November 26, 2001. The staff asked whether the non-safety-related feedwater flow elements (1-FW-FE-1476, -1486, -1496 and 2-FW- FE-2476, -2486, and –2496) used to develop safety-related flow signals as inputs to the reactor protection system at NAS were in-scope for license renewal for the "restricts flow" intended function and pressure boundary. In a letter to the NRC dated February 5, 2002, the applicant confirmed that Table 2.3.4-4 includes this flow detection intended function for these particular flow elements.

The staff also asked why accumulators were not identified as a commodity group in Table 2.3.4-4 of the NAS LRA. In its response to the RAI, dated February 5, 2002, the applicant confirmed that the subject accumulators are within the scope of license renewal and are identified as "Gas Bottles" in Table 2.3.4-4 of the application. The accumulators were evaluated for the effects of aging in Section 3.3.5, "Air and Gas Systems," of each LRA.

The staff observed that the SPS LRA identifies cavitating venturis that were installed in the 3-inch auxiliary feedwater lines leading to each steam generator. The staff asked the applicant to clarify the intended function of these components and identify where the AMR was documented in the LRA; and asked that the applicant address fatigue as an applicable aging effect for these cavitating venturis. In its February 5, 2002, response to the RAI, the applicant stated that the cavitating venturis limit auxiliary feedwater flow to a depressurized steam generator in the event of a feedwater or main steam line rupture in order to ensure adequate flow to the intact steam generators and prevent auxiliary feedwater pump runout, with the license renewal intended functions of restricting flow and pressure boundary. Auxiliary feedwater flow through the cavitating venturis normally only occurs during surveillance testing prior to plant startup and during certain plant transients. On the basis of this limited usage, fatigue due to cavitation-induced dynamic loading was considered to be insignificant and not result in aging effects requiring management. Additionally, the applicant stated a review of operating experience has not identified aging effects on these venturis due to fatigue effects. The staff had no further questions regarding AMR for these components.

The staff did not identify any omissions, but did receive a clarification in a telecommunication on November 21, 2001. The staff requested that the applicant address the Surry LRA, Section 2.3.4.4, "Feedwater System," statement that backup compressed air components are required for the function of selected feedwater isolation valves. Although similar components were depicted on North Anna LRA drawings as within scope, such components do not appear on the FW system drawings contained in the Surry application. The applicant stated that because less detail is presented in the Surry LRA drawings, the components are not shown on the drawings. However, components similar to the NAS components are in scope at SPS. The valves and instrument tubing are shown in the SPS LRA Table 2.3.4-4. The applicant stated that the associated nitrogen bottles are replaced on a set frequency and were deemed short-lived, thus not requiring aging management review.

2.3.4.4.3 Conclusions

On the basis of its review of the information contained in Section 2.3.4.4 of each LRA, the supporting information in the UFSARs, LRA drawings, and the applicant's responses to RAIs, as described above, the staff did not identify any other omissions in the scoping of the FW system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the FW system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a), and 10 CFR 54.21(a)(1), respectively.

2.3.4.5 Main Steam

In the North Anna and Surry LRAs, Section 2.3.4.5, "Main Steam," the applicant describes the components of the main steam (MS) systems that are within the scope of license renewal and subject to an AMR. The main steam system is further described in Section 10.3 of the North Anna UFSAR and Section 10.3.1 of the Surry UFSAR.

2.3.4.5.1 Summary of Technical Information in the Application

The main steam (MS) system transports steam produced in the steam generators to the main turbine for the production of electricity. Additionally, the MS system:

- provides motive steam to the turbine-driven auxiliary feed pump
- removes heat from the reactor coolant system via the Code safety valves, steam generator power-operated relief valves, and/or condenser steam dump valves
- isolates steam flow to the main turbine following a reactor trip or during accident conditions to prevent an excessive cooldown that could have an adverse effect on the reactor

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of each LRA. As described in the scoping methodology, the applicant identified the portions of the MS system that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.4.5 of each LRA. Consistent with the methodology described in Section 2.1.5, "Screening Methodology," of each LRA, the applicant listed the MS system mechanical component commodity groups that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.4-5 of each LRA. The tables also list the intended functions, and the LRA sections containing the AMR for the commodity groups.

The portion of the MS system subject to aging management review includes the major flowpaths from the steam generator outlet nozzle to the turbine stop valves and the condenser steam dump valves. The evaluation boundary extends beyond the safety-related boundary of the system on the basis of high-energy line break analysis and the station blackout and Appendix R requirements. In each LRA, Table 2.3.4-5, the applicant listed the following six component commodity groups as subject to an AMR: flow elements, instrument valve assemblies, pipe, steam traps, tubing, and valve bodies. The applicant identified maintaining pressure boundary integrity and restricting flow (flow elements only) as intended functions for the SCs that are subject to an AMR for the NAS and SPS MS systems.

2.3.4.5.2 Staff Evaluation

The staff reviewed Section 2.3.4.5 of the NAS and SPS LRAs to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the MS system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information presented in Section 2.3.4.5 of the LRA, the applicable piping and instrument drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the portions of the MS system that are within the scope of license renewal. The staff verified that those portions of the MS systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.4.5 of each LRA. To verify that the applicant did include the applicable portions of the MS system within the scope of license renewal, the staff focused its review on those portions of the MS system that were not identified within the scope of license renewal to verify that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the UFSARs to identify any additional system intended functions that were not identified in each LRA and verified that these additional intended functions did not meet the scoping requirements of 10 CFR 54.4.

As a result of this review, the NRC staff requested additional information in a letter to the applicant dated November 26, 2001. The applicant responded to the NRC staff's RAIs in a letter to the NRC dated February 5, 2002, as discussed below:

The staff asked the applicant to provide a technical justification as to why the piping from the exhausts of the main steam safety valves and main steam power-operated relief valves to atmosphere was not included within the scope of license renewal. The applicant responded that although these non-safety-related exhaust lines do not directly support any safety-related functions, the scope of license renewal for Surry and North Anna was modified to include non-safety-related SSCs that have a spatial relationship with safety-related SSCs and whose failure could impact the performance of an intended safety function. This modified scope includes the piping from the exhausts of the main steam safety valves and main steam power-operated relief valves. The piping from the exhausts of the main steam safety valves and main steam power-operated relief valves will be managed for loss of material using the Work Control Process aging management activity.

In the NAS LRA, the staff asked why the main steam system (MS) evaluation boundary ended at a manual valve immediately upstream of the pneumatically controlled decay heat release valve. The UFSAR notes that the decay heat release valve is a Seismic Class I, Quality Assurance Category I valve located in the main steam valve house. The applicant responded that these valves are safety-related, consistent with the UFSAR statements, and perform a system pressure boundary function for the main steam system. The valves and upstream piping were added to the scope of license renewal. The applicant additionally stated that, consistent with the treatment of the main steam safety and power-operated relief valves discussed above, they have modified the scope of license renewal for North Anna to include non-safety-related SSCs that have a spatial relationship with safety-related SSCs and whose failure could impact the performance of an intended safety function. This modified scope includes the decay heat release valve outlet piping. The decay heat release valves and associated outlet piping will be managed for loss of material using the Work Control Process aging management activity. The applicant's response fully addressed staff's questions, therefore, the staff found the applicant's response acceptable. The staff did not identify any additional omissions.

The staff determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the MS system that are identified within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the MS system in Table 2.3.4-5 of the LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the MS system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-5 of the LRA:

Unit 1	Unit 2
11715-LRM-070A, Sh. 1	12050-LRM-070A, Sh. 1
11715-LRM-070A, Sh. 2	12050-LRM-070A, Sh. 2
11715-LRM-070A, Sh. 3	12050-LRM-070A, Sh. 3
11715-LRM-070B, Sh. 1	12050-LRM-070B, Sh. 1
11715-LRM-070B, Sh. 2	12050-LRM-070B, Sh. 2
11715-LRM-070B, Sh. 3	12050-LRM-070B, Sh. 3
11715-LRM-072A, Sh. 1	12050-LRM-072A, Sh. 1

In the SPS LRA, the applicant identified the portions of the MS system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-5 of the LRA:

Unit 1	Unit 2
11448-LRM-064A, Sh. 1	11548-LRM-064A, Sh. 1
11448-LRM-064A, Sh. 2	11548-LRM-064A, Sh. 2
11448-LRM-064A, Sh. 3	11548-LRM-064A, Sh. 3
11448-LRM-064A, Sh. 4	11548-LRM-064A, Sh. 4
11448-LRM-064A, Sh. 5	11548-LRM-064A, Sh. 5
11448-LRM-064A, Sh. 6	11548-LRM-064A, Sh. 6
11448-LRM-066A, Sh. 1	11548-LRM-066A, Sh. 1

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the MS system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the descriptions in the UFSARs to ensure they were representative of the MS system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR, to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties, and that is not subject to replacement on the basis of qualified life or specified time period, was excluded from an AMR.

The staff did not identify any omissions, but received a clarification during a telecommunication on November 21, 2001. The staff asked why the small-bore lines downstream of the main steam trip valves, such as those leading to steam traps, were not included in the MS system scope for the pressure boundary intended function. The applicant clarified that the intended function of the MS system is to prevent excessive reactor cooldown in the event the main steam trip valves cannot be shut due to an Appendix R fire or SBO event. Only large-bore pipe could provide the capacity to cause excessive cooldown as the cooldown analyses for these events was on the basis of a 6-inch opening in the main steam system; therefore smaller lines such as those leading to the steam traps are not in scope for Appendix R or SBO intended functions.

2.3.4.5.3 Conclusions

On the basis of its review of the information contained in Section 2.3.4.5 of each LRA, the supporting information in the UFSARs, the LRA drawings, and the applicant's responses to RAIs, as described above, the staff did not identify any omissions in the scoping of the MS system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the MS system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.4.6 Steam Drains

In the North Anna LRA, Section 2.3.4.6, "Steam Drains," the applicant describes the components of the steam drain (SD) system that are within the scope of license renewal and subject to an AMR. This system is further described in Section 10.4.6 of the NAS UFSAR. The SPS does not have an SD system but its main steam system has a functionally equivalent steam trap drain piping. Therefore, the following staff evaluation only applies to the NAS LRA.

2.3.4.6.1 Summary of Technical Information in the Application

The steam drains (SD) system provides a flow path for returning condensate drips from various steam sources to the condensate system.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology" of the LRA. As described in the scoping methodology, the applicant identified portions of the SD system that are within the scope of license renewal on the piping and instrument drawings listed in Section 2.3.4.6 of the LRA. Consistent with the methodology described in the LRA, Section 2.1.5, "Screening Methodology," the applicant listed SD system mechanical component commodity groupings that are within the license renewal evaluation boundaries and that are subject to an AMR in Table 2.3.4-6 of the LRA. The table also lists the intended functions, and the LRA section containing the AMR for each commodity group.

The portions of the SD system that are subject to aging management review are steam trap drain line piping sections that form the main steam system pressure boundary upstream of the main steam trip valves. In the LRA, Table 2.3.4-6, the applicant listed pipe as the only component commodity group subject to an AMR. The applicant identified maintaining pressure boundary integrity as the only intended function of the SCs subject to an AMR.

2.3.4.6.2 Staff Evaluation

The staff reviewed Section 2.3.4.6 of the NAS LRA to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the SD system that are within the scope of license renewal in accordance with 10 CFR 54.4, and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information presented in Section 2.3.4.6 of the LRA, the applicable piping and instrument drawings, and the North Anna UFSAR to determine whether the applicant adequately identified the portions of the SD system that are within the scope of license renewal. The staff verified that those portions of the SD system that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Section 2.3.4.6 of the NAS LRA. To verify that the applicant did include the applicable portions of the SD system within the scope of license renewal, the staff focused its review on those portions of the SD system that were not identified within the scope of license renewal to verify that they did not meet the scoping criteria of 10 CFR 54.4. In addition, the staff reviewed the NAS UFSAR to identify any additional system intended functions that were not identified in the LRA, and verified that these additional intended functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the SD system that are identified within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the SD system in Table 2.3.4-6 of the LRA using the screening methodology described in Section 2.1 of each LRA. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the SD system that are within the scope of license renewal in the drawings listed below. In addition, the applicant listed pipe as the mechanical component commodity group that is subject to AMR and its intended function in Table 2.3.4-6 of the LRA:

Unit 1	Unit 2
11715-LRM-070A, Sh. 3	12050-LRM-070A, Sh. 3
11715-LRM-070B, Sh. 1	12050-LRM-070B, Sh. 1
11715-LRM-070B, Sh. 2	12050-LRM-070B, Sh. 2
11715-LRM-070B, Sh. 3	12050-LRM-070B, Sh. 3

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the SD system that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the descriptions in the UFSAR to ensure they were representative of the SD system. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component that performs its intended function without moving parts or without a change in configuration or properties and that are not subject to replacement on the basis of qualified life or specified time period, was excluded from an AMR.

The staff did not identify any omissions, but received several clarifications during a telecommunication on November 21, 2001. The staff asked the applicant why it had only included a single isolation valve for the main steam pressure boundary. The applicant clarified that the SD system valves were normally closed, and that this meets the boundary convention of extending to the first normally closed manual valve, check valve, or automatic valve that gets a signal to go closed. Because piping was the only commodity group listed in Table 2.3.4.6-1, the staff also received confirmation from the applicant that the valves depicted as within scope on the SD drawings, which all had MS designations, are included within the component group "valves" for the MS system Table 2.3.4-5.

2.3.4.6.3 Conclusions

On the basis of its review of the information contained in Section 2.3.4.6 of the NAS LRA, the supporting information in the UFSAR, and LRA drawings, the staff did not identify any omissions in the scoping of the steam drain system by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the SD system that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.4.7 Steam Generator Water Treatment/Steam Generator Recirculation and Transfer

In the North Anna LRA, Section 2.3.4.7, "Steam Generator Water Treatment System," the applicant describes the components of the steam generator water treatment (WT) system that are within the scope of license renewal and subject to an AMR. This system is further described in Section 10.4.3 of the North Anna UFSAR. The functionally equivalent system at Surry is described in Section 2.3.4.6 of the SPS LRA, "Steam Generator Recirculation and Transfer." The steam generator recirculation and transfer (RT) system is further described in the SPS UFSAR, Section 10.3.1. Both the WT and RT systems are evaluated in this section of the SER.

2.3.4.7.1 Summary of Technical Information in the Application

The WT and RT systems provide a means of recirculating water in the steam generator during periods of wet layup to help maintain steam generator water chemistry within limits and to provide the capability for water transfer from the steam generators.

The applicant describes its process for identifying the mechanical components that are within the scope of license renewal in Section 2.1.4, "Scoping Methodology," of each LRA. As described in the scoping methodology, the applicant identified portions of the WT and RT systems that are within the scope of license renewal on the piping and instrumentation drawings listed in Section 2.3.4.7 and Section 2.3.3.6 of the respective LRA. Consistent with the methodology described in Section 2.1.5, "Screening Methodology," of each LRA, the applicant listed the WT and RT systems mechanical component commodity groupings that are within the license renewal evaluation boundaries and that are subject to an AMR in Tables 2.3.4-7, "Steam Generator Water Treatment" and 2.3.4-6, "Steam Generator Recirculation and Transfer," respectively. The portions of the WT and RT systems that are subject to aging management review provide the steam generator pressure boundary and the containment pressure boundary. In the SPS LRA, Table 2.3.4-6, the applicant listed the following two component commodity groups as subject to an AMR: pipe and valve bodies. In the NAS LRA,

Table 2.3.4-7, the applicant listed bolting in addition to the pipe and valve component commodity groups subject to an AMR at SPS. The applicant identified maintaining system pressure boundary integrity as the only intended function of the SCs subject to an AMR for the WT and RT systems.

2.3.4.7.2 Staff Evaluation

The staff reviewed the NAS LRA, Section 2.3.4.7, and the SPS LRA, Section 2.3.4.6, to determine whether there is reasonable assurance that the applicant appropriately identified the portions of the WT and RT systems that are within the scope of license renewal in accordance with 10 CFR 54.4 and that the applicant appropriately identified the SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff reviewed the information presented by the applicant in each LRA, the applicable piping and instrumentation drawings, and the North Anna and Surry UFSARs to determine whether the applicant adequately identified the SSCs of the WT and RT systems that are within the scope of license renewal. The staff verified that those portions of the WT and RT systems that meet the scoping requirements of 10 CFR 54.4 were included within the scope of license renewal and were identified as such by the applicant in Sections 2.3.4.7 and 2.3.4.6 of each LRA, respectively. To verify that the applicant did include the applicable portions of the SSs within the scope of license renewal, the staff focused its review on those portions of the WT and RT systems that were not identified within the scope of license renewal to verify that they do not meet the scoping requirements of 10 CFR 54.4. The staff also reviewed the UFSARs to determine whether there were any additional system intended functions that were not identified in the LRA, and verified that those additional intended functions did not meet the scoping requirements of 10 CFR 54.4. The staff did not identify any omissions.

The staff determined whether the applicant had properly identified the SCs that are subject to AMR from among those portions of the WT and RT systems that are identified as being within the scope of license renewal. The applicant identified and lists the SCs subject to AMR for the WT and RT systems in Tables 2.3.4-7 and 2.3.4-6 (respectively) of the LRA using the screening methodology described in each LRA, Section 2.1. The staff evaluated the scoping and screening methodology and documented its findings in Section 2.1 of this SER.

In the NAS LRA, the applicant identified the portions of the WT system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-7 of the NAS LRA:

Unit 1	Unit 2
11715-LRM-074A, Sh. 1	12050-LRM-074A, Sh. 1
11715-LRM-102A, Sh. 2	12050-LRM-102A, Sh. 2
13075-LRM-102C, Sh. 1	12050-LRM-102B, Sh. 1

In the SPS LRA, the applicant identified the portions of the RT system that are within the scope of license renewal in the drawings listed below. The applicant also listed the mechanical component commodity groups that are subject to AMR and their intended functions in Table 2.3.4-6 of the SPS LRA:

Unit 1	Unit 2
11448-LRM-124A, Sh. 1	11548-LRM-124A, Sh. 1
11448-LRM-124A, Sh. 2	11548-LRM-124A, Sh. 2
11448-LRM-124A, Sh. 3	11548-LRM-124A, Sh. 3

The piping and instrumentation drawings were highlighted by the applicant to identify those portions of the WT and RT systems that meet at least one of the scoping requirements of 10 CFR 54.4. The staff compared the LRA drawings to the descriptions in the UFSARs to ensure they were representative of the WT and RT systems. The staff performed its review by sampling the SCs that the applicant identified as being within the scope of license renewal but not subject to AMR to verify that no structure or component, that performs its intended function without moving parts or without a change in configuration or properties and that are not subject to replacement on the basis of qualified life or specified time period, was excluded from an AMR.

The staff did not identify any omissions, but did receive a clarification in a November 21, 2001, telecommunication. The staff asked the applicant why it had only included a single isolation valve for the pressure boundary for the WT system. The applicant clarified that the WT system valves were normally closed, and that this meets the boundary convention of extending to the first normally closed manual valve, check valve, or automatic valve that gets a signal to go closed.

2.3.4.7.3 Conclusions

On the basis of its review of the information contained in Section 2.3.4.7 of the NAS LRA and Section 2.3.4.6 of the SPS LRA, the supporting information in the UFSARs, and LRA drawings, as described above, the staff did not identify any omissions in the scoping of the WT and RT systems by the applicant. The staff concludes that there is reasonable assurance that the applicant has identified those portions of the WT and RT systems that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1), respectively.

2.3.5 Expanded SSCs For Criterion 2 Scoping

Section 54.4(a)(2) of 10 CFR requires that all non-safety-related systems and structures whose failure could prevent satisfactory accomplishment of any of the safety-related functions identified in 10 CFR 54.4(a)(1) be included within the scope of license renewal.

2.3.5.1 Technical Information in the Application

In Sections 2.1.2.2 and 2.1.3.6 of each LRA, the applicant described its scoping and screening methodology for identifying SSCs that are within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(2). In Sections 2.3 and 2.4 of each LRA, the applicant provided its scoping and screening results and identified in-scope systems, components, and structures in LRA drawings.

Section 2.1.3.6 of each LRA indicates that flooding, high-energy-line-break outside containment, and seismic supports are considered for Criterion 2 scoping of non-safety-related mechanical components. Based on its review of the information provided in Sections 2.1.2.2 and 2.1.3.6 of each LRA, the staff requested additional information in RAIs 2.1-1 through 2.1-4, dated October 22, 2001. In these RAIs, the staff identified the areas of inadequacy in each LRA relating to the requirements of 10 CFR 54.4(a)(2). Specifically, the staff stated that the applicant should consider two configurations of non-safety-related piping systems that could potentially meet the section 54.4(a)(2) criterion based on industry operating experience involving age-related pipe failures. The first configuration includes non-safety-related piping systems (including piping segments and supports) that are connected to safety-related piping. The staff stated that these non-safety-related piping systems should be included within the scope of license renewal up to and including the first seismic support past the safety-related/non-safety-related interface. The second configuration involves non-safety-related piping systems, that are not connected to safety-related piping but are located such that their failure could adversely impact the performance of an intended safety function. The above staff position as described in the RAIs is consistent with the Interim Staff Guidance, dated December 3, 2001, and March 15, 2002, regarding 10 CFR 54.4(a)(2) and the Seismic II/I issue.

By letter dated February 1, 2002, the applicant responded to the staff's RAIs. In its response to RAI 2.1-2, the applicant stated that non-safety-related piping that is attached to safety-related piping and that is seismically designed and supported up to the first equivalent anchor point beyond the safety-related/non-safety-related boundary is included within the scope of license renewal. Although these non-safety-related piping segments were not identified or highlighted on each LRA drawing, the applicant expanded the scoping and screening results in the RAI response such that applicable aging effects on these piping segments are managed along with the adjoining safety-related piping. The supports for the non-safety-related piping segments are also included within the scope of license renewal, as stated in Section 2.1.3.6 of each LRA.

In response to RAIs 2.1-3 and 2.1-4, the applicant stated that the methodology in each LRA for scoping of systems, structures, and components did not include any non-safety-related mechanical components for the second configuration described above. Furthermore, in response to the staff's RAIs, the applicant stated that the scope of license renewal for Surry and North Anna was modified to include these non-safety-related piping systems with the second configuration. In addition, the applicant indicated that the details of this scoping process and results are described in its technical report, LR-1921/LR-2921, "Aging Management of Criterion 2 (Non-safety-related/Safety-related) Component Groups not Addressed in AMR Reports." The expanded piping-systems considered for inclusion within the scope of license renewal in this report are piping, valves, tanks, pumps, and other mechanical system equipment.

2.3.5.2 Staff Evaluation

The staff's evaluation of the scoping methodology is in Section 2.1.3.1 of this SER. The evaluation of the associated SSCs initially identified in each LRA is in Sections 2.3 and 2.4 of this SER, not including the expanded SSCs identified in the RAI responses dated February 1,

2002. The staff's evaluation of the non-safety-related piping systems with the first configuration is in Section 2.1.3.1 of this SER. The staff concluded that the applicant's response to RAI 2.1-2 as described above is acceptable based on the staff's confirmation that these non-safety-related piping segments and supports were included in the scope.

The following staff evaluation focuses on the non-safety-related piping systems with the second configuration, which are located close to safety-related components such that their failure could adversely impact the performance of an intended safety function. Specifically, the staff reviewed the applicant's scoping method and results for identifying the expanded piping systems as described in the applicant's technical report, LR-1921/LR-2921.

The scoping method described in LR-1921/LR-2921 involves several steps to identify the non-safety-related piping systems with the second configuration. In the first step, the applicant identified the following structures that contain both safety-related and non-safety-related SSCs (listed in Attachment 1 to LR-1921/LR-2921):

North Anna

auxiliary building
auxiliary feedwater pump house
casing cooling pump house
containment
fuel building
fuel oil pump house
intake structure
main steam valve house
quench spray pump house
service building
safeguards building
service water pump house
service water valve house
turbine building

Surry

auxiliary building
containment
containment spray pump building
fuel building
fuel oil pump house
high level intake structure
low level intake structure
main steam valve house
service building
safeguards building
turbine building

Section 2.1.3.6 of the LRAs (Criterion 2 scoping) states that the structural components such as component supports, building subcompartment block walls, supports and structural members for load handling cranes and devices, certain load handling cranes and devices important to plant operations have been included within the scope of license renewal for the structures housing the expanded systems.

In the second step, the applicant reviewed the equipment database to identify the mechanical systems containing non-safety-related components within these structures. The systems are listed in Attachments 2 and 3 to LR-1921/LR-2921. Attachment 2 lists the following systems, which are included in Section 2.3 of each LRA. These systems have expanded license renewal boundaries as a result of the expanded scoping to consider effects identified in RAI 2.1-3.

North Anna

auxiliary steam (AS)
boron recovery (BR)
component cooling (CC)
chilled water (CD)
chemical and volume control (CH)
condensate (CN)
containment vacuum (CV)
circulating water (CW)
drains aerated (DA)
drains - building services (DB)
drains gaseous (DG)
fuel pit cooling (FC)
feedwater (FW)
high radiation sampling (HRS)
liquid waste (LW)
main steam (MS)
primary grade water (PG)
quench spray (QS)
reactor coolant (RC)
residual heat removal (RH)
radwaste (RW)
steam drains (SD)
safety injection (SI)
sampling (SS)
secondary vents (SV)
service water (SW)
vents gaseous (VG)
vacuum priming (VP)
water treatment (WT)

Surry

auxiliary steam (AS)
bearing cooling (BC)
boron recovery (BR)
component cooling (CC)
chemical and volume control (CH)
condensate (CN)
containment spray (CS)

containment vacuum (CV)
circulating water (CW)
drains aerated (DA)
drains gaseous (DG)
fuel pit cooling (FC)
feedwater (FW)
gaseous waste (GW)
heating (HS)
main steam (MS)
primary grade water (PG)
plumbing (PL)
reactor coolant (RC)
residual heat removal (RH)
recirculation and transfer (RT)
steam drains (SD)
safety injection (SI)
sampling (SS)
secondary vents (SV)
service water (SW)
vents aerated (VA)
vents gaseous(VG)
vacuum priming (VP)
ventilation (VS)

Attachment 3 to LR-1921/LR-2921 lists the following added systems, which are not included in Section 2.3 of each LRA. These systems are included within the scope only because of the effects identified in RAI 2.1-3.

North Anna

Bearing cooling
decontamination
extraction steam
gaseous waste

Surry

chilled water
decontamination
extraction steam
liquid waste
water treatment

The staff reviewed the systems and structures listed above and did not identify any omissions.

In the third step, the applicant excluded the non-fluid-containing component groups. In Section 2.1.3.1 of this SER, the staff reviewed and found the applicant's exclusion of non-fluid-containing components acceptable, based on the applicant's review of the industry operating experience and plant-specific operating experience.

Finally, the applicant evaluated the fluid-containing components of the above-listed systems, and identified each component group that may be excluded from the effects identified in RAI 2.1-3. Assuming a failure of the component group, the applicant examined whether the failure could impact the performance of an intended safety function of any in-scope safety-related SSCs. If not, the component group was excluded. The applicant listed the excluded component groups in Attachments 4 and 5 to LR-1921/LR-2921. The failure modes considered in this exclusion evaluation were pipe whip and jet impingement fluid spray, and physical contact for the component groups of all systems in the structures, listed above.

The staff reviewed the list of excluded component groups along with the justifications for exclusion in Attachments 4 and 5 to LR-1921/LR-2921. The applicant indicated that the non-safety-related component groups that were not near safety-related components were excluded from the scope of license renewal. The staff requested the applicant to clarify the criteria used for this determination. In a letter dated May 22, 2002, the applicant provided clarification for each component group that was excluded.

The following component groups were excluded because they are in cubicles isolated from any safety-related components:

- tanks and pumps in the LW and DC systems
- tanks, heat exchangers, and pumps in the PG system
- filters in the BR, SS, and HRS systems
- pumps and filters in the FC system
- tanks, filters, and concrete-encased piping in the PL and DB systems
- tanks and filters in the GW system

The following two component groups were excluded because they are located in an area remote from any safety-related components:

- tanks, filters, and pumps in the WT system
- tanks, piping, valves, and filters in the FW oil system

In addition, the pumps in the RT system were excluded because these pumps are located in the auxiliary building basement and are secured and isolated when the temperature of the reactor coolant system is higher than 200 °F.

The staff reviewed the above justifications and found them acceptable because the excluded component groups are not located near safety-related components, and their failure cannot impact the performance of an intended safety function.

For the fluid-containing components, following the scoping method described above, the applicant identified mechanical components of the systems that are listed in Attachments 2 and 3 to technical report LR-1921/LR-2921 and that reside in the structures listed in Attachment 1 of the report, except the component groups excluded in Attachments 4 and 5 of the report. The in-scope mechanical components that are passive were screened for an AMR in accordance with 10 CFR 54.21(a)(1).

The results of this expanded scoping were also reviewed by the NRC regional inspection team during an inspection on February 4-8, 2002. The inspection team determined that the applicant's scoping and screening activities were performed in accordance with the prescribed methodology and were adequate. In an inspection report dated March 25, 2002, the inspection team confirmed that additional portions of the system not originally included in scope were to be added as a result of RAI 2.1-3.

In a request supplemental to RAI 2.1-3, the staff asked the applicant how the applicant will modify LRA information to include the additional systems and components identified in Technical Report LR-1921/LR-2921 but not included in LRA boundary drawings. Furthermore, the staff noted that technical report LR-1921/LR-2921 is used as the supplement to each LRA in defining additional components subject to an AMR and should have the same level of document control and record keeping as each LRA and the associated boundary drawings. In its response, dated May 22, 2002, the applicant stated that it would make a note on drawings to indicate that non-safety-related in-scope components due to location near safety-related SSCs are not highlighted and to direct users to the report, LR-1921/LR-2921, for additional guidance.

The staff reviewed the applicant's responses to the RAIs, the scoping method described in technical report LR-1921/LR-2921, the list of systems and structures, the justifications for exclusion, and the findings of the NRC inspection team. Based on the above, the staff finds the expanded scoping and additional SSCs identified in technical report LR-1921/LR-2921 to be acceptable because the applicant has included all the non-safety-related SSCs with the configurations that meet the 10 CFR 54.4(a)(2) scoping criterion as discussed in the staff's RAIs. The expanded scoping is consistent with the staff position stated in the RAIs and the Interim Staff Guidance, dated December 3, 2001, and March 15, 2002, regarding section 54.4(a)(2) and the Seismic II/I issue.

2.3.5.3 Conclusion

On the basis of its review of the information contained in technical report LR-1921/LR-2921 and its attachments, the RAI responses, and the inspection, the staff did not identify any omissions in the scoping and screening of SSCs under section 54.4(a)(2). Therefore, the staff concludes that there is a reasonable assurance that the applicant has identified those portions of the NAS and SPS 54.4(a)(2) SSCs that are within the scope of license renewal and the SCs that are subject to an AMR in accordance with 10 CFR 54.4(a)(2) and 10 CFR 54.21(a)(1), respectively.

2.4 Scoping and Screening Results: Structures

2.4.1 Containment

In the North Anna and Surry LRAs, Section 2.4.1, "Containment," the applicant describes the containment structures for all four units of both plants, and identifies the structural components that are within the scope of license renewal and subject to an AMR. The design of the SPS 1/2 containments structure is described in SPS Updated Final Safety Analysis Report (UFSAR), Sections 5.2 and 15.5. The design of the NAS 1/2 containment structures is described in NAS UFSAR Sections 3.7 and 3.8.2. Additional information for the NAS 1/2 containments is provided in NAS UFSAR, Sections 3.1.12 and 6.2, Table 6.2-37, and drawings 11715-FM-1A through 1G. The staff reviewed this information to determine whether the applicant has adequately demonstrated that the requirements of 10 CFR 54.4 and 54.21 were met for the containment structures and their structural components. The containment structures of the two nuclear power stations are similar in design, and therefore, the staff's safety evaluation (SE) is applicable to both plants unless specified otherwise.

2.4.1.1 Summary of Technical Information in the Application

In each LRA, Section 2.4.1, "Containment," the applicant states that the containment is a seismic Class I structure that houses the reactor and other nuclear steam supply system (NSSS) components for the respective plant. Seismic Class I structures are designed to prevent the uncontrolled release of radioactive material as a result of a specified seismic event, and to withstand all applicable loads without loss of function. The applicant has determined that seismic Class I structures meet the intent of 10 CFR 54.4(a)(1) and are within the scope of license renewal.

The containment structure for each plant consists of a reinforced-concrete cylindrical wall, a hemispherical dome roof, and a 10-foot-thick reinforced-concrete mat foundation. For the NAS 1/2 containments, the mat foundation is supported on fresh, crystalline, metamorphic rock. For the SPS 1/2 containments, the mat foundation is supported on highly consolidated Miocene clay. There is a waterproof membrane under the foundation mat of each containment that extends up to the containment below-ground wall. The internal surfaces of the cylindrical wall and dome roof are lined with a carbon steel liner of varying thickness to maintain a high degree of leak tightness. The liner at the bottom of the containment is covered with a thick reinforced-concrete slab. The containment is divided by the crane wall into an outer annulus section and a central section that supports the polar crane. The central section is subdivided into equipment cubicles. A seismic Class I drainage sump with a stainless steel liner is provided in the containment basement.

The boundary of the containment structure includes all the penetration assemblies that penetrate the containment wall, such as mechanical penetrations, electrical penetrations, and the equipment and personnel hatches. These penetrations are welded to the containment liner to maintain an essentially leak-tight-barrier that prevents uncontrolled release of radioactivity. The equipment hatch is bolted in place to the interior of the containment wall. A two-door emergency escape air lock is provided through the equipment hatch for emergency access to the containment. The personnel hatch has an inner and an outer door. The doors are maintained in a closed position by interlocking tooth closure mechanisms. A fuel transfer tube penetrates the containment to link the refueling canal in the containment and the spent fuel pool in the fuel building. The fuel transfer tube also forms part of the containment pressure boundary.

The applicant has determined that all the structural components and commodities of the containment structure meet the intent of 10 CFR 54.4(a) for license renewal because they perform one or more of the following passive functions:

- provide a pressure boundary
- provide structural and/or functional support for safety-related equipment
- provide enclosure, shelter, or protection for in-scope equipment (including radiation shielding and pipe whip restraint)
- provide a rated fire barrier to confine or retard a fire
- provide a missile (internal or external) barrier
- provide structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety affecting safety-related) and/or Criterion 3 (the five regulated events)
- provide a protective barrier for internal/external flood events
- provide jet impingement shielding for high-energy line breaks
- provide an environmental qualification (EQ) barrier

In Table 2.4.1-1 of each LRA, the applicant listed the structural components and commodities of the containment structure that are subject to an AMR. The applicant grouped them into 44 structural component groups or unique commodities for the NAS 1/2 containments and 43 for SPS 1/2 containments. The one extra component in the NAS 1/2 containments is the spare penetration, which does not exist in SPS 1/2 containments. These components and commodities meet the criteria of 10 CFR 54.21(a)(1), because applicable intended functions are performed 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.

2.4.1.2 Staff Evaluation

The staff reviewed Section 2.4.1, "Containment," of each LRA and the UFSARs to determine whether the applicant has adequately implemented its methodologies as described in Section 2.1 of each LRA, such that there is reasonable assurance that the structural components and commodities of the containment were properly identified 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. After completing its initial review, the staff requested additional information from the applicant by e-mail on September 24, 2001. The applicant responded to the staff's questions via e-mail on October 4, 2001. The applicant's e-mail response to staff's questions is docketed and available to public.

The staff reviewed the additional information and drawings submitted by the applicant in response to the staff's questions to determine whether there are any structure or component within the containment boundary that the applicant did not bring into the scope of license renewal or did not determine to be subject to an AMR. On the basis of this review, the staff has identified the findings as described below:

In each LRA Section 2.4.1, "Containment," the applicant states that the containment is divided by the crane wall that support the polar crane. However, the polar crane and the crane wall are not listed in LRA Table 2.4.1-1 as components subject to an AMR. The staff asked that the applicant verify the table to ensure its completeness. In its response, the applicant stated that both the polar crane and its supporting structures are within the scope of license renewal and subject to an AMR. In each LRA, the polar crane is included in Table 2.4.12-1 under the commodity group "crane", and the crane wall is included in Table 2.4.1-1 under the structural component group "walls." The staff found the applicant's response acceptable in addressing this concern.

In each LRA Section 2.4.1, "Containment," the applicant states that the personnel access hatch has an inner and an outer door and that the doors are maintained in "closed" position by interlocking-tooth closure mechanisms. The staff asked whether the operating mechanisms of the hatch that perform a passive function associated with maintaining the hatch in a closed position (e.g., gears, latches, hinges, and equalizing valves) are subject to an AMR. In its response, the applicant stated that the interlocking-tooth closure mechanism aligns the hatch and holds it in place, performing the intended function of the containment pressure boundary. The latches and hinges do not perform an intended function and are not within the scope of license renewal because the personnel hatch has no gears. However, the equalizing valve body is within the scope and subject to an AMR for license renewal. The staff found that the applicant has included these components in the AMR tables.

In each LRA, Table 2.4.1-1 also lists the fuel transfer tube and its protection shield and the gate valve as being subject to an AMR. However, the table does not list some of the attachments of the fuel transfer tube, such as sleeves that are welded to the liner plate and blind flanges that cover the tube when the transfer tube is not in use. In addition, neither LRA Section 2.4.1 provides any information for these attachments. Since these components perform an intended function to maintain the containment pressure boundary, the staff asked why they are not included in either LRA Table 2.4.1-1. In its response, the applicant stated that the transfer tube sleeves and blind flanges are within the scope of license renewal and subject to an AMR. The fuel transfer tube sleeves and blind flanges are included in the commodity group "penetrations" in each LRA Table 2.4.1-1. The staff confirmed that these components are within the scope of license renewal.

Based on the above review, the staff did not find any omissions as to the scoping and screening of the containment structure. The staff's review also found that all the passive structural components identified within the scope of license renewal were subject to an AMR.

2.4.1.3 Conclusions

The staff reviewed the information presented in each LRA, Section 2.4.1, Table 2.4.1-1, the UFSAR, the additional information submitted by the applicant in response to the staff's RAIs, and the drawings submitted by the applicant for this review. On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the containment structures of both plants and the 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.

2.4.2 Auxiliary Building Structure

In each LRA Section 2.4.2, "Auxiliary Building Structure," the applicant describes the structures of the auxiliary building and identifies their structural components that are within the scope of license renewal and subject to an AMR. The design of the structures within the auxiliary building boundary is described in NAS UFSAR Section 3.8.1 and SPS UFSAR Section 9.10.4.

2.4.2.1 Summary of Technical Information in the Application

In Section 2.4.2 of each LRA, the applicant states that the term "auxiliary building structure" include:

- auxiliary building
- Units 1 and 2 cable vaults
- cable tunnels
- pipe tunnels
- hydrogen recombiner vault (NAS 1/2)
- NAS 1/2 rod drive room and the functionally equivalent to motor control center rooms at SPS 1/2

The auxiliary building, which houses the systems and equipment serving both units, is a four-story seismic Class I structure located between the two reactor containment buildings. The structure consists of a reinforced-concrete substructure (with concrete walls partially below grade), a structural steel framed superstructure, and a reinforced-concrete mat foundation (with monolithic finish). The membrane roofing system is supported by steel framing covered with an insulated metal-roof deck. Flood protection barriers, fire and EQ doors, fire barrier penetrations, and fire barrier seals are provided to protect safety-related equipment.

The cable vault, cable tunnel, motor control center room, and pipe tunnel for each unit are the reinforced-concrete structures within the auxiliary building. The pipe tunnel is in the bottom story, the cable vault and cable tunnel are in the middle story, and the rod drive room is in the top story. The cable vault is the reinforced-concrete portion of the auxiliary building adjacent to the exterior side of the containment wall around the major electric penetrations above the pipe tunnel. The cable tunnel extends from the cable vault through the auxiliary building to the electric control area below the main control room. The hydrogen recombiner vault for the NAS is a single-story reinforced-concrete structure that contains the hydrogen recombiners for NAS 1/2. The hydrogen recombiner vault shares a reinforced-concrete mat foundation with the auxiliary building structure and is attached to the east side of the Unit 2 rod drive room. The reinforced-concrete walls and slabs for these structures are designed with biological shielding and missile protection.

The applicant has determined that all the structural components and commodities within the auxiliary building boundary 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 structural and/or functional support for safety-related equipment
- provide structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety-related affecting safety-related) and/or Criterion 3 (the five regulated events)
- provide enclosure, shelter, or protection for in-scope equipment
- provide a rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant
- provide a missile (internal or external) barrier
- provide a protective barrier for internal/external flood events
- provide an environmental qualification barrier

In Table 2.4.2-1 of each LRA, the applicant listed the structural components and commodities and their intended functions for the auxiliary building structures that are subject to an AMR. These structural components are similar in design and materials. Some of the components are common to many structures and are addressed in the LRA as the commodities for the entire plant. The applicant grouped all the components of the auxiliary building structure into 28 structural component groups and unique commodities for the NAS 1/2 and 26 for SPS 1/2. Two component groups were not listed for the SPS 1/2 because the auxiliary buildings in SPS 1/2 do not have access doors and flood barriers. These components and commodities meet the criteria of 10 CFR 54.21(a)(1) because applicable intended functions are performed without moving parts or without a change of configuration or properties, and they are not replaced on a qualified life or specified time period.

2.4.2.2 Staff Evaluation

The staff reviewed Section 2.4.2 of each LRA and the supporting information in the UFSAR to determine whether there is reasonable assurance that the structural components and commodities within the boundary of the auxiliary building structures were properly identified within the scope of license renewal and subject to an AMR.

In Section 2.4.2 of each LRA, the applicant describes the structures and structural components in the auxiliary building; cable vaults, cable tunnels, etc. However, the staff found that the following structural components, which are described in this section, are not listed in Table 2.4.2-1 of either LRA: fire and EQ doors, fire barrier penetrations, fire barrier seals, and the membrane roofing system. The staff asked the applicant to verify that the Table 2.4.2-1 contains the complete listing of structures and structural components in the auxiliary building. In its response, the applicant stated that the fire and EQ doors and fire barrier penetration seals are included within the scope of license renewal in each LRA Section 2.4.11, and in LRA Table 2.4.11-1 as miscellaneous structural commodities. The membrane roofing is not included in LRA Table 2.4.2-1 and is not subject to an AMR because it is not required to perform any intended function. The staff found the applicant's response acceptable in addressing this concern.

In Section 2.4.2 of each LRA, the applicant states that the auxiliary building consists of a reinforced-concrete foundation mat and below-grade reinforced-concrete walls (substructure), etc. However, the applicant did not explain whether the foundation mat and the lower portion of walls have expansion joints, water stops or waterproofing membranes. The staff was concerned that water stops are important in maintaining the integrity of the concrete components to which they connect. The groundwater in-leakage into the concrete construction joints could occur as a result of degradation of the water stops. The staff asked that the applicant provide information on structural sealants for the below-grade construction joints. In its response, the applicant stated that the water-stops are within the scope of license renewal. As stated in each LRA, Appendix C, Section C2.4, water-stops are considered as part of the components that they are integral to and are not identified as a separate component within each LRA. The staff found the applicant's response acceptable.

Based on the above review, the staff did not find any omissions by the applicant related to scoping and screening of the auxiliary building structures. The staff's review also found that all the passive structural components identified within the scope of license renewal were subject to an AMR.

2.4.2.3 Conclusions

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the structural components and commodities of the auxiliary building structure 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.

2.4.3 Other Class 1 Structures

In the North Anna and Surry LRAs, Section 2.4.3, "Other Class 1 Structures," the applicant describes the other Class 1 structures and identifies their structural components that are within the scope of license renewal and subject to an AMR. The applicant has determined that the following Class 1 structures are within the boundary of the other structures that are within the scope of license renewal in either the NAS or the SPS:

- safeguard building (both plants)
- main steam valve house (both plants)
- fuel oil pump house (both plants)
- quench spray pump house (NAS only)
- containment spray pump building (SPS only)
- auxiliary feed water pump house (NAS only)
- auxiliary feed water tunnel (NAS only)
- casing cooling pump house (NAS only)
- service water pump house (NAS only)
- service water pipe expansion joint enclosure (NAS only)
- service water valve house (NAS only)
- service water tie-in vault (NAS only)
- fire pump house (SPS only)

The staff reviewed the information submitted by the applicant to determine whether the applicant has demonstrated that the requirements of 10 CFR 54.4 and 10 CFR 54.21 were met for the above structures and the associated components. The design of these Class 1 structures is addressed in Sections 3.8.1.1, 9.2.1.2, 9.5.1.3, and Section 3C.5.4.9 of the NAS UFSAR, and Sections 9.10.4 and 9.13.3.4 of the SPS UFSAR.

2.4.3.1 Summary of Technical Information in the Application

Safeguards Building

In Section 2.4.3 of each LRA, the applicant states that the safeguards building is a seismic Class 1 structure that houses the safeguards equipment, including the outside recirculating spray pumps, the low-head safety injection pumps, and the associated pipe tunnels. The safeguards building is a reinforced-concrete structure supported on a reinforced-concrete mat foundation adjacent to the reactor containment. The building has three external side wall of reinforced-concrete; the fourth side wall is a common wall with the containment. The structure has a reinforced-concrete roof with hatches for the removal of equipment. For the North Anna plant, the exterior walls and roof are specially designed for missile protection. The Unit 2's 24-inch service water lines that run in a separate cubicle are part of the safeguard building. For the Surry plant, the safeguards building concrete structure is partially below grade. A pipe chase located on the missile barrier roof extends along the entire length of the roof. A concrete wall and a steel-framed metal deck on top enclose the pipe chase. The structural components of the safeguards building that require an AMR are listed in Table 2.4.3-1 of each LRA.

Main Steam Valve House

The main steam valve house provides shelter for the main steam isolation valves and auxiliary feedwater pumps. It is a seismic Class 1, reinforced-concrete structure supported by a reinforced-concrete mat foundation adjacent to the containment and cable vault. The mat foundation is founded on soil (for the North Anna plant) or on concrete-filled steel pipe piles (for the Surry plant). The valve house has a roof slab and an intermediate floor slab. Both slabs are reinforced-concrete structures supported by structural steel framing and are cast against permanent metal deck formwork. The openings of the roof slab, which are used for the removal of equipment, have concrete hatches (for the North Anna plant) or missile screens (for the Surry plant). The structural components subject to an AMR are listed in Table 2.4.3-2 of each LRA.

Quench Spray Pump House (NAS)/Containment Spray Pump Building (SPS)

The quench spray pump house of the North Anna plant is functionally equivalent to the containment spray pump building of the Surry plant. Each performs the same function, which is to house the containment spray pumps (or quench spray pumps) and their accessories.

For the North Anna plant, the quench spray pump house for each unit consists of a quench spray area and a refueling water recirculating pump area; both the areas are open to the cylindrical containment wall. The pump house is a reinforced-concrete structure with its exterior walls supported on a reinforced-concrete mat foundation. It has a metal deck roof and an intermediate reinforced-concrete floor slab which are supported by structural steel framing. The structural components of the quench spray pump house that require an AMR are listed in Table 2.4.3-3 of the NAS LRA.

For the Surry plant, the containment spray pump building for each unit consists of a containment spray area and a refueling water recirculating pump area. The building is adjacent to the main steam valve house and safeguard building and is open to the containment exterior wall. It is a reinforced-concrete structure supported on a reinforced-concrete mat foundation.

The building has a metal deck roof and a reinforced-concrete intermediate floor slab which are supported by structural steel framing. The 24-inch service water lines for Unit 1 run in an area below grade, which is part of the main steam valve house, and the Unit 1 containment spray pump building. The 24-inch service water lines for Unit 2 run in a separate area below grade level, which is part of the containment spray pump building. This area has a reinforced-concrete roof slab with several hatches. The structural components for the containment spray pump building that require an AMR are listed in Table 2.4.3-3 of the SPS LRA.

Fuel Oil Pump House

The fuel oil pump house (common to both units), which shelters the diesel generator fuel oil supply pumps, is divided into two cubicles with a reinforced-concrete interior wall (one for each unit). For the North Anna plant, the fuel oil pump house is built at the grade level and the motor control center room is part of the pump house. For the Surry plant, the two cubicles are below grade and the roof slab is at the ground level. There is a concrete missile shield at the ground level to protect the fuel oil lines. A concrete missile-protected manhole adjacent to the fuel oil pump house is an integral part of the pump house. The structural components that require an AMR are listed in Table 2.4.3-4 of each LRA.

Auxiliary Feed-water Pump House (NAS 1/2)

The auxiliary feed-water pump house for each unit is a single-story reinforced-concrete building founded at grade level. The building is divided into two cubicles by a reinforced-concrete wall. One cubicle houses the two motor-driven auxiliary feed-water pumps and the other cubicle houses one turbine-driven auxiliary feed-water pump. The auxiliary feed-water pump house is a tornado missile-protected structure. The roof openings are provided with missile-protected concrete hatches. The structural components that require an AMR are listed in Table 2.4.3-5 of the NAS LRA.

Auxiliary Feed-water Tunnel (NAS 1/2)

The auxiliary feed-water tunnel located below grade runs between the auxiliary feed-water pump house and the quench spray pump house. The tunnel carries the auxiliary feed-water pump piping and other safeguards piping. The tunnel is a reinforced-concrete structure that is designed for seismic and tornado missile protection. There are missile-protected manholes along the tunnel at the grade level. The structural components subject to an AMR are listed in Table 2.4.3-6 of the NAS LRA.

Casing Cooling Pump House (NAS 1/2)

The casing cooling pump house provides a weather-protected enclosure for the casing cooling systems, motors, and other equipment. The pump house is a reinforced-concrete structure supported by a common mat foundation on bedrock. The roof of the pump house is a concrete slab built on metal decking that is supported by a structural steel frame. The structural components subject to an AMR are listed in Table 2.4.3-7 of the NAS LRA.

Service Water Pump House (NAS 1/2)

The service water pump house, located at the edge of the service water reservoir, provides shelter for the service water system equipment for both units. The pump house is a reinforced-concrete structure founded on a mat foundation. The structure has missile-protected concrete roof openings and missile barriers between the service water pumps. The structural components subject to an AMR are listed in Table 2.4.3-8 of the NAS LRA.

Service Water Pipe Expansion Joint Enclosure (NAS 1/2)

The service water expansion joint enclosure is a single-story reinforced-concrete building attached to the service water pump house. The reinforced-concrete floor slab is built on grade level and the walls are supported by concrete footing. The reinforced-concrete roof slab and walls are designed for missile protection. There is a manhole on the roof for access to the building. The manhole is covered with a missile-protected steel cover. The structural components subject to AMR are listed in Table 2.4.3-9 of the NAS LRA.

Service Water Valve House (NAS 1/2)

The service water valve house provides shelter and protection for the service water valves and related equipment for both units. The valve house is a reinforced-concrete structure with missile-protected concrete roof openings. A reinforced-concrete access pit to the expansion joint is located along the north side of the service water valve house. The pit encloses and provides access to the two 36-inch pressure balance expansion joints in the service water return headers entering the valve house. The structural components subject to an AMR are listed in Table 2.4.3-10 of the NAS LRA.

Service Water Tie-in Vault (NAS 1/2)

The service water tie-in vault houses the four pressure-balanced expansion joints, pipe access hatches, and the associated cathodic protection equipment. This vault is provided at the tie-in to the original buried service water lines to protect from the adverse effects of tornado-generated missiles and effects due to earthquake-induced ground motion for the four service water headers, four new service line expansion joints, and two new access ports. The tie-in vault is a reinforced-concrete structure founded on a reinforced mat foundation. The roof is a reinforced-concrete slab on steel decking and has a manhole opening with a steel cover for personnel access into the vault. Various platforms are provided for access to the pipe access hatches. The structural components subject to an AMR are listed in Table 2.4.3-11 of the NAS LRA.

Fire Pump House (SPS 1/2)

The fire pump house is a free-standing, reinforced-concrete structure in the southwest area of the yard. The pump house is divided into two separate cubicles by a reinforced-concrete wall with a metal door. One cubicle is a seismic Class 1 reinforced-concrete structure that houses the diesel-engine-driven fire pump. It has openings in the exterior wall that are protected with missile screens. The other cubicle which houses the electric-motor-driven fire pump, motor control center, surge tank, and two small water booster pumps, is not a seismic Class 1 structure. This cubicle is enclosed with a built-up metal deck roof and masonry block walls and is supported on spread footing. The applicant determined that the cubicle that houses the diesel-engine-driven fire pump is within the scope of license renewal. For the cubicle that houses the electric-motor-driven fire pump, only the equipment pad, the floor, and the common concrete wall between the two cubicles are in scope. The structural components subject to an AMR are listed in Table 2.4.3-5 of the SPS LRA.

2.4.3.2 Staff Evaluation

The staff reviewed Section 2.4.3 of each LRA and the UFSARs for each plant to determine whether there is reasonable assurance that the applicant has properly identified the structures and components of the other Class 1 structures 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 from the applicant by an e-mail on September 24, 2001. The applicant responded to the staff's questions via e-mail on October 4, 2001.

The applicant identified the structural components and commodities and their intended functions, in the following tables for each of the buildings and structures that are within the scope of license renewal. The methodology used to identify these generic component groups is evaluated in Section 2.1 of this report. For NAS, the generic component groups for each Class 1 structure are listed in the following tables:

Table 2.4.3-1 lists 17 components for the safeguards building
Table 2.4.3-2 lists 20 components for the main steam valve house
Table 2.4.3-3 lists 17 components for the quench spray pump house
Table 2.4.3-4 lists 7 components for the fuel pump house
Table 2.4.3-5 lists 9 components for the auxiliary feed-water pump house
Table 2.4.3-6 lists 7 components for the auxiliary feed-water tunnel
Table 2.4.3-7 lists 10 components for the casing cooling pump house
Table 2.4.3-8 lists 17 components for the service water pump house
Table 2.4.3-9 lists 4 components for the service water pipe expansion joint enclosure
Table 2.4.3-10 lists 16 components for the service water valve house
Table 2.4.3-11 lists 12 components for the service water tie-in vault

For SPS, the generic component groups for each Class 1 structure are listed in the following tables:

Table 2.4.3-1 lists 15 components for the safeguards building
Table 2.4.3-2 lists 21 components for the main steam valve house
Table 2.4.3-3 lists 17 components for the containment spray pump building
Table 2.4.3-4 lists 10 components for the fuel oil pump house
Table 2.4.3-5 lists 12 components for the fire pump house

The applicant determined that components and commodities listed in above tables are subject to an AMR because the intended functions are performed without moving parts or without a change in configuration or properties and because they are not replaced based on qualified life or specified time period. The staff reviewed each of the above tables and compared the descriptions in each LRA and the UFSARs for both plants to determine whether there were any components or commodities within the boundary of the other Class 1 structures that the applicant did not identify within the scope of license renewal or did not identify in the tables subject to an AMR. On the basis of this review, the staff has made the following findings:

In Section 2.4.3 of the NAS LRA, the applicant describes the auxiliary feed-water pump house, auxiliary feed-water tunnel, casing cooling pump house, service water pump house, service water pipe expansion joint enclosure, service water valve house, and service water tie-in vault that are Class 1 structures within the scope of license renewal. However, Section 2.4.3 of the SPS LRA does not address any equivalent structures that perform similar functions for the Surry plant. The staff asked that the applicant to verify whether there are any structures at the Surry plant that house and protect the equipment of the auxiliary feed-water systems, or the service water systems that should be included in the scope of license renewal.

In its response, the applicant stated that the Surry plant does not have these specific structures. The auxiliary feedwater systems are located in the main steam valve house along with their piping (part of the piping is buried in the yard). The part of the service water system that includes the emergency service water pumps is located in the low-level intake structure, which is addressed in Section 2.4.6 of the SPS LRA. The casing cooling pump system is not required at the Surry plant, because the net positive suction head for the recirculating spray system pumps is not needed for the Surry plant. Based on the applicant's response, the staff found that the applicant did not omit any Class 1 structures in the Surry plant that should be within the scope of license renewal.

In Section 2.4.3 of the NAS LRA, the applicant states that the floor of the service water pipe expansion joint enclosure is a reinforced-concrete slab on grade and the reinforced-concrete walls are supported on concrete footings. However, the concrete footings are not listed in Table 2.4.3-9 of the NAS LRA as a component group subject to an AMR. The staff asked the applicant to verify the table for completeness. In its response, the applicant stated that the on-grade slab is monolithic with the footing. The footings are evaluated as part of the on-grade slab and are not listed as a separate item. The staff confirmed that the footings are subject to an AMR.

In Section 2.4.3 of the NAS LRA, the applicant states that the structures of the service water pump house and service water valve house have missile-protected reinforced-concrete roof openings. However, Tables 2.4.3-8 and 2.4.3-10 of the NAS LRA did not list these missile-protected roof openings as components subject to an AMR. The applicant explained that these roof openings are identified as "concrete hatches" in the tables and one of their intended functions listed in the tables is "missile barrier." The staff confirmed that these roof openings are subject to an AMR.

Section 3.8.1.1.7 of the NAS UFSAR states that the service water pump house contains among other things, screen wells, traveling screens, basket, pump missile barriers, pump house footing, and wing walls. However, these structural components are not discussed in Section 2.4.3 of the NAS LRA nor listed in Table 2.4.3-8 of the NAS LRA. The staff asked that the applicant explain why these components were not included in the scope of license renewal.

In its response, the applicant stated that the screen wells, which have concrete walls and floors, are addressed as part of the structural walls and floors of the service water pump house. The traveling screens are identified in Table 2.3.3-6 of the NAS LRA as "filters/strainers" in the service water system. The baskets do not perform any intended function and are not included in scope. The pump missile barriers are addressed as part of internal and external walls of the service water pump house. The footing for the service water pump house is identified in Table 2.4.3-8 of the NAS LRA as the foundation mat slab. The wing walls are addressed as part of the external walls of the service water pump house. The staff found that components of concern were included in the scope and subject to an AMR for license renewal.

In Section 2.4.3 of the SPS LRA, the applicant states that the fire pump house is divided by a wall with a metal door forming two separate rooms. Section 9.10.4.23 of the SPS UFSAR states that the door in this wall is fire rated in excess of 3 hours. However, this interior fire door is not listed in Table 2.4.3-5 of the SPS LRA as a component subject to an AMR. The staff asked that the applicant verify the table to ensure its completeness. In its response, the applicant stated that the fire door in question is listed in Table 2.4.3-5 of the SPS LRA as "missile protection door" with the intended functions of both missile barrier and fire barrier. The staff confirmed that the fire door is subject to an AMR.

In Section 2.4.3 of the SPS LRA, the applicant states that the containment spray pump building consists of containment spray and refueling water recirculating pump areas that are within the scope of license renewal. Section 9.10.4.13 of the SPS UFSAR states that the containment spray pump building and auxiliary feed-water pump building for each unit are essentially identical structures, each located adjacent to the containment of its unit. However, the auxiliary feed-water pump building is not addressed in Section 2.4.3 of the SPS LRA. The staff asked why the auxiliary feed-water pump building is not within the scope of license renewal.

In its response, the applicant stated that the buildings which are described in Section 9.10.4.13 of the SPS UFSAR that house the containment spray pumps and the auxiliary feed-water pumps, are physically two structures, i.e., the containment spray pump building and the main steam valve house. Actually, the auxiliary feed-water pumps are located in the main steam valve house, which is included in the scope of license renewal as described in Section 2.4.3 of the SPS LRA. The staff found the applicant's response acceptable.

The staff has completed its review of the information presented in Section 2.4.3 of each LRA, the UFSAR for each plant, and additional information provided by the applicant in response to the staff's questions. As a result of the above review, the staff did not find any omissions by the applicant related to scoping the structures for license renewal as defined under 10 CFR 54.4(a). The staff also found no omissions in screening the components of the Class 1 structures that require an AMR.

2.4.3.3 Conclusions

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

2.4.4 Fuel Building

In the North Anna and Surry LRAs, Section 2.4.4, "Fuel Building," the applicant describes the structures of the fuel building and identifies its structural components that are within the scope of license renewal and subject to an AMR. The fuel building consists of the following major structures in each plant:

- fuel building structure
- new fuel storage area
- fuel pool (including transfer canals)
- spent fuel storage racks

The design of the fuel building structures is described in Sections 3.8.1.1.4 and 9.4.5 of the NAS UFSAR, and Section 9.10.4.14 of the SPS UFSAR. The staff reviewed this information provided by the applicant to determine whether the applicant has demonstrated that the requirements of 10 CFR 54.4 and 10 CFR 54.21 were met for the structures of the fuel building.

2.4.4.1 Summary of Technical Information in the Application

Fuel Building Structure

In Section 2.4.4 of each LRA, the applicant states that the fuel building, located between the two reactor containment buildings, is a seismic Class 1 structure that is common to both units. The fuel pool and exterior reinforced-concrete walls of the fuel building substructure are supported by a reinforced-concrete mat foundation. For the North Anna plant, the mat foundation is founded on bedrock. For the Surry plant, the mat foundation is founded on concrete-filled steel pipe piles. The substructure of the fuel building consists of an intermediate reinforced-concrete floor slab, beams, interior walls, and masonry walls. A reinforced-concrete pipe tunnel is built on the top of the foundation mat. The superstructure of the fuel building extends from the top of the reinforced-concrete walls to the roof which is supported by structural steel framing and enclosed with insulated metal siding (blow-off metal panel). The roof is covered with insulated metal decking and a single-ply, mechanically attached membrane roofing system.

New Fuel Storage Area

The new fuel storage area in the fuel building is provided to hold new fuel assemblies for one-third of a replacement core. The new fuel assemblies are stored in the specially designed seismic Class 1 array racks. These racks consist of 126 stainless steel square guide tubes, which are supported by a structural steel network at the top and horizontally restrained at the bottom. The fuel assemblies are inserted in these guide tubes on the racks that are supported by concrete floor of the new fuel storage area.

Spent Fuel Pool and Fuel Transfer Canals

The spent fuel pool provides storage for the spent fuel received from the containment through the fuel transfer tubes, which enter the fuel transfer canals on the east and west ends of the fuel building. The spent fuel pool and fuel transfer canals are seismic Class 1 reinforced-concrete structures lined inside with stainless steel plates. During normal operation of both Units, the fuel transfer tube is isolated with a blind flange on the reactor cavity side and a gate valve on the pool side. The fuel transfer canal can be isolated from the pool with movable stainless steel gates. For the North Anna plant, the spent fuel pool has a stainless-steel-lined, reinforced-concrete wall, which separates the spent fuel cask area from the spent fuel storage racks. For the Surry plant, fuel cask impact pads are provided in the pool to protect the floor from damage in the event of a spent fuel pool cask dropping accident.

Spent Fuel Storage Racks

The spent fuel storage racks in the spent fuel pool are high-density racks submerged in borated water. These racks, which hold the spent fuel assemblies, are seismic Class 1 structures erected on the pool floor. The racks are free-standing on the floor support pads, and are integrally connected to embedded plates.

2.4.4.2 Staff Evaluation

The staff reviewed Section 2.4.4 of each LRA and the UFSARs of each plant to determine whether the applicant has identified the structures of each of the fuel buildings that are within the scope of license renewal in accordance with 10 CFR 54.4(a), and the components and commodities that require an AMR in accordance with 10 CFR 54.21(a)(1). After completing its initial review, the staff requested additional information from the applicant by an E-mail on September 24, 2001. The applicant responses are documented in a telecommunication summary dated October 25, 2001, and its letter submitted on May 22, 2002.

The applicant identified 20 generic component groups in the fuel building for the North Anna plant and 22 for the Surry plant and their intended functions in Table 2.4.4-1 of the respective LRA. These components and commodities in scope are subject to an AMR because the specified intended functions, as indicated in the tables, are performed without moving parts or without change in configuration or properties, and are not subject to replacement based on qualified life or specified time period as specified under 10 CFR 54.21(a)(1). The staff examined these components in the LRA tables and compared them with the descriptions in the LRA and UFSAR. The staff did not find any omissions except two.

In Section 2.4.4 of each LRA, the applicant describes the reinforced-concrete pipe tunnel for the fuel building, and the fuel transfer canals for the spent fuel pool. The applicant did not list the structural components for these structures in Table 2.4.4-1 of neither LRA. In an RAI, the staff requested the applicant to clarify whether these components were within the scope of license renewal. In its response, the applicant stated that the fuel pool, including fuel transfer canals, consists of reinforced-concrete walls above the mat foundation. The mat foundation and all walls are included in Table 2.4.4-1 of each LRA. The "walls" and "floor slabs" listed in the tables envelop the structural components of the concrete pipe tunnel for the fuel building structure. Therefore, the pipe tunnel was not listed separately. The staff found the applicant's response acceptable and confirmed that all the components of the pipe tunnel and fuel transfer canals are subject to an AMR.

Section 9.1.2 of the NAS UFSAR describes the spent fuel storage and indicates that a movable platform crane is used to move the three spent fuel gates. However, the platform crane is not described in Section 2.4.4 or identified in Table 2.4.4-1 of the NAS LRA. The staff asked that the applicant to verify whether the crane is within the scope of license renewal. The applicant stated that the movable platform crane is within the scope of license renewal and is identified as the fuel handling bridge crane in Section 2.4.12 of the NAS LRA. The staff found the applicant's response acceptable.

The staff has completed its review of the structures within the boundary of the fuel building and did not find any omissions by the applicant related to scoping and screening of the structures and components.

2.4.4.3 Conclusions

On the basis of the review described above, the staff concludes that there is reasonable assurance that the applicant has adequately identified the structures and components associated with the fuel building 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.

2.4.5 Miscellaneous Structures

In the North Anna and Surry LRAs, Section 2.4.5, "Miscellaneous Structures," the applicant described the miscellaneous structures. The applicant has determined that the following buildings at either NAS or the SPS plant or both are the structures that are within the scope of license renewal:

- turbine building
- service building
- station blackout (SBO) building
- security diesel building
- condensate polishing building (Surry plant)
- black battery building (Surry plant)
- radwaste facility (Surry plant)
- maintenance building (North Anna plant)

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 were met for the above miscellaneous structures and their structural components. The design of these buildings is described in Sections 3.8.1.1, 7.8, 9.4.1, and 13.3 of the NAS UFSAR, and Sections 8.4.6, 9.10.4, 9.9.2.1, 9.13.3 of the SPS UFSAR.

2.4.5.1 Summary of Technical Information in the Application

Turbine Building

In Section 2.4.5 of each LRA, the applicant identified the turbine building as being within the scope of license renewal because failure of the structure could impact the adjacent safety-related structures. Two turbine buildings in each plant (one for each unit) house the turbine generators, condensers, feed-water heaters, pumps, and associated components and equipment. The turbine building is a non-safety-related structure that is constructed with a reinforced-concrete substructure and a steel framing superstructure. The substructure consists of below-grade reinforced-concrete walls, footings, and grade beams. The above-grade superstructure is a structural steel building enclosed with metal sidings. The roof is made of metal decking covered with a membrane roofing system.

In NAS, the portion of the turbine building adjacent to the main control room was designed for tornado wind loads to prevent its collapse on the main control room. In SPS, the turbine building contains several seismic Class 1 structures, including the battery room 2B, component cooling water heat exchangers floor slab (missile barrier), and mechanical equipment room No.4. These rooms have reinforced-concrete walls that protect the safety-related equipment. In SPS, Unit 2, the turbine building also houses portions of the equipment and components of the station blackout system. Therefore, the turbine buildings in SPS 1/2 were designed for seismic and tornado wind loads so that a seismic event will not impact the Class 1 structures within the turbine building.

Service Building

The service building, located between the auxiliary building and the turbine building, is a multistory reinforced-concrete structure that serves both Units. The building is founded on reinforced-concrete piers, spread footings, and grade beams. Thick reinforced-concrete walls around the cubicles are provided in the service building for tornado missile and radiation protection. The following cubicles and rooms in the service building at either the NAS or the SPS or both plants are within the scope of license renewal because they protect safety-related equipment or non-safety-related equipment which can affect the safety-related equipment function:

- emergency switchgear and relay rooms
- control room
- emergency diesel generator rooms
- battery rooms
- cable tray rooms
- cable vault (at column line E)
- normal switchgear rooms
- stairwell
- technical support center
- mechanical equipment room 3 (Surry-specific name, MER-3)
- AC chiller rooms (North Anna-specific name, functionally equivalent to MER-3))
- mechanical equipment rooms 1 and 2 (Surry-specific name, MER-1, MER-2)
- mechanical equipment rooms (North Anna-specific name, functionally equivalent to MER-1 and MER-2)
- instrument repair shop (NAS 1/2)

In the above cubicles, the emergency switchgear and relay rooms, battery rooms, cable vault, emergency diesel generator rooms, AC chiller rooms, and the control room are the seismic Class 1 structures. The cable tray rooms, normal switchgear rooms, technical support center, mechanical equipment rooms, instrument repair shop, and stairwell are the non-safety structures. Each of four diesel generator rooms contains one emergency diesel generator and its auxiliary equipment. The cable tray rooms and normal switchgear rooms house the station blackout (SBO) equipment and components. The technical support center houses the essential fire-protection-related equipment and the stairwell provides access to the fire protection equipment. The instrument repair shop houses the essential fire protection components. The control room that serves both units is designed to provide fire, biological, and tornado missile protection.

Station Blackout Building

The station blackout building is a single story non-seismic structure that houses the AAC diesel generator and its associated auxiliaries. The diesel generator and its components in the SBO building are non-safety-related. However, the SBO building is within the scope of license renewal because the diesel generator provides alternate power to the safe shutdown equipment in the event of a station blackout. The upper portion of the SBO building is a steel frame structure enclosed with metal siding. The lower portion of the SBO building has exterior reinforced-concrete walls founded on reinforced-concrete piers and spread footings. The roof is covered with metal decking and a membrane roofing system.

Security Diesel Building

The security diesel building is a non-seismic single story building that houses the security diesel generator. It is a reinforced-concrete structure supported on a mat foundation. The roof is a reinforced-concrete slab.

Condensate Polishing Building (SPS)

The condensate polishing building is a non-safety and non-seismic structure that houses the SBO system cables and raceways. The applicant determined that the portion of the building that support the SBO system cables and raceways, is within the scope of license renewal.

Black Battery Building (SPS)

The black battery building houses numerous DC loads, including the power supply equipment (batteries and associated accessories) for the actuation circuitry panel of the anticipated transient without scram (ATWS) mitigation system located in the service building. The building is a non-safety, non-seismic structure. Since the batteries and accessory equipment are supported by the reinforced-concrete on-grade floor slab, the applicant determined that only the floor slab on grade is within the scope of license renewal.

2.4.5.2 Staff Evaluation

The staff reviewed Section 2.4.5 of each LRA and the UFSARs to determine whether the applicant has adequately identified the structural components and commodities of the miscellaneous structures specified in each LRA that are within the scope of license renewal and subject to an AMR. After completing the initial review, the staff requested additional information to clarify some of these structures (E-mail to the applicant on September 24, 2001). The applicant responded to the staff's questions via E-mail on October 4, 2001. The staff's evaluation of these structures is described below:

Turbine Building

The applicant listed 20 generic component groups and their intended functions in Table 2.4.5-1 of the NAS LRA for the turbine building of the North Anna plant and lists 24 in Table 2.4.5-1 of the SPS LRA for the turbine building of the Surry plant. The components listed in both tables are essentially identical except the Surry turbine building has more components than the North Anna turbine building because of building design differences. The staff reviewed the LRA and

UFSAR of each plant and examined the components listed in the table. The staff did not find any significant omissions except the following components which are addressed in each LRA and are not listed in Table 2.4.5-1 of each LRA as being subject to an AMR: metal siding, sliding fire-rated steel doors, fire barrier penetrations, and fire barrier seals. In addition, Section 9.10.4.18 of the SPS UFSAR states that cable trays are located at all elevations of the turbine building. These cable trays and their supports are not addressed in Section 2.4.5 or listed in Table 2.4.5-1 of the SPS LRA. The staff asked that the applicant provide additional information for these components.

In its response, the applicant stated that the metal siding is not included in the table because it does not perform any intended function. All types of fire-rated doors and fire barrier penetration seals are addressed generically in Section 2.4.11 and listed in Table 2.4.11-1 of each LRA as "miscellaneous structural commodities." The cable trays and supports are addressed in Section 2.5.4.10 of each LRA as "the general structural supports." The staff's review found that the applicant did not omit any of these components that require an AMR.

Service Building

The applicant listed 28 generic component groups and their intended functions for the service building in Table 2.4.5-2 of the NAS LRA for the North Anna plant, and listed 31 of them in Table 2.4.5-2 of the SPS LRA for the Surry plant. The staff reviewed these tables and compared the components described in each LRA and UFSARs for each plant. The staff did not find any omissions, except the following components, which are not listed in Table 2.4.5-2 of either LRA as being subject to an AMR: reinforced-concrete piers, structural steel framing that supports floor slabs, flood protection barriers, fire-rated doors and fire barriers. The staff asked that the applicant verify the LRA tables to ensure their completeness.

In its response, the applicant stated that the concrete piers are included in the commodity group "footing and grade beam." Structural steel framing that supports floor slabs is included in the commodity group "concrete floor support framing and decking." Flood protection barriers are included in the component commodity group "flood barrier." The fire-rated doors and fire barriers are covered in Section 2.4.11 of each LRA as "miscellaneous structural commodities." The staff confirmed that these components, which require an AMR, were included in each LRA table.

Station Blackout Building

The applicant listed 10 generic component groups and their intended functions in Table 2.4.5-3 of each LRA. The staff reviewed the information in each LRA and UFSARs and did not find any omissions.

Security Diesel Building

The applicant listed the foundation mat slabs, roof slabs, and external walls in Table 2.4.5-4 of the NAS LRA as the structural components of the security diesel building for the North Anna plant. The applicant also listed the foundation mat slabs, masonry block walls, roof framing and decking, and steel beams in Table 2.4.5-4 of the SPS LRA as the structural components of the security diesel building for the Surry plant. The different listing in the different tables is due to the building design of the two plants. The staff reviewed the applicant's submittals and did not find any omissions.

Condensate Polishing Building (SPS)

The applicant listed seven generic component groups with their intended functions in Table 2.4.5-5 of the SPS LRA for the condensate polishing building of the Surry plant. The North Anna plant does not have such a building. In Section 2.4.5 of the SPS LRA, the applicant addresses the function of the building but does not describe its structures. The staff asked the applicant to provide additional information on the portion of the structure that supports the SBO system cables and raceways, which are in scope for license renewal.

In its response, the applicant stated that the cables and raceways of the SBO system are located in the west of column line B.8 of the condensate polishing building. The structural steel between column lines B.6 and B.8, and column line 17.2 through 20 supports the cables and raceways for the SBO system. The portion of the foundation mat that supports the columns meets license renewal Criterion 3. These structures that support the cables and raceways are the only portions of the building that are in scope and subject to an AMR for license renewal. The staff reviewed Table 2.4.5-5 of the SPS LRA and did not found any omissions.

Black Battery Building (SPS)

The applicant listed "slabs on grade" and "grout" in Table 2.4.5-6 of the SPS LRA as the components of the black battery building subject to an AMR. The staff reviewed this information in the LRA and UFSAR and did not find any omissions.

2.4.5.3 Conclusions

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the structures and components associated with each of the miscellaneous structures in each LRA 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 10 CFR 54.21(a)(1), respectively.

2.4.6 Intake Structures

In the North Anna and Surry LRAs, Section 2.4.6, "Intake Structures", the applicant describes the intake structures and identifies their components and commodities that are within the scope of license renewal and subject to an AMR. The intake structures of the North Anna and the Surry plants have different design except the discharge tunnels and seal pit are similar in design. The intake structure of each plant includes the following structures.

North Anna Intake Structure

- intake structure, including circulating water intake tunnel header, auxiliary service water pump house, fire pump house, and intake structure control house
- discharge tunnel and seal pit

Surry Intake Structure

- low-level intake structure, including the emergency service water pump house
- high-level intake structure
- concrete circulating water pipe
- discharge tunnel and seal pit

The design of the intake structures is described in Section 3.8.1.1.9 of the NAS UFSAR for the North Anna plant, and in Section 9.10.4.16 of the SPS UFSAR for the Surry plant. 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 were met for the intake structures.

2.4.6.1 Summary of Technical Information in the Application

North Anna Intake Structure

The North Anna intake structure, located on the shore of the North Anna reservoir is an eight-bay (four bays serve each unit) reinforced-concrete structure supported by a reinforced-concrete mat foundation on soil. The intake structure draws water from the reservoir and provides cooling water to the main condensers for both units. There are two reinforced-concrete wing walls on the waterside corners of the intake structure to direct water into the bay. The interior walls of the intake structure separate the eight bays. Each bay has an associated circulating water pump and two of the bays have a motor-driven auxiliary service water pump. The auxiliary service water pump house and fire pump house are located on the exposed deck of the intake structure. The safety-related auxiliary service water pump house, fire pump house, and the intake structure control house at the west side of the intake structure are within the scope of license renewal. The electrical cable that runs from the intake structure control house to the auxiliary fire pump is routed in a concrete duck bank (in the area of yard structures) which is supported by the intake tunnel header. Therefore, the intake tunnel header is also within the scope of license renewal.

The outlet water from the main condensers is directed to a reinforced-concrete discharge tunnel (one for each unit). The Unit 2 discharge tunnel combines with the Unit 1 discharge tunnel (opposite to Unit 1 condensers) to form a common tunnel which shares an inner wall. The two tunnels terminate at a seal pit, which is a reinforced-concrete outlet structure. The discharge tunnels and the seal pit are within the scope of license renewal.

Surry Intake Structure

The Surry intake structure consists of a low-level intake structure and a high-level intake structure. The low-level intake structure draws water from the James River and pumped the water into an intake canal to provide the cooling water for the main condensers and the service water system. The low-level intake structure is an eight-bay (four bays serve each unit) reinforced-concrete structure supported by a reinforced-concrete mat foundation on soil. Before entering the intake structure, the inlet water passes through a trash rack and traveling screen located at the mouth of each bay or screen well to remove the debris from water. The trash racks are supported by the steel beams between the mat foundation and the top slab of the intake structure.

Each bay has an associated circulating water pump, and three of the eight bays have an emergency diesel-driven service water pump. The emergency service water pump house and the electrical equipment room are located on the exposed deck of the intake structure. The emergency service water pump house is a reinforced-concrete structure that is divided into two rooms, i.e., service water pump room and diesel fuel-oil storage room. The entrances to the service water pump room and the diesel fuel-oil storage room are missile-protected and have flood barriers.

The safety-related high-level intake structure for each unit is located at the station end of the intake canal that provides conduits for water flow from the intake canal to the 96-inch-diameter reinforced-concrete circulating water pipe located at the end of each bay area. The high-level intake structure is a four-bay reinforced-concrete structure supported by a reinforced-concrete mat foundation that is founded on natural soil. The four bays are separated by reinforced-concrete interior walls and an exposed deck is built on top of the walls. Each of the four bays directs water from the intake canal to the 96-inch-diameter pipe that provides the cooling water for the safety-related plant shutdown systems. Circulating water flows from the high-level intake structure through the four pipes to the main condenser and then returns through four separate pipes to a safety-related discharge tunnel.

A separate discharge tunnel for each unit continues to the discharge canal. Each discharge tunnel ends at a seal pit at the edge of the discharge canal. The discharge tunnel is a reinforced-concrete structure supported on soil. The seal pit has a reinforced-concrete weir wall across the mouth of the discharge tunnel. The weir forms a dead end that maintains the water level at an elevation so that flow through the system is slow enough to keep the condenser discharge water box full.

2.4.6.2 Staff Evaluation

The staff reviewed Section 2.4.6 of both the NAS LRA and SPA LRA and the UFSARs to determine whether there is reasonable assurance that the applicant has properly identified and listed those structures and components of the intake structures for each plant to meet the requirements stated in 10 CFR 54.21(a)(1). After completing its initial review, the staff requested additional information from the applicant by an E-mail on September 24, 2001. The applicant responded to the staff's questions via an E-mail, dated October 4, 2001. The staff's evaluation of each of the intake structures is described below.

North Anna Intake Structure

The applicant identified the intake structure, intake tunnel header, auxiliary service water pump house, fire pump house and the intake structure control house as the structures within the boundary of the intake structure that are within the scope of license renewal. The staff reviewed Section 2.4.6 of the NAS LRA and found that some of the structures of the intake structure were not clearly described. The staff asked that the applicant provides information on the structural components of the exposed deck and the pump house on top of the deck. The applicant's response was summarized in Section 2.4.6.1 of this report as the technical information.

The North Anna intake structure has eight bays and each bay has a trash rack and traveling screen at the mouth of the bay that prevents debris entering into the intake tunnel. The applicant determined that only two of the eight trash racks associated with the safety-related auxiliary service water system and one trash rack associated with the auxiliary fire pump are within the scope of license renewal. Due to fire protection regulations, the intake structure control house at the west side of the intake structure is also in-scope. The staff's review found the applicant's determination for the structures in scope acceptable because these structures perform the intended functions as defined in 10 CFR 54.4(a). The intake structure of the North Anna plant comprises various structural components and commodities that are within the scope of license renewal. The applicant listed 20 generic component groups and their intended functions in Table 2.4.6-1 of the NAS LRA that are subject to an AMR. Some of the structural components do not contribute to any of the intended functions defined in 10 CFR 54.4(a), the applicant has justified not to include them in the table.

The staff has examined the components and commodities listed in Table 2.4.6-1 of the NAS LRA and did not identify any omissions by the applicant in the structures within the boundary of the intake structure that were included within the scope of license renewal as defined in 10 CFR 54.4(a). The staff also found no omissions in the components of the intake structure included in the applicant's AMR that perform their intended functions without moving parts or without a change in configuration or properties, or that are not replaced based on a qualified life or specified time period.

Surry Intake Structure

The staff reviewed the information provided in Section 2.4.6 and Table 2.4.6-1 of the SPS LRA and found that the design of the Surry intake structure is different from the North Ann intake structure. The low-level intake structure for the Surry plant is similar to the North Anna intake structure. However, North Anna plant does not have the high-level intake structure. The Surry low-level intake structure has eight bays with a trash rack in each bay. The applicant determined that three of the eight bays and their trash racks associated with the emergency service water pumps are within the scope of license renewal. The safety-related emergency service water pump house is in scope, but the electric equipment room is not in scope. The staff's review finds that the scoping of the low-level intake structure meets the requirements of 10 CFR 54.4.

The Surry plant has a safety-related high-level intake structure for each unit at the station end of the intake canal. Each high-level intake structure has four bays separated by reinforced-concrete interior walls and a exposed deck that is built on top of the walls. Trash racks are provided at the mouth of each bay. The applicant determined that all four of the Unit 1 trash racks associated with the emergency service water system are in scope. Two of the Unit 2 trash racks are within the scope of license renewal because they are associated with the emergency service water system. Each of the four bays directs water from the intake canal into the 96-inch-diameter concrete circulating water pipe. The outlet water from the condensers is directed to a single concrete discharge tunnel. A safety-related discharge tunnel is provided for each unit that ends at a seal pit. The applicant determined that the concrete circulating water pipe, the discharge tunnel and seal pit are within the scope of license renewal. The staff's review found that including these structures within the scope of license renewal meets the intent of 10 CFR 54.4.

The applicant listed 17 generic component and commodity groups and their intended functions in Table 2.4.6-1 of the SPS LRA for the low-level intake structure and listed 11 of them in

Table 2.4.6-2 of the SPS LRA for the high-level intake structure. The applicant listed 3 components and their intended functions in Table 2.4.6-3 of the SPS LRA for the concrete circulating water pipe and listed concrete tunnels, seal pits, and weirs in Table 2.4.6-4 of the SPS LRA for the discharge tunnels and seal pits. The component groups in these tables are subject to an AMR because applicable intended functions are performed without moving parts or without a change of configuration or properties, and they are not replaced on a qualified life or specified time period. The staff reviewed Tables 2.4.6-1 through 2.4.6-4 of the SPS LRA and the information in Section 2.4.6 of the LRA and the UFSAR for the Surry plant, and the additional information submitted by the applicant in response to the staff's questions. Based on this review, the staff did not find any omissions by the applicant related to scoping and screening the Surry intake structures. The staff's review also found that all the long-live and passive structures and components identified within the scope of license renewal were subject to an AMR.

2.4.6.3 Conclusions

On the basis of this review, the staff concludes that there is reasonable assurance the applicant has adequately identified those portions of the structures and components within the boundary of the intake structures for both the North Anna plant and the Surry plant that are within the scope of license renewal and the associated components and commodities that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(A) and 10 CFR 54.21(A)(1), respectively.

2.4.7 Yard Structures

In the North Anna and Surry LRAs, Section 2.4.7, "Yard Structures," the applicant described the yard structures and identified their structural components at each plant site that are within the scope of license renewal and subject to an AMR. As described in Section 2.4.7 of each LRA, the applicant has identified the following yard structures at the North Anna or the Surry plant or both that are within the scope of license renewal:

- buried fuel oil tank missile barrier
- chemical addition tank foundation
- emergency condensate storage tank foundation and missile barrier
- refueling water storage tank foundation
- casing cooling tank foundation (NAS 1/2)
- fire protection/domestic water tank foundation (SPS 1/2)
- fuel oil lines missile barrier (SPS 1/2)
- manholes
- fuel oil storage tank dike
- transformer fire walls and dikes
- duct banks
- security lighting poles
- domestic water treatment building (NAS 1/2)
- auxiliary service water expansion joint enclosure (NAS 1/2)
- yard valve pit (NAS 1/2)
- containment mat sub-surface pump access shaft

The design of the yard structures is addressed in Sections 6.2.2.2, 9.5.1.3, 9.5.1.4, 9.5.4.3, and 10.4.3.3 of the NAS UFSAR for the North Anna plant and Sections 6.3.1.3, 8.4, 8.5, 9.10.2., 9.10.4, and 10.3.5 of the SPS UFSAR for the Surry plant.

2.4.7.1 Summary of Technical Information in the Application

Buried Fuel Oil Tank Missile Barrier

There are two underground fuel oil tanks which provide fuel oil to the three emergency diesel generators. A 2-foot-thick reinforced-concrete slab is provided on top of the tanks for missile protection. The applicant determined that the slab on grade is within the scope of license renewal.

Chemical Addition Tank Foundation

The chemical addition tanks for the North Anna plant are tied with anchor bolts to the reinforced-concrete mat foundations. The chemical addition tanks for the Surry plant are supported by reinforced-concrete spread footings on soil approximately 9 feet below grade. The tank is attached to an octagon-shaped pedestal with anchor bolts. The pedestal is keyed and integral to the spread footing. The applicant determined that the mat foundation, spread footing, and pedestal are within the scope of license renewal.

Emergency Condensate Storage Tank Foundation and Missile Barrier

The emergency condensate storage tanks are tied with anchor bolts to the 4-foot-thick reinforced-concrete mat foundations on soil and are encapsulated by 2-foot-thick walls and roof for missile protection. For the North Anna plant, the roof has a 20-inch opening which is covered with a carbon steel blind flange for access and missile protection. For the Surry plant, a 2-foot reinforced-concrete hatch is provided on the roof for access and missile protection. The applicant determined that the mat foundations, tank enclosures, and missile shields are in scope for the license renewal.

Refueling Water Storage Tank Foundation

The refueling water storage tanks are tied with anchor bolts to a reinforced-concrete mat foundation. For the North Anna plant, the mat foundation is built on sound rock. For the Surry plant, the mat foundation is supported by concrete-filled steel pipe piles. The mat foundations and steel pipe piles are within the scope of license renewal.

Manholes

The concrete manholes within the scope of license renewal are the small reinforced-concrete structures that are cast in place and soil supported. These manholes are located underground with access openings at grade level. The openings of the safety-related manhole are protected with steel manway covers for missile protection. For the North Anna plant, some of the manholes for cable installation and removal have concrete hatches with missile barriers. For the Surry plant, the electrical concrete manhole No.1 is divided into two sections and its roof is covered with a carbon steel plate as a missile-resistant shield. The manholes and their accessaries are within the scope of license renewal.

Fuel Oil Storage Tank Dike

The fuel oil storage tank dike is a 12-inch-thick reinforced-concrete wall supported on a spread footing on soil. The dike is sized to contain the entire 210,000 gallons of fuel oil in the tank. The walls and spread footings are in scope.

Transformer firewalls/dikes

The main and station service transformers for Units 1 and 2 are protected from fire. They are separated from each other by a 12-inch concrete fire wall that is supported on a soil-supported spread footing. The transformers sit on a bed of crushed stone with a 6-inch-high dike surrounding each transformer to prevent oil spreading. The dike walls and crushed stone pits are sized to contain the full volume of the oil from a transformer. The dikes, fire walls, and crushed stone pits are in scope.

Duct Banks

The duct banks, which protect or support the cable duct, are the reinforced-concrete structures founded on soil. For the Surry plant, the reinforced-concrete transition box, pull box, and cable trench are installed on the duct banks between the station blackout building and the condensate polishing building. The duct banks are buried with a portion above ground. The duct banks, pull box, transition boxes, and trenches are in scope.

Security Lighting Poles

The security lighting poles are required for Appendix R safe shutdown. The poles at NAS and SPS are different in design. At the North Anna plant, 17 security lighting poles installed in the yard area provide security lighting for operator access to various components in other buildings or structures. The NAS poles are galvanized steel poles supported on a 3-foot-square reinforced-concrete foundation tied with anchor bolts to the base plate which is welded to the base of the pole. For the Surry plant, eight security lighting poles in the yard area provide illumination for operator access to various components in other building or structures. These are the reinforced-concrete poles which are buried directly into ground soil. The lighting poles and foundations are within the scope of license renewal.

North Anna Casing Cooling Tank Foundation

Each unit of the North Anna plant has a 26-foot-diameter casing cooling tank that is supported on a common reinforced-concrete mat foundation. The tank is located adjacent to corresponding casing cooling pump house. The tank is tied with anchor bolts to a mat foundation that is supported on rock. The mat foundation is within the scope of license renewal.

North Anna Domestic Water Treatment Building

The domestic water treatment building of the North Anna plant is a one-story building enclosed with masonry block walls and built-up roofing. The building houses the 475-gallon hydropneumatic tank associated with the fire protection system and is supported by a reinforced-concrete mat foundation. The applicant determined that only the mat foundation is within the scope of license renewal.

North Anna Auxiliary Service Water Expansion Joint Enclosure

The auxiliary service water expansion joint enclosure, located adjacent to the intake structure, is an underground reinforced-concrete structure on soil. The enclosure protects and provides access to the expansion joints, which accommodate movement in the 24-inch auxiliary service water lines and the 8-inch service water makeup line. The top of the structure is missile-protected with a reinforced-concrete roof and a manhole access opening on top of the roof is protected with a missile-resistant cover. There are two reinforced-concrete hatches on the top of the structure for equipment installation and removal. The enclosure and its associated components are within the scope of license renewal.

North Anna yard valve pit

The yard valve pit is an underground reinforced-concrete structure that is installed in line with the expansion joint enclosure structure. The valve pit encloses, protects, and provides access for the two 24-inch safety-related auxiliary service water lines and the 8-inch service water makeup line. The reinforced-concrete roof and its three reinforced hatches are missile-protected. A steel platform inside the structure provides access to the valves and associated equipment. The structural components subject to an AMR are listed in Table 2.4.7-8 of the NAS LRA.

Surry Fire Protection/domestic Water Tank Foundation

There are two 300,000-gallon fire protection/domestic water tanks in the Surry plant adjacent to the fire pump house. The tanks are supported on well-tamped sand and gravel with a 2-inch oiled-sand cushion on top that is confined within a 2½-foot-deep reinforced-concrete ring wall at grade level just outside the perimeter of the tank. The foundation ring wall is in-scope for license renewal.

Surry Fuel Oil Lines Missile Barriers

The fuel oil lines in the Surry plant are buried sufficiently deep that the covering soil provides an adequate missile barrier. The fuel oil lines at outside of the fuel oil pump house are protected with a 10-foot long reinforced-concrete slab on soil (as a missile barrier). A bridge missile barrier, consisting of a reinforced-concrete slab resting on steel plate, protects the fuel oil lines where they are routed over the top of the enclosed concrete liquid waste trench on their way to the emergency diesel generator room. The 25-ft long bridge for missile protection rests on spread footings. The missile shields, slabs on soil, and spread footings are in-scope for license renewal.

2.4.7.2 Staff Evaluation

The staff reviewed Section 2.4.7 and Tables 2.4.7-1 through 2.4.7-8 of the NAS LRA and Section 2.4.7 and Table 2.4.7-1 through 2.4.7-5 of the SPS LRA and the UFSARs to determine whether the applicant has adequately implemented its methodologies such that there is reasonable assurance that the structures and components comprising the yard structures in each plant were properly identified 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(a)(1). After completing the initial review, the staff requested additional information from the applicant by E-mail on September 24, 2001. The applicant responded to the staff's questions via an E-mail, dated October 4, 2001. The staff reviewed the additional information and drawings submitted by the applicant in response to the staff's questions to determine whether there were any structures or components within the boundary of the yard structures that the applicant did not identify subject to an AMR. On the basis of this review, the staff identified the findings as described below:

In Section 2.4.7 of the NAS LRA, the applicant describes the yard structures for the North Anna plant. The staff's review found that the following structural components for the tank foundations are not listed in Table 2.4.7-1 of the NAS LRA subject to an AMR: carbon steel blind flange cover for the emergency condensate storage tank, anchor bolts for the refueling water storage tank foundation and the casing cooling tank foundation. Also, it is not clear whether there are any concrete pits or foundations to support the two underground fuel oil tanks. The staff asked that the applicant verify the table to ensure its completeness.

In its response, the applicant stated that the carbon steel blind flange cover for the emergency condensate storage tank is listed in Table 2.4.7-1 under "missile shields." In Table 3.5.7-1, the missile shields are listed as carbon steel. Anchor bolts are not uniquely identified in the table. The embedded portion of anchor bolts is considered steel embedded in concrete (like a reinforcing bar) and evaluated with concrete. The portion of the anchor bolts that is not embedded in concrete is evaluated as part of the general structural supports. As discussed in Section C2.2 of the LRA, bolting (including anchor bolts) was not uniquely identified, and is typically evaluated as part of the larger host component. There is no concrete pit or foundation to support the two underground tanks. The tanks are directly buried and supported by compacted fill with 4 inches of oil-sand placed around the tanks. The staff's review found that the components of concern were identified in the table.

In Section 2.4.7 of the SPS LRA, the applicant describes the yard structures for the Surry plant. The staff found that the following structural components are not identified in Table 2.4.7-1 of SPS LRA subject to an AMR: anchor bolts and steel skirt for the chemical addition tank foundation, anchor bolts and missile walls for the emergency condensate storage tank foundation, concrete bridge for the fuel oil lines missile barriers. The staff asked that the applicant verify the table to ensure its completeness.

In its response, the applicant stated that anchor bolts are not uniquely identified in Table 2.4.7-1. The embedded portions of the anchor bolts are evaluated as part of yard structures. The scoping of anchor bolts is the same as for the North Anna plant. The steel skirt is welded to the chemical addition tank and is considered part of the tank as described in LRA, Section 2.3.2. The missile walls for the emergency condensate storage tanks are listed in Table 2.4.7-1 as "walls" with a missile barrier intended function. The staff found no omissions by the applicant.

In Section 2.2-4 of the NAS LRA, the applicant listed 22 structures in the North Anna plant that are not within the scope of license renewal. The staff agrees with respect to most of these structures because they do not perform the intended function required by 10 CFR 54.21 and, therefore, do not require an AMR. However, the following structures in the table needed to be verified to determine whether they perform any intended functions and should be included in the scope of license renewal: (1) concrete foundations for the main transformers and station service transformers, (2) fire pump house embankment, (3) independent spent fuel storage facility, (4) spent fuel cask handling structure, and (5) transmission line towers. The staff requested that the applicant provide additional information on these structures.

In its response, the applicant stated that the main transformers and station service transformers are not within the scope of license renewal and their foundations are not in scope. However, the dikes and firewalls associated with these transformers are in scope as indicated in Section 2.4.7 of the NAS LRA. The dike and firewalls prevent a fire from spreading from the transformer area. The fire pump house embankment surrounds and supports a fabric tank. The fabric tank supplies water to the fire protection system for warehouse No.5. The warehouse No.5 fire protection system is not in scope. Therefore, the fabric tank and the embankment are not within the scope of license renewal. The independent spent fuel storage facility is not licensed under 10 CFR Part 50 and is not included in each LRA. The independent spent fuel pool is licensed separately under 10 CFR Part 72. The cable that is supported by the transmission line towers is not in scope and, therefore, the transmission towers are not within the scope of license renewal. The staff finds that the applicant's response fully addressed staff's questions, therefore, the applicant 's response is acceptable.

As a result of the above review, the staff did not find any omissions by the applicant in the structures and components of the yard structures that were included within the scope of license renewal. The staff also found no omissions in the components of the yard structures identified in the LRA tables that require an AMR.

2.4.7.3 Conclusions

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has properly identified the structures and components in the boundary of the yard structures that are within the scope 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.

2.4.8 Earthen Structures

In the North Anna and Surry LRAs, the applicant described the components of the earthen structures for the NAS and SPS that are within the scope of license renewal and subject to an AMR. The earthen structures are further described in Section 3.8.4 and Section 9.2.1 of the NAS UFSAR and in Section 10.3.4 and Section 15.6 of the SPS UFSAR. The staff reviewed the earthen structures to determine whether there is reasonable assurance that the applicant has identified and listed structures and components subject to AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.4.8.1 Summary of Technical Information in the Application

The applicant describes its methodology for identifying the components that are within the scope of license renewal in Section 2.0 of the applications, "Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review, and Implementation Results." In Table 2.2-3 of each LRA, the applicant listed structures within the scope of license renewal and lists structures not within the scope of license renewal in Table 2.2-4. These tables link the reader to the appropriate section in the LRA to view the "screening results." Based on the scoping methodology, the applicant, in Table 2.2-3 of each LRA, identifies the earthen structures within the scope of license renewal and describes the results of its scoping methodology in Section 2.4.8 in the North Anna and Surry LRAs.

North Anna Power Station

The earthen structures at NAS consist of the service water reservoir and the floodwall west of the turbine building. The service water reservoir (SWR) supports normal operations of safety-related equipment and provides cooling water for plant shutdown. Technical specification requirements ensure that a minimum 30-day supply of service water is available in the SWR for each of the two reactors operating at the site, in the event of the design basis accident. The SWR is the ultimate heat sink for both units.

The applicant identified SWR "component groups" that require AMRs in Table 2.4.8-1 in each LRA. This table lists the component groups with their passive function identified and a link to their AMR results. The applicant has identified the following component groups for the SWR that are subject to AMR: clay liner, concrete liners, earthen dike and embankment, spread footing.

The purpose of the floodwall west of the turbine building is to provide protection from the probable maximum flood. The earthen floodwall dike is located just west of the Unit 2 end of the Turbine Building and the Heating Boiler Room Service Building in the Unit 3 and 4 restoration area. Because the dike provides protection from the probable maximum flood, it will protect the station from flood waters entering the restoration area from Lake Anna through the abandon Unit 3 and 4 intake tunnel.

The applicant identified "component groups" for the floodwall west of the Turbine Building that require AMR. These are presented in Table 2.4.8-2 in each LRA. This table lists the component groups with their passive function identified and a link to their AMR results. The applicant has identified the following component groups for the floodwall west of the Turbine Building that are subject to AMR: culverts, earthen dike and embankment.

Surry Power Station

The earthen structures at SPS consist of the intake and discharge canals. The primary purpose of the intake canal is to provide a source of cooling water from the James River to the station. The intake canal is located south of the station, between the low-level intake structure at the river and the high-level intake structure at the station. The canal is part of the flowpaths for both the circulating water system and the service water system, and it acts as a reservoir for the service water system. In the event of a loss of station power at the low-level intake, three diesel-driven, vertical emergency service water pumps are provided for both units at the low-level intake structure to supply makeup water to the intake canal. The emergency service water lines leaving the low-level intake structure are buried underground and encased in reinforced-concrete (missile barrier) from the beginning of the intake canal embankment to the discharge point into the canal.

The applicant identified component groups for the intake canal that require AMR in Table 2.4.8-1 of each LRA. This table lists the component groups with their passive function identified and a link to their AMR results. The applicant has identified the following component groups for the intake that are subject to AMR: concrete liner sealant, concrete culverts, concrete liners, earthen dike and embankment, concrete culvert gaskets, missile barrier.

The primary purpose of the discharge canal is to convey discharge cooling water to the James River. The discharge canal is located north of the station. Its centerline is approximately 380 feet from the containment structures. The discharge canal begins at the discharge structure's seal pits and extends to the James River. The James River is the ultimate heat sink for both units.

The applicant identified component groups for the discharge canal that require AMR in Table 2.4.8-2 of each LRA. This table lists the component groups with their passive function identified and a link to their AMR results. The applicant has identified the following component groups for the discharge canal that are subject to AMR: concrete liners, earthen dike and embankment.

In Tables 2.4.8-1 and 2.4.8-2 the applicant listed the SCs of the NAS and SPS earthen structures that are within the scope of license renewal because they fulfill one or more of the following intended functions: (1) provide a protective barrier for internal/external flood events; (2) provide a missile (internal or external) barrier; (3) provide a heat sink during SBO or design basis accidents; (4) provides a source of cooling water for plant shutdown; (5) provide structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety affecting safety-related) and/or to Criterion 3 (the five regulated events); and (6) provides structural and/or functional support for safety-related equipment.

As stated by the applicant, SCs of the earthen structures are subject to an AMR because they support safety-related equipment or equipment meeting license renewal Criterion 2 and/or 3 in a passive manner. As a result, 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.

2.4.8.2 Staff Evaluation

The NRC staff reviewed Section 2.4.8 in the North Anna and Surry LRA and the supporting information in the various sections of the NAS and SPS UFSARs to determine whether there is reasonable assurance that the SCs of the earthen structures were adequately identified 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 members in Tables 2.4.8-1 and 2.4.8-2 for NAS and SPS to determine whether any other structures associated with the earthen structures meet the scoping criteria of 10 CFR 54.4(a), but were not included within the scope of license renewal. The staff then reviewed portions of the UFSAR descriptions to ensure that all SCs of the earthen structures had been adequately identified and that they were passive, long-lived and performed their intended functions without moving parts or with a change in configuration or properties and were subject to replacement based on qualified life or specified time period. The staff found that the service water reservoir, floodwall, intake canal, and discharge canal are part of safety-related SSCs and meet 10 CFR 54.4(a), as identified in each LRA. On the basis of the above review the staff did not find any omissions by the applicant.

SPS identified underdrains and pressure relief valves associated with the intake canal within the scope of license renewal but not subject to an AMR. In a teleconference with the applicant in

November 2001, the staff asked whether the drain piping and valves should require an AMR. The applicant stated that the underdrains and pressure relief valves were provided to prevent uplift of the concrete liner by hydrostatic pressure experienced during construction. Since there is no potential for uplifting on the intake canal concrete liner with water maintained in the canal, the drain piping and valves perform no intended function. Therefore, the uderdrain piping and pressure relief valves are not subject to an AMR. The staff found the applicant response to be acceptable.

2.4.8.3 Conclusions

On the basis of the staff's review of the information submitted by the applicant in each LRA and supporting information in the NAS and SPS UFSAR as described above, the staff did not identify any omissions by the applicant. Therefore, the staff finds that there is reasonable assurance that the applicant has adequately identified the earthen structures that are within the scope of license renewal and the associated SC's that are subject to an AMR, in accordance with the requirements of 10 CFR 54.4(a) and 54.21(a)(1), respectively.

2.4.9 Nuclear Steam Supply System (NSSS) Equipment Supports

In the North Anna and Surry LRAs, Section 2.4.9, "NSSS Equipment Supports," the applicant describes the support structures for the NSSS equipment that are within the scope of license renewal and subject to an AMR. The NSSS equipment supports include the supports for the reactor vessel (RV), reactor coolant pumps (RCPs), steam generators (SGs), and the pressurizer (PZR). The design of the NSSS equipment supports is described in Section 5.5.9 of the NAS UFSAR for the North Anna plant and Section 15.6.2 of the SPS UFSAR for the Surry plant. The boundary for each of the NSSS equipment supports lies between the integral attachment being supported and its concrete supporting structure. The staff reviewed this 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 were met for the NSSS equipment supports.

2.4.9.1 Summary of Technical Information in the Application

<u>Reactor Vessel Support</u>

The reactor vessel is supported by six sliding-foot assemblies that are mounted to the neutron shield tank (NST) assembly. The NST assembly is a skirt-mounted steel tank that transfers loads from the support ring of the NST to the containment mat foundation. The tank is filled with water, which circulates through an external heat exchanger to limit heat transfer to the concrete shield wall and cool the sliding-foot assemblies. The sliding-foot assemblies support the RV on bearing pads that are integral to and located beneath each of the six RV primary loop nozzles. The sliding-foot assembly consists of a ball-and-socket joint mounted on a foot, which is permitted to slide only radially along the RV centerline. The connection hardware for the RV support structure includes threaded bolting components, nuts, washers, and anchorage components.

Reactor Coolant Pump Support

The North Anna and the Surry reactor coolant pump (RCP) supports have different designs. The North Anna plant RCP support assembly restrains the RCP for all the design loading conditions. The support assembly consists of a lower support frame that is supported from the cubicle floor by three pin-ended support columns. Lateral seismic restraint for the pump is provided by hydraulic snubbers. The design of the support frame permits low friction radial thermal expansion between the RCP feet and the lower support frame. The Surry RCP support assembly is a pin-jointed frame suspended from the building structure, which is attached to the four feet of the RCP at the approximate elevation of the pump discharge line (cold leg). The RCP is supported laterally from the SG with horizontal struts.

The RCP support for each plant has spherical bearing assemblies at the connections to allow for unrestrained rotational movement. Each bearing assembly consists of a high-grade steel ball encased within a high-grade stainless steel socket. Bolting and pin-connection hardware used in the RCP support structure include threaded bolting components, pins, nuts, washers, and anchorage components.

Steam Generator Support

For the North Anna plant, the steam generator support assembly consists of a lower support frame and an upper support ring. The lower support frame is a rigid frame structure that carries the weight of the SG and is anchored to the concrete support structure. The upper SG support consists of a pair of snubbers and a pair of rigid restraints attached to the upper support ring. A bronze alloy plate, impregnated with lubricant, provides low-friction thermal expansion between the SG and its lower support frame.

For the Surry plant, the steam generator support assembly consists of two (upper and lower) steel cast rings with vertical support arrangements. Lateral restraint in the radial direction is provided by snubbers and traverse direction is provided by the upper and lower support rings. The lower ring steel casting, which is located under the four SG support pads, carries the weight of the SG and is suspended by three vertical support rods attached to the concrete structure. Thermal expansion between the SG and the lower support ring is accommodated by the support foot assemblies.

Spherical bearing assemblies are provided for each plant at the connections to allow for unrestrained rotational movement. The bolting and pin-connection hardware used for the SG support structures include threaded bolting components, pins, nuts, washers, and anchorage components.

Pressurizer Support

The pressurizer in each plant is supported by a rigid ring girder bolted to the PZR skirt. The ring girder is suspended from the building with rods. At the upper PZR casing lugs, lateral restraint against dynamic loads is provided by gapped rigid restraints. Bolting and pin-connection hardware used in the PZR support assembly include threaded bolting components, pins, nuts, washers, and visible anchorage components.

2.4.9.2 Staff Evaluation

The staff reviewed Section 2.4.9 of LRAs and the UFSARs to determine whether the applicant has adequately identified the structural components of the NSSS equipment supports that are 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. After completing its initial review, the staff requested additional information of the applicant by an E-mail on September 24, 2001. The applicant responded to the staff's questions via an E-mail, dated October 4, 2001. The staff's evaluation of the applicant's submittals is summarized below.

In Section 2.4.9 of each LRA, the applicant describes the NSSS equipment supports for the reactor vessel, reactor coolant pump, steam generator, and the pressurizer. Table 2.4.9-1 of each LRA lists the RCP, SG, and PZR support structures as all the components of the NSSS equipment supports subject to an AMR. However, the reactor vessel support is not included in the table. The staff believes that the support structure for each of the NSSS equipment supports is designed differently as a specific support assembly that is not a typical design for all the supports. The staff asked that which LRA table lists the RV support and whether the NSSS equipment supports should be itemized in the table (e.g., the RCP support assembly, SG support assembly, and the PZR support assembly).

In its response, the applicant stated that the components of the RV support structure are identified in Table 2.4.9-1 of each LRA. As discussed in Section 2.4.9 of each LRA, support for the RV is provided by six sliding-foot assemblies that are mounted on the neutron shield tank. The sliding-foot assembly, neutron shield tank, and neutron shield tank support structure are listed in Table 2.4.9-1 of each LRA. The support structures for the RCP, SG, and PZR were not listed separately in the table because the materials and the environments are similar (carbon and low-alloy steel in an air and borated water leakage environment). The remaining structural components listed in the table are general support elements associated with the NSSS equipment supports. The staff's review found that all the components of the NSSS equipment supports were included in scope and subject to an AMR for license renewal.

Based on the above review, the staff did not find any omissions by the applicant related to scoping and screening of the structures for the NSSS equipment supports. The staff's review also found that all the structural components within the NSSS equipment supports were identified subject to an AMR.

2.4.9.3 Conclusions

On the basis of this review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the structures and components associated with the NSSS equipment supports 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.

2.4.10 General Structural Supports

In the North Anna and Surry LRAs, Section 2.4.10, "General Structural Supports," the applicant describes the general structural supports for mechanical and electrical components, and identified the structures within the scope of license renewal that make up the evaluation boundary for the general structural supports. The staff reviewed the general structural supports to determine whether there is reasonable assurance that the applicant has identified and listed all supports subject to AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.4.10.1 Summary of Technical Information in the Application

The general structural supports are the SCs that support mechanical, electrical, and miscellaneous equipment that are common to plant systems and have similar characteristics (design, materials of construction, environments, and anticipated stressors). The applicant identified that the general structural supports within the scope of license renewal are in Table 2.2-3, "Structures Within the Scope of License renewal" and include structures such as the auxiliary building, discharge canal, fire pump house, fuel building, fuel oil pump house, chemical addition tank foundation, and the emergency condensate storage tank foundation and missile barrier. In Table 2.4.10-1 of each LRA the applicant listed the general structural supports that are within the scope of license renewal because they fulfill one or more of the following intended functions:

- provide enclosure, shelter, or protection for in-scope equipment (including radiation shielding and pipe whip restraint)
- provide structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety affecting safety-related) and/or Criterion 3 (the five regulated events)
- provide structural and/or functional support for safety-related equipment

In each LRA, Table 2.4.10-1, the applicant assigns the general structural supports to six component groups based on design, material construction, anticipated stressors, and environment. These groups are battery racks, control rod drive mechanism restraints, electrical conduit and cable trays, bearing plate, structural support subcomponents such as plate and structural shapes, and vendor-supplied specialty items such as spring hangers and struts.

As stated by the applicant, SCs of the general structural supports are subject to an AMR because they support safety-related equipment or equipment meeting license renewal Criterion 2 and/or 3 in a passive manner. As a result, 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.

2.4.10.2 Staff Evaluation

The staff reviewed Section 2.4.10, Table 2.2-3, and Table 2.4.10-1 of the NAS and SPS LRAs to determine whether the applicant has adequately identified the general structural supports in the structures that are within the scope of license renewal in accordance with 10 CFR 54.4. The staff previously reviewed a sample of the structures in Table 2.2-3 of the LRA to verify whether the listed general structural supports were located within or part of the SCs in Table 2.2-3. The staff found that these general structural supports are part of the safety-related, non-safety-related, and regulated-event SSCs that are similar to most nuclear power plants. The staff did not identify any omissions in the general structural supports identified by the applicant subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1). On the basis of the above review the staff did not find any omissions by the applicant.

In the NAS and SPS LRAs, the applicant indicates that there are structural supports included within the evaluation boundary that, upon detailed review, would not be within the scope of license renewal. In a telecommunication with the applicant in November 2001, the staff asked how these structural supports were evaluated, and to provide examples justifying the exclusion of structural supports within the evaluation boundary that had been reviewed. The applicant stated that it did not exclude structural supports in the areas of the plant with mechanical and electrical components. The applicant stated that it evaluated all structural supports within these areas as part of the AMR process. The staff found the applicant response to be acceptable.

2.4.10.3 Conclusions

On the basis of the review described above, the staff finds that there is reasonable assurance that the applicant has adequately identified the general structural supports 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 10 CFR 54.21(a)(1), respectively.

2.4.11 Miscellaneous Structural Commodities

In the North Anna and Surry LRAs, Section 2.4.11, "Miscellaneous Structural Commodities," the applicant describes the miscellaneous structural commodities, and identifies the commodity groupings which protect safety-related equipment and equipment meeting license renewal Criterion 2 and 3. Miscellaneous structural commodities are further described in Section 9.5.1.2.4.2, Section 9.5.1.3.1.1 and Section 7.1.2 of the North Anna updated final safety analysis report (UFSAR). Also, Section 2.4.8 and Section 9.10.2.9 of the Surry UFSAR provide a description of miscellaneous structural commodities. The staff reviewed the miscellaneous structural commodities to determine whether there is reasonable assurance that the applicant has identified and listed structures and components subject to aging management review (AMR) in accordance with the requirements stated in 10 CFR 54.21(a)(1)

2.4.11.1 Summary of Technical Information in the Application

The applicant describes its methodology for identifying the SCs within the scope of license renewal in Section 2.1 of each LRA. Based on its scoping methodology, the applicant, in Table 2.2-3 of each LRA, identifies the miscellaneous structures within the scope of license renewal and describes the results of its scoping methodology in Section 2.4.11 of the North Anna and Surry LRA.

The miscellaneous structural commodities are the SCs that support or protect various SSCs that are safety-related or meet 10 CFR 54.4(a)(2) or (3). The applicant in Table 2.2-3, "Structures Within the Scope of License renewal" defines those areas where miscellaneous structural commodities are within the scope of license renewal (e.g., security diesel building, SBO building, service building, turbine building, and condensate polishing building). The applicant listed the miscellaneous structural commodities in Table 2.4.11-1 that are within the scope of license renewal because they fulfill one or more of the following intended functions:

- provide enclosure, shelter, or protection for in-scope equipment (including radiation shielding and pipe whip restraint)
- provide an environmental qualification (EQ) barrier

- provide a rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant

- provide a protective barrier for internal/external flood events

- provide a pressure boundary

- provide structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety affecting safety-related) and/or Criterion 3 (the five regulated events)

- provide structural and/or functional support for safety-related equipment

In each LRA, Table 2.4.11-1, the applicant identified the "structural members" for the miscellaneous structural commodities that require an AMR. This table lists the structural members with their passive function identified and a link to their AMR results. The applicant has identified the following structural members for the miscellaneous structures that are subject to an AMR, bus duct enclosure, cable tray cover, electrical component supports (within panels and cabinets), fire barrier penetration seals, fire doors and/or EQ barrier doors, firestops, fire wraps, fire wrap bands, firestop supports, gaskets (in junction, terminal, and pull boxes), gypsum boards, panels and cabinets, radiant energy shield, seismic gap materials, seismic gap covers, and switchgear enclosures.

On the basis of the above-described methodology, the applicant identified both the SCs and the structural members that are part of the miscellaneous structural commodities and identified the intended functions of the structural members that are subject to an AMR in Table 2.4.11-1 in each LRA. As stated by the applicant, SCs of the miscellaneous structural commodities are subject to AMR because they protect or support safety-related equipment or equipment meeting 10 CFR 54.4(a)(2) or (3) in a passive manner. As a result, 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.

2.4.11.2 Staff Evaluation

The NRC staff reviewed Section 2.4.11 in the LRA and the supporting information in Sections 9.5.1.2.4.2, 9.5.1.3.1.1, and 7.1.2 of the North Anna UFSAR and Sections 2.4.8 and 9.10.2.9 of the Surry UFSAR to determine whether there is reasonable assurance that the SCs of the miscellaneous structural commodities were adequately identified 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 members in Table 2.4.11-1 to determine whether there were any other components associated with the miscellaneous structural commodities that meet the scoping criteria of 10 CFR 54.4(a) but were not included within the scope of license renewal. The staff previously reviewed and sampled sections of Table 2.2-3 which identify structures within the scope of license renewal that included structures having miscellaneous structural commodities within the scope of license renewal. The staff found that these miscellaneous structural commodities are part of safety-related SSCs and meet 10 CFR 54.4(a)(2) and (3) as identified in each LRA. In addition, the staff reviewed the various sections of the North Anna and Surry UFSARs. The staff examined the structural members in Table 2.4.11-1 of each LRA to determine whether 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 find any omissions by the applicant.

2.4.11.3 Conclusions

On the basis of the review described above, the staff found that there is reasonable assurance that the applicant has appropriately identified the miscellaneous structural commodities components 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.

2.4.12 Load-handling Cranes and Devices

In the North Anna and Surry LRAs, Section 2.4.12, "Load-handling Cranes and Devices," the applicant describes the structural components of the load-handling cranes and devices that are within the scope of license renewal and subject to an AMR. The load-handling cranes and devices are further described in the Section 9.1 and 9.6 of the North Anna updated final safety analysis report (UFSAR) and Section 9.12.4 of the Surry UFSAR. The staff reviewed the load-handling cranes and devices to determine whether there is reasonable assurance that the applicant has identified and listed structures and components subject to AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.4.12.1 Summary of Technical Information in the Application

The applicant describes its methodology for identifying the SCs within the scope of license renewal in Section 2.1 of each LRA. Based on its scoping methodology, the applicant identifies the load-handling cranes and devices within the scope of license renewal and describes the results of its scoping methodology in Section 2.4.12 in the North Anna and Surry LRAs.

As stated in the North Anna UFSAR Section 9.6, "Control of Heavy Loads," the load-handling systems are classified into two groups: (1) Group I includes handling systems that conform to the guidelines of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," because a load drop may result in damage to system required for plant shutdown or decay heat removal, and (2) Group II includes handling systems (excluded from Group I) that do not conform to the guidelines of NUREG-0612 because a load drop from these systems would not impact plant operations and safety due to the physical separation between the handling system and systems needed for plant shutdown or decay heat removal.

Surry UFSAR Section 9.12.4, "Refueling Equipment," states that equipment (i.e., containment polar crane, refueling manipulator cranes, fuel-handling bridge crane, new fuel transfer elevator, etc.) are designed to be Class I structures. Section 15.2, "Structural Design Criteria," of the Surry UFSAR states that Class I structures of the facility are essential to the prevention of accidents that could affect public health and safety or to the mitigation of their consequences. As such, Class I structures are designed to resist seismic loadings in accordance with Section 15.2.4 of the Surry UFSAR.

The load-handling cranes and devices and the associated components meet the intent of 10 CFR 54.4(a) for license renewal because they perform the following functions:

- provide structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety affecting safety-related) and/or Criterion 3 (the five regulated events)

- provides structural and/or functional support for safety-related equipment

On the basis of the above described methodology, the applicant identified both the SCs and the component groups that are part of the load-handling cranes and devices, and identified the intended functions of the structural components that are subject to an AMR in Table 2.4.12-1 in each LRA. As stated by the applicant, SCs and components of the load-handling cranes and devices are subject to AMR because they are limited to load-bearing elements that support the lifting of loads in a passive manner. As a result, 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.

2.4.12.2 Staff Evaluation

The NRC staff reviewed Section 2.4.12 in the LRA and the supporting information in Section 9.1 and 9.6 of the NAS UFSAR and Sections 9.12.4 and 15.2 of the SPS UFSAR to determine whether there is reasonable assurance that the SCs of the load-handling cranes and devices were adequately identified 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 groups in Table 2.4.12-1 (i.e., fuel elevator structural beams, columns, rails, baseplates and anchors for attachment to structures, structural crane components such as structural beams, girders, columns, trolley rails, baseplates and anchors for attachment to structures, and retaining clips) to determine whether there were any other components associated with the load-handling cranes and devices 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 2.4.12 of each LRA and NAS and SPS UFSARs. The staff also examined the component groupings listed in Table 2.4.12-1 in the LRA to determine whether 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 find any omissions by the applicant.

2.4.12.3 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 load-handling cranes and devices 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.

2.5 Screening Results: Electrical and Instrumentation and Controls Systems

In the North Anna and Surry LRAs, Section 2.5, "Screening Results: Electrical and Instrumentation and Controls Systems," 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 each LRA to determine whether there is reasonable assurance that all SCCs within the scope of license renewal were identified, as required by 10 CFR 54.4(a), and that all structures and components subject to an AMR were identified, as required by 10 CFR 54.21(a)(1).

On the basis of this review the staff requested additional information in a letter to the applicant dated August 8, 2001 (Ref. 2.5-1). The applicant responded to this request for additional information in letters to the staff dated September 27, 2001 (Ref. 2.5-2), and July 11, 2002 (Ref. 2.5-8).

The applicant screened and evaluated the electrical and I&C components as commodities on a plant-wide basis rather than on a system basis. The following electrical and I&C component groups are identified in Section 2.5 as performing their intended functions without moving parts and without a change in configuration or properties:

1. bus ducts
2. cables and connectors
3. electrical penetrations

The applicant states in Section 2.5 that all electrical penetration assemblies are within the scope of the environmental qualification program and are also the subject of a TLAA. The electrical penetrations, therefore, are addressed in Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment," of this SER. The bus duct and non-EQ cables and connectors are evaluated below.

Although the applicant screened and evaluated the electrical and I&C components on a plant-wide basis rather than on a system basis, Table 2.2 -2 of each LRA identifies systems not within the scope of license renewal. In Table 2.2-2 of both the North Anna and Surry applications the AAC diesel service air (BSR) is listed as a system that is not within the scope of license renewal. In Table 2.2-1 of both applications, however, various AAC diesel systems are listed as systems that are within the scope of license renewal. In a conference call with the applicant on July 31, 2001 (Ref 2.5-3), the staff asked the applicant to clarify why the AAC diesel service air system is not included within the scope of license renewal.

The applicant stated that the AAC diesel service air system is primarily used for maintenance purposes and does not provide a support function to the EDG or any other safety-related component. The AAC diesel starting air system supports the EDG safety-related function, and is in the scope of license renewal. The staff finds this response acceptable.

In Table 2.2-2 of the North Anna LRA, 4kV and above electrical equipment (PH) is listed as a system that is not within the scope of license renewal. In Table 2.2-1 of the North Anna and Surry applications, however, electrical power (EP) is listed as a system that is within the scope of license renewal. In the July 31, 2001 conference call (Ref. 2.5-3), the staff requested a clarification of whether the PH system has any safety-related or support functions.

The applicant stated that the PH system is unique to North Anna. Its primary function is to support the main generator output breaker, which is non-safety-related. It has no other safety-related or support functions. The staff finds this response acceptable.

Offsite Power System Scoping

The screening results in Section 2.5 of each LRA do not include any electrical components listed in NEI 95-10 (Appendix B) and the Standard Review Plan (Table 2.1-5) for the offsite power system. These are components such as switchyard bus, transmission conductors, switchyard insulators, and transmission line insulators. The regulation in 10 CFR 54.4(a)(3) requires that all systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63) be included within the scope of Part 54. A requirement of 10 CFR 50.63 is that each light-water-cooled power plant licensed to operate be able to withstand and recover from a station blackout of a specified duration that is based upon factors that include the expected frequency of loss of offsite power and the probable time needed to recover offsite power. At North Anna and Surry the specified duration was determined based upon evaluations that followed the guidance in NRC Regulatory Guide 1.155 and NUMARC 87-00 and included the plants' offsite power characteristics. These characteristics helped determine the probable time needed to recover offsite power (coping duration). The resulting 4-hour coping duration at North Anna and Surry is therefore based on the likelihood of recovering offsite power within 4 hours.

In a conference call with the applicant on July 31, 2001 (Ref. 2.5-3), the staff requested that the applicant explain the exclusion of offsite power systems from the scope of license renewal (10 CFR 54.4(a)(3)) with regard to station blackout (10 CFR 50.63). The applicant stated that the North Anna and Surry station blackout analysis relied primarily on the recovery of the emergency diesel generators.

The staff disagreed with the applicant and stated that, for North Anna and Surry, the specified duration for recovery was based on Regulatory Guide 1.155 and NUMARC 87-00 and included the recovery of offsite power. In addition, 10 CFR 50.63(a) states that the station blackout duration shall be based on "[t]he expected frequency of loss of offsite power" and "[t]he probable-time needed to restore offsite power." Based on this information, the staff determined that applicable offsite power structures and components are included within the scope of license renewal and are subject to an aging management review or additional justification for their exclusion must be provided. The staff forwarded to the applicant an RAI on August 8, 2001, as a followup to this concern. The applicant responded, in its letter dated September 27, 2001 (Ref 2.5-2), that the alternate AC (AAC) power sources (diesel generators) and emergency diesel generators are relied on to recover from an SBO event at North Anna and Surry. They indicated that the AAC diesel generators can be run past the 4-hour coping period to restore power. The applicant concluded that neither North Anna nor Surry relies on offsite power to recover from an SBO event and that offsite power is not within the scope of license renewal because it is not required to perform the intended functions for compliance with 10 CFR 50.63.

The AAC power sources were accepted under the SBO rule as an alternate means of withstanding an SBO. The definition of an AAC power source is contained in 10 CFR 50.2. The definition addresses the capability of these power sources to cope with an SBO but not to recover from an SBO. While a very small number of AAC sources may have capabilities beyond those required for coping, the staff nevertheless finds that they were only reviewed as a means of coping with an SBO for the plant-specific coping duration. Reference to AAC power sources as a means of recovering from an SBO is therefore not intended within the context of the SBO rule. According to the rule, only offsite power and onsite power are credited as means of recovering from an SBO event and, therefore, both must be included within the scope of license renewal.

An example of an AAC power source coping discussion during an SBO review exists in the North Anna SBO documentation. The applicant indicated in a February 10, 1992 letter (Ref. 2.5-4), that the capacity of the AAC power source fuel (day) tank required for a 4-hour coping duration at North Anna was about 1200 gallons and that the size of the day tank that would be required for an 8-hour coping duration might be larger than acceptable based on insurance and other considerations. The staff accepted the 4-hour coping duration and use of the smaller (1200 gallon) day tank in its supplemental evaluation for North Anna sent to the applicant in a letter dated June 8, 1992 (Ref. 2.5-5). Examples of AAC power source coping discussions also exist at the Surry plant. An applicant letter dated May 10,1993 (Ref. 2.5-6), and the subsequent NRC staff supplemental SBO evaluation on Surry, dated June 25, 1993 (Ref. 2.5-7), speak of an AAC power source capability to carry only the loads required for coping with an SBO for the required coping duration.

The staff has pursued license renewal scoping of offsite power generically with the Nuclear Energy Institute (NEI) and held several public meetings on the subject. The following NRC staff position is the result of industry and public input gathered during these meetings.

Staff Position

Consistent with the requirements specified in 10 CFR 54.4(a)(3) and 10 CFR 50.63(a)(1), the plant system portion of the offsite power system should be included within the scope of license renewal. The reasons for this position follow.

Rationale

The license renewal rule, 10 CFR 54.4(a)(3), requires that "all systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for ... station blackout (10 CFR 50.63)" be included within the scope of license renewal. The SBO rule, 10 CFR 50.63(a)(1), requires that each light-water-cooled nuclear power plant licensed to operate be able to withstand and recover from a station blackout of a specified duration that is based upon factors that include: "(iii) The expected frequency of loss of offsite power; and (iv) The probable time needed to restore offsite power." The SBO rule in this regard is consistent with the staff findings identified in the statement of considerations and NUREG-1032, "Evaluation of Station Blackout Accidents at Nuclear Power Plants." In particular, with regard to factor (iv), the staff found that offsite power is more likely to be restored (0.6 hour median time to restore) than are the emergency diesel generators (eight hours median time to repair) in terminating an SBO event.

Station blackout is the loss of offsite and onsite AC electric power to the essential and non essential switchgear buses in a nuclear power plant. It does not include the loss of AC power fed from inverters powered by station batteries or loss of AC power from an SBO defined AAC power source. The SBO rule was added to the regulations in 10 CFR Part 50 because, as operating experience accumulated, concern arose that the reliability of both the offsite and onsite AC power systems might be less than originally anticipated, even for designs that met the requirements of General Design Criteria 17 and 18. As a result, the SBO rule required that nuclear power plants have the capability to withstand and recover from the loss of offsite and onsite AC power of a specified duration (the coping duration).

Licensees' plant evaluations followed the guidance specified in NRC Regulatory Guide (RG) 1.155 and NUMARC 87-00 to determine the required plant-specific coping duration. The criteria specified in RG 1.155 to calculate a plant-specific coping duration were based upon the expected frequency of loss of offsite power *and* the probable time needed to restore offsite power, as well as on the other two factors (onsite emergency AC power source redundancy and reliability) specified in 10 CFR 50.63(a)(1). In requiring that a plant's coping duration be based in part on the probable time needed to restore offsite power, 10 CFR 50.63(a)(1) specifies that the offsite power system be an assumed method of recovering from an SBO. Disregarding the offsite power system as a means of recovering from an SBO would not meet the requirements of the rule and would result in a longer required coping duration.

The reference to the offsite power system in 10 CFR 50.63(a)(1) as a means of recovering from an SBO should not be construed to mean that it is the only acceptable means of recovering from an SBO. A licensee could, for example, recover offsite power or emergency (onsite) power. It is not possible to determine prior to an actual SBO event which source of power can be returned first. As a result, 10 CFR 50.63(c)(1)(ii) and the associated guidance in RG 1.155, Section 1.3 and Section 2, provide for procedures to recover from an SBO that include restoration of offsite and onsite power.

Based on the above, both the offsite and onsite power systems are relied upon to meet the requirements of the SBO rule. Elements of both offsite and onsite power are necessary to determine the required coping duration under 10 CFR 50.63(a)(1), and the procedures required by 10 CFR 50.63(c)(1)(ii) must address both offsite power and onsite power restoration. It follows, therefore, that both systems are used to demonstrate compliance with the SBO rule and must be included within the scope of license renewal consistent with the requirements of 10 CFR 54.4(a)(3). License renewal applicants are presently including the onsite power system within the scope of license renewal on the basis of the requirements under 10 CFR 54.4(a)(1) (safety-related systems). They are also including equipment that is relied upon to cope with an SBO (e.g., AAC power sources) on the basis of the requirements under 10 CFR 54.4(a)(3). Therefore, only the addition of the offsite power system is necessary to complete the required scope of the electrical power systems for license renewal.

The offsite power systems of U.S. nuclear power plants consist of a transmission system, the grid, which provides a source of power, and a plant system that connects that power source to a plant's onsite electrical distribution system, which powers safety equipment. Historically, the staff has relied upon the well-distributed, redundant, and interconnected nature of the grid to provide the necessary level of reliability to support nuclear power plant operations. For purposes of the license renewal rule, the staff has determined that the plant system portion of the offsite power system that is used to connect the plant to the offsite power source should be included within the scope of the rule. This path typically includes the switchyard circuit breakers that connect to the offsite system power transformers (startup transformers), the transformers themselves, the intervening overhead or underground circuits between circuit breaker and transformer and the onsite electrical distribution system, and the associated control circuits and structures. Ensuring that the appropriate offsite power system long-lived passive structures and components that are part of this circuit path are subject to an aging management review will assure that the bases underlying the SBO requirements are maintained over the period of the extended license. This is consistent with the Commission's expectation that the SBO regulated-event be included under 10 CFR 54.4(a)(3) of the license renewal rule.

Consistent with the above position, the plant system portion of the offsite power system at North Anna and Surry should be included within the scope of license renewal. In a letter dated July 11, 2002 (Ref. 2.5-8), the applicant responded to the staff position with a revised response to the staff's original request for additional information on this matter. In the revised response, the applicant identified portions of the offsite power system at North Anna and Surry that will be included within the scope of license renewal, consistent with the staff position and the SBO scoping criterion in 10 CFR 54.4(a)(3). The power path identified for both plants includes the 34.5 kV circuit breakers in the station's switchyard, which supply power to the reserve station service transformers (RSSTs), and extends through the transfer buses at each station. The additional electrical components included within the scope of license renewal for the Surry plant are as follows (note: this list does not include structural components associated with the offsite circuits, which are addressed separately in this report):

- 34.5 kV circuit breakers with associated control components (including cables) and disconnect switches to connect the RSST circuits to the grid

- 34.5 kV power conductors (insulated cable, bare overhead cable, tubular bus, and connectors) from the switchyard to the RSSTs

- Power cables and connectors for sump pumps located in manholes associated with underground 34.5 kV cable

- Ceramic insulators used with disconnect switches, overhead bare cable, and tubular bus for 34.5 kV and 4160 V circuits

- RSSTs, 4160 V power conductors (tubular bus, insulated cable, and connectors) that supply transfer buses D, E, and F, the 4160 V breakers connecting to the transfer buses, and transfer buses D, E, and F

The applicant stated that, based on the guidance in NEI 95-10, the circuit breakers, disconnect switches, and RSSTs do not require an aging management review because they are considered active components. The staff agrees with the applicant. In addition, the applicant currently includes the RSST A and RSST B 4160 V circuit breakers and their controls within the SBO scope of license renewal, as well as transfer buses D and E. Transfer bus F is newly added to the scope. The staff evaluation of the newly added electrical components requiring an AMR is contained in Section 3.9 of this report.

The additional SBO-related offsite power electrical components included within the scope of license renewal for North Anna are as follows:

- 34.5 kV disconnect switches, ceramic insulators, and circuit breakers with associated controls (including cables) to connect RSST circuits to the grid

- insulated cables, connectors, and aluminum bus bars connecting the 34.5 kV circuit breakers to the RSSTs

- RSSTs, insulated cables, and connectors to connect to the line side of the 4160 V circuit breakers which power transfer buses D, E, and F

- aluminum tube bus, insulated cables, and connectors to connect to the 4160 V circuit breakers which power normal station service buses A, B, C, and G of each unit

The applicant stated that, based on the guidance in NEI 95-10, the circuit breakers, disconnect switches, and RSSTs do not require an aging management review because they are considered active components. The staff agrees with the applicant. In addition, the applicant currently includes the 4160 V circuit breakers to transfer buses D, E, and F and their controls within the SBO scope of license renewal, as well as the transfer buses themselves. The staff evaluation of the newly added electrical components requiring an AMR is contained in Section 3.9 of this report.

2.5.1 Bus Duct

Section 2.5.1, "Bus Duct," in the North Anna and Surry LRAs identifies bus ducts as a component group that performs its intended functions without moving parts and without a change in configuration or properties.

2.5.1.1 Summary of Technical Information in the Application

In the North Anna and Surry LRAs, the applicant describes the bus duct as a component assembly conducting electrical power between equipment using a preassembled raceway (enclosure) design, with conductors installed on insulated supports.

In the North Anna LRA, Section 2.5.1, "Bus Duct," the following nonsegregated bus ducts are identified as within the scope of license renewal for the reasons indicated in parentheses:

- the three 3,000-ampacity bus ducts of transfer buses D, E, and F (related to station blackout, 10 CFR 50.63)
- the four 1,200-ampacity bus ducts of the H and J buses for each of the two units (safety-related)

In the Surry LRA, Section 2.5.1, "Bus Duct," the following nonsegregated bus ducts are identified as within the scope of license renewal for reasons indicated in parentheses:

- the three 3,000-ampacity, 4160-volt bus ducts of transfer buses D, E. and F (related to station blackout, 10 CFR 50.63)
- the two 1,200-ampacity, 4,160-volt SBO bus ducts (related to station blackout, 10 CFR 50.63)
- the four 1,200-ampacity, 4,160-volt bus ducts of the H and J buses for each of the two units (safety-related)

- the one 1,600-ampacity, 480-volt bus duct connecting transformer 1A2 to switchgear 1A2 (related to fire protection, 10 CFR 50.48)

The North Anna and Surry LRAs both state that the non-segregated bus ducts at the site in the scope of license renewal are the totally enclosed, non-ventilated type and that these bus ducts are located above the switchgear and are connected to the top of entry cubicles.

2.5.1.2 Staff Evaluation

The staff reviewed Section 2.5.1 of the North Anna and Surry LRAs to determine whether there is reasonable assurance that the applicant has identified the bus ducts within the scope of license renewal. This is in accordance with 10 CFR 54.4. The staff also reviewed this section of each LRA to determine whether there is reasonable assurance that the applicant has identified the bus ducts subject to an AMR. This is in accordance with 10 CFR 54.21(a)(1).

The bus ducts identified by the applicant are safety-related, station-blackout-related, and fire-protection-related bus ducts. The staff reviewed these component categories against the requirements in 10 CFR 54.4(a)(1) and 10 CFR 54.4(b) and found that those categories are included in the requirements. The staff reviewed the information in the North Anna and Surry UFSARs and found that there is reasonable assurance that the applicant has identified the bus ducts within the scope of license renewal.

The North Anna and Surry LRAs state that the boundary of a nonsegregated bus duct which is evaluated for aging management is the point at which the nonsegregated passive bus duct connects with active switchgear (i.e., the bolted connections of the bus assembly to the active switchgear bus and the bolted connection of the enclosure assembly to the switchgear housing). In Table 2.5.1-1 of the North Anna and Surry LRAs, the applicant indicates that the bus assembly portion of the bus duct is the electrical portion of the duct that requires an AMR. Its passive function is to conduct electricity. The staff agrees that the applicant has properly identified the electrical portion of the bus duct because it performs its function without moving parts or a change in configuration or properties (is passive and long-lived) and is therefore subject to an AMR.

2.5.1.3 Conclusions

On the basis of the staff's review of the bus duct information presented in Section 2.5.1 of the North Anna and Surry LRAs and the supporting information in the UFSARs, the staff did not find any omissions by the applicant. The staff therefore concludes that there is reasonable assurance that the applicant has identified those bus ducts that are within the scope of license renewal, as required by 10 CFR 54.4(a), and are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5.2 Cables and Connectors

Section 2.5.2, "Cables and Connectors," in the North Anna and Surry LRAs identifies cable and connectors as component groups that perform their intended functions without moving parts and without a change in configuration or properties.

2.5.2.1 Summary of Technical Information in the Application

Section 2.5.2 in the North Anna and Surry LRAs states that cables and associated connectors provide electrical connections to specified sections of an electrical circuit to deliver system voltage and current. It states that the insulation resistance, which precludes shorts, grounds, and unacceptable leakage currents, maintains circuit integrity.

The applicant has evaluated the North Anna and Surry cables and connectors as commodities across system boundaries. This is termed the "spaces approach" in Section 2.5.3.1 of the NRC Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (NUREG-1800). Table 2.2-3 of the North Anna and Surry LRAs defines those buildings and structures (areas) containing components that perform 10 CFR 54.4(a) intended functions. Each LRA states that these same areas contain the cables and connectors needed to support component intended functions. The application states that these cables and connectors are within the scope of license renewal and are subject to aging management review.

Section 2.5.2 in the North Anna and Surry LRAs lists the following cable types that require evaluation for aging management:

- power cables
  medium-voltage power (2.0 kV to 15 kV)
  low-voltage power (below 2.0 kV)

- instrumentation and control
  control
  instrumentation
  thermocouple
  communication

2.5.2.2 Staff Evaluation

The staff reviewed Section 2.5.2 of the North Anna and Surry LRAs to determine whether there is reasonable assurance that the applicant has identified the cables and connectors within the scope of license renewal. This is in accordance with 10 CFR 54.4. The staff also reviewed this section of each LRA to determine whether there is reasonable assurance that the applicant has identified the cables and connectors subject to an AMR. This is in accordance with 10 CFR 54.21(a)(1).

The applicant evaluated the cables and connectors as commodities across system boundaries using the spaces approach. In Section 2.5.2 of the North Anna and Surry LRAs it is stated that the evaluation boundary generally includes all cables and connectors in these areas to provide complete coverage of cables and connectors in the scope of license renewal. In its July 31, 2001, telecommunication with the applicant (Ref. 2.5-3), the staff requested a clarification of the use of the term "generally" in this statement.

The applicant stated that the word "generally" was used because the evaluation boundaries included all cables and connectors with the exception of those supplying the control rod drive mechanisms (CRDMs) and the bare grounding conductors. The applicant explained that the CRDMs are included within the scope of license renewal because they serve a safety-related pressure boundary function. However, the rod movement function is not safety-related and is not within the scope of license renewal. Therefore, the associated cables and connectors are also not within the scope of license renewal. The bare grounding conductors were found to be outside the scope of license renewal in several past license renewal applications. In a letter dated August 8, 2001 (Ref. 2.5-1), the staff requested additional information relating to this concern and asked the applicant to formally document the information provided during this telecommunication.

In a letter dated September 27, 2001 (Ref. 2.5-2), the applicant verified that loss of the CRDM cables would neither impede nor prevent the performance of the control rod safety function, and they are not required to support intended functions meeting the criteria in 10 CFR 54.4(a). With regard to the bare grounding conductors, the applicant explained that they provide personnel safety protection by interconnecting plant areas and equipment to minimize potential gradients (voltage differences) between these areas during electrical power system ground fault conditions. They are not required to support the intended functions meeting the 10 CFR 54.4(a) criteria. Accordingly, the staff finds these responses resolve the staff's concerns on this issue. This item is closed.

The staff reviewed the spaces (buildings and structures) in Table 2.2-3 of the North Anna and Surry LRAs that the applicant has identified as containing cables and connectors that are within the scope of license renewal and subject to an aging management review. The staff also reviewed Table 2.2-4 of each LRA, which identifies buildings and structures that are not within the scope of license renewal.

In the Surry LRA, Table 2.2-3, the applicant states that the high-level and low-level intake structures are within the scope of license renewal. However, in Table 2.2-4 of the Surry LRA, the applicant states that the high-level intake structure control house and the low-level intake structure switchgear building are not within the scope of license renewal. The staff requested a clarification as to the function of the high-level intake structure control house and the low-level intake structure switchgear building, and verified that the structures in questions do not contain any safety-related or support equipment.

The applicant stated (Ref. 2.5-3) that the high-level intake structure control house and the low-level intake structure switchgear building are unique to Surry because of its natural circulation service water and circulating water systems. The high-level intake structure control house contains such components as screen drive motors, screen wash pumps, and hotel loads. The low-level intake structure switchgear building primarily houses the switchgear for the 4160-volt, 480-volt, and 120-volt power supplies, switchgear, and transformers to the non-safety-related circulating water systems. It has no other safety-related or support function. The staff finds this response acceptable.

In the Surry LRA, Table 2.2-4, the applicant states that the local emergency operating facility is not within the scope of license renewal. The staff requested a clarification of the function of the local emergency operating facility and any safety-related or support functions.

The applicant states (Ref. 2.5-3) that the local emergency operating facility was originally built to support an emergency response. These functions have since been transferred to the applicant's headquarters in Richmond, VA, and other onsite locations. The only emergency response function of this facility is that it serves as a gathering place for State and local officials during an emergency, as appropriate. This structure has no other safety-related or support functions and, therefore, is not within the scope of license renewal. The staff finds this response acceptable.

In Table 2.5.2-1 of the North Anna and Surry LRAs, the applicant indicates that the passive function of the cables and connectors is to conduct electricity and that the cable and connectors are subject to an AMR. The staff agrees that the applicant has correctly identified the cables and connectors as passive and long-lived components that perform their function without moving parts or a change in configuration or properties and are therefore subject to an AMR.

2.5.2.3 Conclusions

On the basis of the staff's review of the cable and connector information presented in Section 2.5.1 of the North Anna and Surry LRAs and the supporting information in the UFSARs, the staff did not find any omissions by the applicant. The staff therefore concludes that there is reasonable assurance that the applicant has identified those cables and connectors that are within the scope of license renewal, as required by 10 CFR 54.4(a), and are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5.3 Staff Position on Screening of Electrical Fuse Holders

In a letter dated May 16, 2002, the NRC forwarded to the Nuclear Energy Institute (NEI) and Union of Concerned Scientists, a proposed staff position on screening of electrical fuse holders. The staff position indicated that fuse holders should be scoped, screened, and included in the aging management review (AMR) in the same manner as terminal blocks and other types of electrical connections that are currently being treated in the process. NUREG-1760 (Aging Assessment of Safety-Related Fuses Used in Low- and Medium-Voltage Applications in Nuclear Power Plants) found that aging stressors such as vibration, thermal cycling, electrical transients, mechanical stress, fatigue, corrosion, chemical contamination, or oxidation of the connecting surfaces can result in fuse holder failure. The final staff position on this issue is under development. In a letter dated November 4, 2002 (ADAMS Accession Number ML023080355), the applicant committed to implement, at North Anna and Surry, the final staff guidance on this subject.

2.5.4 References for Section 2.5

2.5-1 NRC Letter to Virginia Electric and Power Company, dated August 8, 2001, Adams No. ML012260171

2.5-2 Virginia Electric and Power Company letter (Serial No. 01-514) to the NRC, dated September 27, 2001

2.5-3 NRC Telecommunication with Virginia Electric Power Company, dated August 8, 2001, Adams No. ML012260187

2.5-4 Virginia Electric and Power Company letter (Serial No. 91-738A) to the NRC, dated February 10, 1992

2.5-5 NRC (Leon B. Engle) letter to Virginia Electric and Power Company (W.L. Stewart), dated June 8, 1992

2.5-6 Virginia Electric and Power Company letter (Serial No. 93-292) to the NRC, dated May 10, 1993

2.5-7 NRC (Bart C. Buckley) letter to Virginia Electric and Power Company (William Stewart), dated June 25, 1993

2.5-8 Virginia Electric and Power Company letter (Serial No. 02-297) to the NRC, dated July 11, 1992

3.0 Aging Management Review Results

3.1 Introduction

This chapter presents the staff's evaluation of the applicant's AMR. The section 3.0 of the LRAs provide the results of the aging management review for those structures and components (SCs) identified in Section 2.0 as being subject to aging management review. The applicant reviewed existing programs and activities for the SCs that are subject to an AMR, and identified those programs that can be used to manage the applicable aging effects. The applicant either identified a demonstration of the effectiveness of different programs consistent with 10 CFR 54.21(a)(3), or developed new aging management programs or activities to manage the remaining applicable aging effects. The applicant provides descriptions of the aging management programs (AMPs) in Appendix B of the LRAs, "Aging Management Activities."

3.2 Summary of Technical Information in the Application

The applicant described its AMR of the mechanical SCs for license renewal in the LRAs Section 3.1, "Reactor Coolant System," Section 3.2, "Engineered Safety Features," Section 3.3, "Auxiliary Systems," Section 3.4, "Steam and Power Conversion Systems," Section 3.5, "Containment, Structures, and Component Supports," and Section 3.6,"Electrical, and Instrument and Controls." The methodology used for performing aging management reviews including the process for identifying the aging effects requiring management is explained in Appendix C to the LRAs, "Aging Management Review Methodology."

3.3 Aging Management Review

The NRC staff evaluated the applicant's AMR of the structures, components, and commodity groups that have been identified as being subject to an AMR in Chapters 2 and 3 of the LRAs, and any additional SSCs identified by the staff during its scoping and screening evaluation, audit, and inspection activities. As part of this effort, the staff also reviewed the applicant's summary descriptions of the AMPs and the evaluations of the time-limited aging analyses (TLAAs) provided by the applicant in Appendix A to the LRAs, "UFSAR Supplement." A more detailed discussion of the additional FSAR supplement information can be found throughout Chapter 3 and 4 of this SER, as appropriate.

3.3.1 Existing Aging Management Activities

This section of the SER contains the staff's evaluation of 19 AMPs that are currently being implemented and discussed in Appendix B2.2 of the LRAs, "Existing Aging Management Activities," and are references as part of the AMR for two or more of the systems and/or structures. The staff's evaluation of the applicant's 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 will be maintained consistent with the current licensing basis (CLB) for 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 for license renewal (SRP-LR), published in1997. The final version of the SRP-LR was published in July 2001.

The following 10 elements will be considered in evaluating each AMP used by the applicant to manage the applicable aging effects identified in this SER:

- scope of program
- preventative actions
- parameters monitors or inspected
- detection of aging effects
- monitoring and trending
- acceptance criteria
- corrective actions
- confirmation process
- administrative controls
- operating experience

In Appendix A to the LRAs, the applicant states that the quality assurance program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Section A.2 of the standard review plan for license renewal. The quality assurance program includes the three elements of corrective action, confirmation process, and administrative controls; and is applicable to the safety-related and non-safety-related structures, systems, and components that are within the scope of license renewal.

The staff's evaluation of the applicant's corrective actions, confirmation process, and administrative controls are discussed separately, and generically evaluated in Section 3.3.2 of this SER.

3.3.1.1 Augmented Inspection Activities

The applicant describes its augmented inspection activities in Section B2.2.1 of Appendix B of each LRA. The applicant credits this inspection activity with managing the aging for systems, commodities, and major components in all four units. In addition, the applicant provides a summary description of the augmented inspection activities in Section A2.2.1 of the UFSAR supplement. The staff reviewed the applicant's description of the program in Section B2.2.1 of each LRA to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.1.1 Summary of Technical Information in the Application

In Section B2.2.1 of each LRA, the applicant states that the purpose of the augmented inspection activities is to perform examinations of selected components and supports in accordance with requirements identified in the Technical Specifications, UFSAR, license commitments, industry operating experience, and good practices for all four units. These activities are outside the required scope of ASME Section XI. However, selected activities are performed during each refueling outage in accordance with controlled procedures. The applicant has performed aging management reviews for the following systems, commodities, and major components in all four units that credit the augmented inspection activities for managing the aging effects of loss of material and cracking:

- chemical and volume control (SPS 1/2 only)

- containment spray (SPS 1/2 only)
- feedwater
- main steam
- reactor coolant system
- residual heat removal (SPS 1/2 only)
- safety injection (SPS 1/2 only)
- general structural supports
- pressurizer (SPS 1/2 only)

The applicant provides two tables in Section B2.2.1 of each LRA (one for NAS 1/2 and one for SPS 1/2) that summarize the augmented inspection activities for license renewal, the test methods, and the frequency of the examination. The applicant also states that:

> As a licensee followup action, as described in Section B4.0 of the LRAs, the station will implement an augmented examination of the pressurizer surge line connection to the reactor coolant system's hot-leg loop piping prior to the end of the current operating license term. These examinations will address the issue of thermal fatigue failure of welds due to environmental effects, GSI-190 (Reference19). Additionally, a Licensee Followup Action will be implemented to include inspection of the core barrel hold-down spring as one of the Augmented Inspection Activities. The initial inspection of the core barrel hold-down spring will be performed prior to the end of the current operating license term.

3.3.1.1.2 Staff Evaluation

The staff's evaluation of the augmented inspection activities 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.1 of each LRA summarizes the test methods and frequency of the examinations for inspection items that are part of the augmented inspection activities. In order to complete the evaluation, the staff requested that the applicant confirm that this information listed in Section B2.2.1 of each LRA, and the corresponding acceptance criteria for each item, is the same as the commitments included in the CLB. The staff also requested a discussion of the technical basis for any differences. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant verified that this information and the corresponding acceptance criteria for each item are consistent with the augmented inspection activities currently being performed under its CLB. The staff found this response acceptable and did not identify any need to expand the scope of the program for the period of extended operation beyond that already described in Section B2.2.1 of each LRA.

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

Parameters monitored or inspected: The applicant states in Section B2.2.1 of each LRA that component conditions are monitored to detect degradation due to loss of material and cracking by use of visual testing, surface examinations, and volumetric examinations. The applicant also commits to the development of inspection procedures for the pressurizer surge line connection and the core barrel holddown springs. The initial inspections for these additional items will be performed prior to the end of the current operating license term. The commitment to the performance of these inspections is acceptable to the staff.

Detection of aging effects: The augmented inspection activities check for loss of material and cracking through a combination of visual inspections, surface examinations, and volumetric examinations. The applicant states in Section B2.2.1 of each LRA that these examinations are consistent with those endorsed by the NRC for ASME Section XI inspections. The staff accepts the nondestructive examination methods in the augmented inspection activities to be reliable and effective in detecting age-related degradation of the subject components.

Monitoring and trending: In Section B2.2.1 of each LRA, the applicant states that anomalous indications of degradation are documented on nondestructive examination reports and evaluations are performed for inspection results that do not meet established acceptance standards. The applicant's activities include engineering evaluations to consider the extent of degradation so that timely corrective or mitigative actions are taken to provide reasonable assurance that intended functions of inspected components are maintained. The inspection frequencies for components covered by the augmented inspection activities are (1) every 40 months for turbine throttle valves and steam generator supports, (2) every refueling outage for reactor vessel incore flux thimble tubes, reactor vessel head, and steam generator feedwater nozzles, and (3) every ISI inspection period for the component supports. Welds for the main steam and feedwater postulated break locations are inspected over a 120-month interval with 25% of all selected welds inspected during each 40-month period and 75% completed by the end of each 120-moth interval. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant verified that these inspection frequencies are consistent with the augmented inspection activities currently being performed under its CLB. The staff did not identify any need to change the inspection frequencies for the period of extended operation and, therefore, these monitoring and trending activities are acceptable to the staff.

Acceptance criteria: The applicant states in Section B2.2.1 of each LRA that the acceptance criteria for the augmented inspection activities are consistent with guidance provided in Section XI of the ASME Code. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant verified that the acceptance criteria for the augmented inspection activities for the extended period of operation are the same as the commitments included in the CLB. The staff found the acceptance criteria used for the augmented inspection activities to be satisfactory for managing the effects of aging of the subject components and did not identify any need to change the acceptance criteria for the period of extended operation.

Operating experience: The applicant's discussion of operating experience for the augmented inspection activities does not provide any specific information with respect to the operating experience with the existing programs at NAS 1/2 and SPS 1/2. As such, the staff requested that the applicant provide specific information regarding the operating experience with the existing program at NAS 1/2 and SPS 1/2. In its response to RAI B2.2.1-1, the applicant states that a review of operating experience, including equipment failure and maintenance results, has not identified any indication of aging not being detected by inspection activities credited for license renewal. Inspection results have not identified any notable aging that warranted corrective action, or the need to trend ongoing degradation, to prevent a loss of intended function prior to the next scheduled inspection. Therefore, the results of operating experience have not generated any changes to inspection activities. If any anomalous results were found during an augmented inspection, an evaluation and any required maintenance would be initiated in accordance with the applicant's corrective action system, which implements the requirements of 10 CFR Part 50, Appendix B. The applicant used the eddy-current examinations of flux thimble tubes as an example of operating experience with augmented inspections. In this case, the applicant states that strict wall-thinning limits are established for the thimble tubes such that the tubes are repositioned or taken out of service well before a potential loss of reactor coolant system pressure boundary. The staff concludes that there is reasonable assurance that the effects of aging associated with the systems and commodities that credit the augmented inspection activities will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.1.3 Conclusions

The staff has reviewed the information provided in Section B2.2.1 of each LRA and the summary description of the augmented inspection activities in Section A2.2.1 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs and additional information provided in a letter to the NRC dated May 22, 2002 (Serial No. 02-277).

On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effects of aging associated with components covered by the augmented inspection activities will be adequately managed so that there is reasonable assurance that the intended functions will be consistent with the CLB for the period of extended operation.

3.3.1.1.4 FSAR Supplement

The staff reviewed Section A2.2.1 of the UFSAR supplement and found that the description of the augmented inspection activities is consistent with Section B2.2.1 of each LRA. However, Section B2.2.1 of each LRA states that the station will implement an augmented examination of the pressurizer surge line connection to the reactor coolant system's hot-leg loop piping prior to the end of the current operating license term, and an inspection of the core barrel holddown spring. These two items are included in each LRA, Table B4.0-1, which contains a comprehensive list of followup action items. The applicant was requested to explain why these commitments are not included in Section A2.2.1 of the UFSAR supplement.

In its response to RAI B2.2.9-3, the applicant stated that it would incorporate the followup actions from Table B4.0-1 of each LRA into the UFSAR supplements for Surry and North Anna. The applicant committed to describe the followup actions in the appropriate aging management activity summaries provided in UFSAR supplement of the applications. In its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1 of the LRAs have been incorporated into the text of their respective Aging Management Activities (AMAs) in the UFSAR Supplement. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.1-1 closed.

3.3.1.2 Battery Rack Inspections

The applicant describes its battery rack inspection activities in Section B2.2.2 of Appendix B to each LRA. The applicant credits this inspection activity with managing the potential aging of the supports for various batteries. The staff reviewed the applicant's description of the battery rack inspection program in Section B2.2.2 of each LRA to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.2.1 Summary of Technical Information in the Application

In Section B2.2.2 of each LRA, the applicant states that the purpose of the battery rack inspections will be to reasonably assure the integrity of the supports for various batteries consistent with the CLB throughout the period of extended operation. The applicant states that loss of material due to corrosion is the applicable aging effect for the battery racks. Inspections are performed, as part of the battery rack inspections, for the support racks of numerous batteries, including:

- main station batteries
- emergency diesel generator batteries
- diesel-driven fire pump battery
- security diesel generator battery
- station blackout (AAC) diesel generator battery

3.3.1.2.2 Staff Evaluation

The staff's evaluation of the battery rack inspections focused on how the program manages aging effects through the effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: The applicant stated that the battery rack inspection activity is credited with managing the aging effect of loss of material for battery racks, as indicated in Table 3.5.10-1 of each LRA, which covers general structural supports. The applicant stated that the periodic checks of rack integrity, coinciding with periodic battery inspections, are performed to determine the physical condition of support racks for batteries that are important for the proper functioning of components within the scope of license renewal. The staff finds that the applicant's program is in general accord with industry experience and is, therefore, acceptable.

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

Parameters monitored or inspected: The applicant states that the condition of the battery support racks is visually inspected on a periodic basis to reasonably assure that their function to adequately support the batteries is not compromised. The aging effect that is monitored by these inspections is loss of material due to corrosion. In addition to the battery support racks, the applicant was requested to discuss the effect of aging on battery spacers used in the seismic rack assembly of the batteries. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant responded by stating that both rigid and compressible spacers are used between cells of station batteries. These spacers are considered to be part of the battery support rack and degradation of the spacers would be detected during the periodic inspections of the battery racks. Based on the applicant's responses and the scope of the battery rack inspections, the staff finds the parameters monitored are acceptable.

Detection of aging effects: The applicant states in Section B2.2.2 of each LRA that visual inspections are used to identify degradation of the support racks. These inspections check for loss of material (corrosion) of the support racks and provide reasonable assurance that the integrity of the racks is maintained during a seismic event. The applicant also indicates that once degradation is detected, engineering evaluations will determine whether the observed condition is significant enough to compromise the ability of the battery rack to perform its intended function during a seismic event. In addition, the applicant states that repairs that are required as a result of the engineering evaluation would be implemented through the corrective action system. The staff finds that the visual battery rack inspection activity provides reasonable assurance that loss of material of the battery rack supports will be detected prior to the loss of intended function.

Monitoring and trending: The inspection frequency for the battery rack inspections is typically quarterly, but is monthly or weekly on a few battery systems. The applicant states that engineering evaluation assesses whether any observed loss of material could result in a loss of intended function. In addition, all observations regarding the material condition of the battery racks are recorded in completed inspection procedures. The staff finds that quarterly inspections of the battery rack supports are sufficient to provide reasonable assurance that loss of material of the supports will be detected prior of the loss of intended function.

Acceptance criteria: The applicant states in Section B2.2.2 of each LRA that the acceptance criterion for visual inspections is the absence of anomalous indications of degradation. In addition, the applicant states that engineering evaluation will determine whether observed degradation of the battery rack supports is significant enough to compromise the ability of the support to perform its intended function during a seismic event. In addition, occurrence of degradation which is determined to be adverse to quality, is entered into the applicant's corrective action system. The staff finds that the acceptance criteria for the battery rack inspections provide reasonable assurance that the component section identified to have potentially unacceptable degradation will be subject to subsequent evaluations and remedial actions.

Operating experience: The applicant states in Section B2.2.2 of each LRA that incidents of battery rack corrosion have occurred and corrective action has been taken to repair or replace rack components as necessary. In addition, the applicant states that the battery rack inspections and corrective actions have been successful in maintaining battery rack integrity and will continue into the period of extended operation. Based on the applicant's description of the periodic inspection and corrective actions, and the evidence of their successful performance in the past, the staff considers the visual inspection program for battery racks to be acceptable.

3.3.1.2.3 Conclusions

The staff has reviewed the information provided in Section B2.2.2 of each LRA and the summary description of the battery rack inspections in Section A2.2.2 of the UFSAR supplement. In addition, the staff considered the information provided by the applicant in a letter to the NRC dated May 22, 2002 (Serial No. 02-277). On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effect of aging associated with the battery rack supports will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.2.4 FSAR Supplement

The staff reviewed Section A2.2.2 of the UFSAR supplement and found that the description of the applicant's battery rack inspections is consistent with Section B2.2.2 of each LRA.

3.3.1.3 Boric Acid Corrosion Surveillance

The applicant describes its boric acid corrosion surveillance program in Section B2.2.3 of Appendix B of each LRA. The applicant credits this program for managing the aging effect of loss of material for all four units. The staff reviewed each LRA to determine whether the applicant has demonstrated that the boric acid corrosion surveillance program will adequately manage the applicable effects of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.3.1 Summary of Technical Information in the Application

In Section B2.2.3 of each LRA, the applicant states that the inspections are performed to provide reasonable assurance that borated water leakage does not lead to undetected loss of material from the reactor coolant pressure boundary and surrounding components.

This AMP was developed by the applicant in response to Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants." The applicant's program includes examination of primary coolant components for evidence of borated water leakage that could degrade the external surfaces of nearby structures or components and implementation of corrective actions to address coolant leakage. At a minimum, these activities are performed inside containment at the beginning and end of each refueling outage.

The following systems, structures, commodities, and major components credit this AMP for managing the aging effect of loss of material:

<u>System</u>

- blowdown
- chemical and volume control
- chilled water (NAS 1/2 only)
- component cooling water
- containment vacuum

- containment spray (SPS 1/2 only)
- quench spray (NAS 1/2 only)
- drains - aerated
- drains - gaseous
- feedwater
- fire protection
- fuel pit cooling
- gaseous waste (SPS 1/2 only)
- instrument air
- main steam
- neutron shield tank cooling
- post-accident hydrogen removal (NAS 1/2 only)
- primary and secondary plant gas supply
- primary grade water (SPS 1/2 only)
- radiation monitoring
- refueling purification (NAS 1/2 only)
- reactor cavity purification (SPS 1/2 only)
- reactor coolant system
- recirculation spray
- residual heat removal
- safety injection
- sampling system
- service air (NAS 1/2 only)
- service water
- steam generator water treatment (NAS 1/2 only)
- steam generator recirculation and transfer (SPS 1/2 only)
- vacuum priming
- ventilation
- vents - aerated (SPS 1/2 only)

Structure

- containment
- load-handling cranes and devices
- NSSS equipment supports

Commodity

- general structural supports
- miscellaneous structural commodities

Major Component

- pressurizer
- reactor vessel
- steam generator

3.3.1.3.2 Staff Evaluation

The staff's evaluation of the boric acid corrosion surveillance 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.3 of each LRA states that the scope of the boric acid corrosion surveillance activities includes the effects on the leaking borated systems and susceptible equipment and structures in the vicinity of leakage. The systems, structures, commodities, and major components inside containment that credit this activity are listed in Section B2.2.3.1 of the LRAs. Similar inspections for the effects of boric acid leakage on components outside containment are performed in accordance with the applicant's general-condition-monitoring activities which are described in Section B2.2.9 of each LRA. The staff agrees that the program includes the recommendations of NRC GL 88-05. The staff finds the scope of this AMP acceptable because the scope includes the systems, structures, commodities, and major components inside containment that may be affected by borated water leakage.

Preventive actions: The applicant states that the boric acid corrosion surveillance activities are considered to be condition monitoring and no preventive actions are performed. The staff observed during the review that the recommendations of GL 88-05 include preventive actions and it appeared that preventive actions are included in this AMP. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant indicated that the boric acid corrosion surveillance activities are performed at the beginning of each refueling outage, or when the calculation of the primary-system leakage rate, which is required by Technical Specifications, indicates an increased level of unidentified leakage. If indications of leakage are found, the boric acid residue is removed, the cause of the leakage is determined, and repairs are implemented in accordance with the corrective action program. Operating experience confirms that leakage is discovered and corrected prior to a loss of intended function. Furthermore, the applicant stated that the boric acid corrosion surveillance activities are considered as preventive actions.

The staff found the additional clarifications that were provided by the applicant to be acceptable. The staff concludes that appropriate preventive actions are being performed in accordance with the requirements of NRC GL 88-05.

Parameters monitored or inspected: The applicant performs visual inspections of external surfaces inside the containment to determine the presence of borated water leakage, which could lead to the deterioration of susceptible components. Equipment surfaces, insulated surfaces, and surrounding areas are examined for discoloration, staining, boric acid residue, and other evidence of leakage. Components that have come in contact with borated water leaks are visually examined to determine whether degradation has occurred. The staff finds the parameters monitored to be acceptable since coolant leakage results in deposits of white boric acid crystals and presence of moisture can be observed by the naked eye.

Detection of aging effects: The applicant performs inspections of carbon steel components in accordance with Generic Letter 88-05 to determine the borated water leakage locations and pathways. These examinations do not need to be performed with the reactor coolant system pressurized. The applicant also performs additional visual inspections inside containment with the reactor coolant system at normal pressure, to determine the possible existence of leakage. These inspections are performed in accordance with ASME Section XI, as modified by NRC-approved relief requests. Upon identification of borated water leakage, the boric acid residue is removed, and a visual examination is performed by a qualified individual.

NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," was issued as a result of the Davis-Besse control rod drive mechanism nozzle cracking event, which resulted in severe degradation of the reactor vessel head due to exposure to concentrated boric acid. To date, all licensees have responded to the bulletin, providing information about their boric acid corrosion control (BACC) programs. However, the staff has determined that a follow-up information request regarding the bulletin response is necessary because the licensee's response to Bulletin 2002-01 lacked specificity, and therefore the staff could not make a reasonable assurance finding that the BACC programs are effective. This information request is necessary to permit the assessment of plant-specific compliance with NRC regulations. This information will also be used by the NRC staff to determine the need for, and to guide the development of, additional regulatory actions to prevent degradation of the reactor coolant pressure boundary.

The staff is currently reviewing the issues associated with NRC bulletin 2001-01, 2002-01, and 2002-02. Any future regulatory actions that may be required as a result of those reviews will be addressed by the staff in a separate regulatory action. The staff will continue to pursue this issue with the applicant through the issuance of the supplement to the bulletin.

Monitoring and trending: The applicant states in Section B2.2.3 of each LRA that monitoring under this AMP involves examination for evidence of borated water leakage, reviews of inspection results, and evaluations of the effects of leakage. Walkdowns for borated water leakage are performed at a frequency of each refueling outage. Therefore, the staff found the applicant's approach of monitoring activities to be acceptable.

Acceptance criteria: The applicant's acceptance criterion for visual inspections is the absence of detectable leakage or boric acid residues. Whenever evidence of borated water leakage exists, a visual examination is performed and the results are evaluated to determine whether degradation of susceptible components has occurred and whether the observed condition is acceptable without repair. The occurrence of degradation that is adverse to quality is entered into the applicant's corrective action system. Therefore, the staff concludes that the applicant has demonstrated that the acceptance criteria to ensure that the intended functions of the systems, structures, commodities, and major components containing (or exposed to) borated water are acceptable.

Operating experience: The applicant has reported that evidence of boric acid residues have been found during the plant walkdown inspections during refueling outages. Borated water leaks have typically occurred at valve packings or bolted connections. The applicant states that these leaks are usually corrected by minor adjustments and have had only minor effects on equipment or structures in the vicinity of the leakage.

During a refueling outage in September 2002, the applicant performed a bare-metal inspection of the North Anna 2 vessel-head-nozzles. The inspection showed indications of leakage from the head penetration nozzles. The applicant performed visual and eddy current inspections of 65 penetrations in the reactor vessel head. The applicant identified indications in the weld surface of 63 penetrations. Six of the penetrations showed leakage above the head. The applicant plans to replace the reactor vessel head.

The staff is currently reviewing the issues associated with NRC Bulletins 2001-01, 2002-01, and 2002-02. NRC Bulletin 2002-01 was issued as a result of a control rod drive mechanism nozzle cracking event at Davis-Besse, which resulted in severe degradation of the reactor vessel head due to exposure to concentrated boric acid. To date, all licensees (except Davis-Besse) have responded to the bulletin, providing information about their boric acid corrosion control (BACC) programs. Any future regulatory actions that may be required as a result of those reviews will be addressed by the staff in a separate regulatory action. This is considered a current operating issue and will be handled as such. The staff will resolve this issue in accordance with 10 CFR 54.30 outside of the license renewal process.

Therefore, the staff concludes that the boric acid corrosion surveillance program has been effective in managing the effects of boric acid corrosion on the intended function of reactor components.

3.3.1.3.3 Conclusions

The staff has reviewed the information provided in Section B2.2.3 of each LRA and the summary description of the boric acid corrosion surveillance program in Section A2.2.3 of the UFSAR supplement. On the basis of this review, the above evaluation, and resolution of the current operating issues raised in Bulletins 2002-01 and 2002-02 in accordance with 10 CFR 54.30, the staff finds that the effects of aging associated with boric acid corrosion will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.3.4 FSAR Supplement

The staff reviewed Section A2.2.3 of the UFSAR supplement and found that the description of the applicant's boric acid corrosion surveillance program is consistent with Section B2.2.3 of each LRA. However, the applicant should modify the FSAR supplement descriptions of the boric acid corrosion surveillance program to reflect the information that was provided in response to NRC Bulletin 2002-01 and the information that will be provided in response to the supplement to the bulletin.

3.3.1.4 Chemistry Control Program for Primary Systems

The applicant describes its chemistry control program for primary systems in Section B2.2.4 of each LRA. The applicant credits this program for managing the aging effects of loss of material and cracking for all four units. The staff reviewed each LRA to determine whether the applicant has demonstrated that the chemistry control program for primary systems will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.4.1 Summary of Technical Information in the Application

In Section B2.2.4 of each LRA, the applicant states that the purpose of the chemistry control program for primary systems is to provide reasonable assurance that water quality is compatible with materials of construction in the plant systems and equipment in order to minimize loss of material and cracking. The chemistry control program for primary systems creates an environment in which material degradation is minimized, thereby, maintaining material integrity and reducing the amount of corrosion products that could accumulate and interfere with the equipment operation or heat transfer.

The program is based on Technical Specification requirements and on EPRI guidelines provided in Technical Report TR-105714, entitled "PWR Primary-Water Chemistry Guidelines." The EPRI guidelines reflect industry operating experience and are revised based on this experience to optimize plant chemistry control. The applicant committed to revising its chemistry control program for primary systems to maintain consistency with the EPRI guidelines.

The applicant identified the following systems in all four units that credit the chemistry control program for primary systems for managing the aging effects for loss of material and cracking:

- blowdown (NAS 1/2 only)
- boron recovery
- chemical and volume control
- component cooling water
- quench spray (NAS 1/2 only)
- condensate (SPS 1/2 only)
- containment vacuum (NAS 1/2 only)
- containment spray (SPS 1/2 only)
- drains - gaseous
- fuel pit cooling
- heating (NAS 1/2 only) and ventilation
- high radiation sampling (NAS 1/2 only)
- liquid and solid waste (NAS 1/2 only)
- instrument air (SPS 1/2 only)
- neutron shield tank cooling
- radwaste (NAS 1/2 only)
- primary grade water (SPS 1/2 only)
- refueling purification (NAS 1/2 only)
- reactor cavity purification (SPS 1/2 only)
- reactor coolant system (including reactor primary-water and closed-water systems)
- recirculation spray
- residual heat removal
- safety injection
- sampling system
- vents - gaseous (SPS 1/2 only)

The applicant states that the scope of the chemistry control program for primary systems includes the following structures:

- containment

- fuel building
- load-handling cranes and devices
- NSSS equipment supports

The applicant states that the scope of the chemistry control program for primary systems includes the following commodities, and major components:

<u>Commodity</u>

- general structural supports

<u>Major Components</u>

- pressurizer
- reactor vessel
- reactor vessel internals
- steam generator

In addition, the applicant states that the scope of the chemistry control program for primary systems monitors fluid for the parameters within the following systems and components:

System/Component	Chemistry Parameters
• primary-grade water tank	aluminum, calcium, chloride, fluoride, magnesium, oxygen, silica, sodium, suspended solids, tritium
• primary systems	aluminum (required only if silica exceeds 1.0 ppm), boron, calcium (required only if silica exceeds 1.0 ppm), chloride, crud, fluoride, hydrogen, lithium, liquid isotopic, magnesium (required only if silica exceeds 1.0 ppm), oxygen, pH, silica, specific conductivity, sulfate, suspended solids, tritium
• component cooling	chloride, chromate, fluoride, liquid isotopic, pH, specific conductivity
• spent fuel pit	pH, aluminum, boron, calcium plus magnesium, chloride, fluoride, liquid isotopic, magnesium, silica, sodium sulfate, specific conductivity
• refueling water storage tank	aluminum, boron, calcium, chloride, fluoride, liquid isotopic, magnesium, pH, silica, suspended solids
• boric acid storage tank	aluminum, boron, calcium, chloride, fluoride, magnesium, silica
• accumulator tank	boron, chloride, fluoride
• chemical addition tank	chloride, sodium hydroxide
• boron injection tank*	boron
• casing cooling tank *	boron, chloride, fluoride, liquid isotopic, pH, silica

* Applicable to NAS 1/2 only

3.3.1.4.2 Staff Evaluation

The staff's evaluation of the chemistry control program for primary systems 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.4 of each LRA lists systems, structures, major components, and a commodity that credit the chemistry control program for primary systems for minimizing loss of material and cracking. The four major components are the pressurizer, reactor vessel, reactor vessel internals, and the steam generator. The staff noted that the aging management review of the reactor coolant pumps is included as part of the reactor coolant system and that the related component groups credit this program.

The staff finds the scope of the program to be acceptable because it includes a comprehensive list of systems, structures, commodities, and major components exposed to a treated-water environment.

Preventive actions: Each LRA specifies that the chemistry control program for primary systems is a set of mitigative activities utilized to maintain water chemistry that is compatible with materials of construction. In particular, the levels of dissolved oxygen and other impurities are maintained at low levels, and system pH is maintained in the optimal range such that conditions for loss of material or cracking are minimized. The staff finds that these procedures are adequate because they include all of the activities needed to mitigate age-related effects in SCs that are within the scope of license renewal.

Parameters monitored or inspected: This AMP monitors fluid within 10 systems and components for NAS 1/2 and 8 systems and components for SPS 1/2. The parameters that are monitored are based on information in the EPRI guidelines and the requirements of the station's Technical Specifications. The parameters monitored and their acceptable ranges vary depending on the mode of plant operation (i.e., operations at full power, operation at a reduced power level, hot-standby operation, or plant shutdown).

In a letter dated May 22, 2002 (Serial No. 02-277), the applicant verified that the chemistry parameters monitored by this chemistry monitoring program are, at a minimum, complete, and consistently more conservative than the parameters in the EPRI guidelines. The applicant monitors some additional parameters that are not identified in the EPRI guidelines. The applicant explained that crud is the same as suspended solids and that it does monitor this impurity for intrusion into, and potential clogging of, the control rod drive mechanisms and the seal injection lines for the reactor coolant pumps, and (c) explained that it has sample and analysis procedures to control the quality of the sampling and analysis techniques. They verified that these procedures are controlled by its 10 CFR Part 50, Appendix B program.

The staff found the parameters monitored to be acceptable since they are in accordance with standard industry practice and the sample and analysis procedures are controlled by its 10 CFR Part 50, Appendix B program.

Detection of aging effects: The applicant states that the chemistry control program for primary systems mitigates rather than detects aging effects. The staff finds this acceptable and agrees that this AMP does not have aging detection capability and that its purpose is to maintain a coolant environment that will minimize aging effects such as loss of material and cracking.

Monitoring and trending: The applicant states that water chemistry parameters are monitored and the results are trended to provide timely indication of abnormal chemistry conditions. Monitoring and trending guidelines and sampling frequencies are included in the Chemistry Control Program for Primary Systems. Trending is stated to provide a basis for confirming that the sampling frequencies are appropriately set to provide effective chemistry monitoring. Therefore, the staff concludes that trending of the sampling frequencies can provide early indication of chemistry deviations, allowing for timely corrective action.

Acceptance criteria: The applicant states that the acceptance criteria reflect EPRI guidelines for parameters that have been shown to contribute to general corrosion and stress corrosion cracking of components. Control of oxygen in the primary-water will lead to mitigation of stress corrosion cracking. In general, adherence to the guidelines minimizes the effects of loss of material and cracking. The staff agrees that the EPRI guidelines for primary-water chemistry control will satisfactorily mitigate loss of material and cracking in all the systems identified in Section 3.3.1.4.1 of this SER.

Operating experience: The application states that operating experience indicates that chemistry parameters can drift from acceptable ranges, but that the chemistry control program for primary systems is effective in identifying these anomalies, implementing corrective actions, and trending the parameters. When chemistry results have reached a level at which loss of material or cracking could create a concern regarding loss of intended function, immediate corrective actions have been implemented to minimize the necessity for plant shutdown. The applicant states that the numerous component inspections that occur during preventative maintenance and corrective maintenance work activities confirm that there has been no significant degradation in the ability of the components to perform their intended functions due to chemistry concerns.

Such operating experience has provided feedback to revisions of the EPRI water chemistry guideline document. The staff concluded that the EPRI guideline document, which has been developed based on operating experience is effective over time with widespread use.

3.3.1.4.3 Conclusions

The staff has reviewed the information provided in Section B2.2.4 of each LRA and the summary description of the chemistry control program for primary systems in Section A2.2.4 of the UFSAR supplement. On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effects of aging associated with the chemistry control program for primary systems will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.4.4 FSAR Supplement

The staff reviewed Section A2.2.4 of the UFSAR supplement and found that the description of the applicant's chemistry control program for primary systems is consistent with Section B2.2.4 of each LRA and that no changes were needed.

3.3.1.5 Chemistry Control Program for Secondary Systems

The applicant describes its chemistry control program for secondary systems in Section B2.2.5 of each LRA. The applicant credits this program for managing the aging effects of loss of material and cracking for all four units. The staff reviewed the applicant's description of the program in Section B2.2.5 of each LRA to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.5.1 Summary of Technical Information in the Application

The applicant states that the purpose of this AMP is to provide reasonable assurance that water quality is compatible with materials of construction in the plant systems and equipment in order to minimize loss of material and cracking. The chemistry control program for secondary systems creates an environment in which material degradation is minimized, thereby, maintaining material integrity and reducing the amount of corrosion product that could accumulate and interfere with the equipment operation or heat transfer.

The program is based on EPRI guidelines provided in Technical Report TR-102134, entitled "PWR Secondary-water Chemistry Guidelines." The EPRI guidelines reflect industry operating experience and are revised based on this experience to optimize plant chemistry control. The applicant committed to revising its chemistry control program for secondary systems to maintain consistency with the EPRI guidelines.

The applicant identified the following systems and major components in all four units that credit the chemistry control program for secondary systems for managing the aging effects for loss of material and cracking:

<u>System</u>

- alternate AC diesel generator system
- auxiliary steam
- bearing cooling (SPS 1/2 only)
- blowdown
- chilled water (NAS 1/2 only)
- emergency diesel generator system
- feedwater
- heating (NAS 1/2 only) and ventilation
- liquid and solid waste (NAS 1/2 only)
- main steam
- primary and secondary plant gas supply (SPS 1/2 only)
- sampling system
- security

- service water (SPS 1/2 only)
- steam drains (NAS 1/2 only)

Major Component

- steam generator

In addition, the applicant states that the scope of the chemistry control program for secondary systems monitors fluid for the parameters within the following systems and components:

System/Component	Chemistry Parameters
• Condensate Storage Tanks	silica, sodium, total organic carbon (not required if makeup water is analyzed for TOC)
• Condensate (NAS 1/2)	Ammonia, Cation Conductivity, Ethanolamine, Hydrazine, Oxygen, pH, Sodium, Specific Conductivity
• Condensate (SPS 1/2)	Ammonia, Cation Conductivity, Ethanolamine, Hydrazine, pH, Sodium, Specific Conductivity
• Condensate Polishing (NAS 1/2)	Cation Conductivity, Silica, Sodium, Specific Conductivity, Resin fines (when in demineralizer mode rather than filter mode)
• Condensate Polishing (SPS 1/2)	Chloride, Sodium, Specific Conductivity, Sulfate
• Feedwater	Acetate, Ammonia, Cation Conductivity, Copper, Formate, Hydrazine, Iron, Ethanolamine, Oxygen, pH, Sodium, Specific Conductivity
• Steam Generator	Acetate, Ammonia, Blowdown Rate, Cation Conductivity, Chloride, Formate, Gross Activity, Liquid Isotopic, Molar Ratio (Sodium Chloride), Ethanolamine, pH, Silica, Sodium, Specific Conductivity, Sulfate, Primary-to-secondary Leak Rate
• Main Steam	Cation Conductivity (monitored in one loop), Chloride (analysis required if corresponding SG exceeds Action Level 1, Oxygen (analysis required if condensate dissolved oxygen exceeds Action Level 2), Silica (analysis required if corresponding SG exceeds Action Level 1), Sodium (analysis required if corresponding SG exceeds Action Level 1), Sulfate (analysis required if corresponding SG exceeds Action Level 1)
• Steam Generator Wet Layup	Ammonia, Chloride, Hydrazine, pH, Sodium, Sulfate
• Diesel Generator Cooling (NAS 1/2)	Corrosion Inhibitor, Glycol Percent (Conditioner), pH (Boron-nitrite and Glycol Treatment)
• Diesel Generator Cooling (SPS 1/2)	Chromate, pH
• Station Makeup Water	Specific Conductivity, Silica, Sodium, Dissolved Oxygen, Total Organic Carbon

•	Air-conditioning	Corrosion Inhibitor, pH, Specific Conductivity
•	Steam Generator Blowdown Cleanup Effluent (SPS 1/2)	Cation Conductivity, Chloride, Hydrazine, Silica, Sodium

3.3.1.5.2 Staff Evaluation

The staff's evaluation of the chemistry control program for secondary systems 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.5 of each LRA lists systems and components that credit the chemistry control program for secondary systems for minimizing loss of material and cracking. The major component included in the program is the steam generator.

The staff finds the scope of the program to be acceptable because it includes a comprehensive list of systems and components exposed to treated-water or steam environment.

Preventive actions: Each LRA specifies that the chemistry control program for secondary systems is a set of mitigative activities utilized to maintain water chemistry that is compatible with materials of construction. The aging effects to be mitigated through the program are loss of material and cracking. The staff finds that these procedures are adequate because they include all of the activities needed to mitigate age-related effects in SCs that are within the scope of license renewal.

Parameters monitored or inspected: This AMP monitors fluid within 10 systems and components for NAS 1/2 and 11 systems and components for SPS 1/2. The parameters that are monitored are based on information in the EPRI guidelines. The parameters monitored and their acceptable ranges vary depending on the mode of plant operation, (i.e., operations at full power, operation at a reduced power level, hot-standby operation, or plant shutdown).

In a letter dated May 22, 2002 (Serial No. 02-277), the applicant (a) verified that the chemistry parameters monitored by this chemistry monitoring program are, at a minimum, complete and consistent with, or more conservative than, the parameters in the EPRI guidelines. The applicant does monitor some additional parameters that are not identified in the EPRI guidelines, and (b) explained that it has sample and analysis procedures to control the quality of the sampling and analysis techniques. The applicant verified that these procedures are controlled by its 10 CFR Part 50, Appendix B program.

The staff found the parameters monitored to be acceptable since they are in accordance with standard industry practice and the sample and analysis procedures are controlled by its 10 CFR Part 50, Appendix B program.

Detection of aging effects: The applicant states that the chemistry control program for secondary systems mitigates rather than detects aging effects. The staff agrees that this AMP does not have aging detection capability and that its use is to maintain a fluid environment that will minimize aging effects such as loss of material and cracking, and therefore finds this acceptable.

Monitoring and trending: The applicant states that water chemistry parameters are monitored and the results trended to provide timely indication of abnormal chemistry conditions. Monitoring and trending guidelines and sampling frequencies are included in the Chemistry Control Program for Secondary Systems. Trending is stated to provide a basis for confirming that the sampling frequencies are appropriately set to provide effective chemistry monitoring. Therefore, the staff concludes that trending of the sampling frequencies can provide early indication of chemistry deviations, allowing for timely corrective action.

Acceptance criteria: The applicant states that the acceptance criteria reflect EPRI guidelines for parameters that have been shown to contribute to component degradation. In general, adherence to the guidelines minimizes the effects of loss of material and cracking. The staff agrees that the EPRI guidelines for secondary-water chemistry control will satisfactorily mitigate loss of material and cracking in all the systems identified in Section B2.2.5.1, above.

Operating experience: The application states that operating experience indicates that chemistry parameters can drift from acceptable ranges, but that the chemistry control program for secondary systems is effective in identifying these anomalies, implementing corrective actions, and trending the parameters. When chemistry results have reached a level at which loss of material or cracking could create a concern regarding loss of intended function, plant power reductions have been implemented until corrective actions were completed. With the exception of tubing in steam generators that already have been replaced, the numerous component inspections that occur during preventive maintenance and corrective maintenance work activities confirm that there has been no significant degradation of the ability of components to perform their intended functions due to coolant chemistry concerns. Changes in tubing materials and changes in chemistry controls have resulted in excellent performance for tubing in the replacement steam generators.

Such operating experience has provided feedback to revisions of the EPRI water chemistry guideline document. The EPRI guideline document, which is based on operating experience, has been widely used and the staff has found the EPRI guidelines to be effective for controlling chemistry parameters.

3.3.1.5.3 Conclusions

The staff has reviewed the information provided in Section B2.2.5 of each LRA and the summary description of the chemistry control program for secondary systems in Section A2.2.5 of the UFSAR supplement. On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effects of aging associated with the chemistry control program for secondary systems structures and components will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.5.4 FSAR Supplement

The staff reviewed Section A2.2.5 of the UFSAR supplement and found that the description of the applicant's chemistry control program for secondary systems is consistent with Section B2.2.5 of each LRA and that no changes were needed.

3.3.1.6 Civil Engineering Structural Inspection

The applicant describes its civil engineering structural inspection activities in Section B2.2.6 of each LRA. The applicant credits this inspection program with assessing the overall condition of the North Anna and Surry 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 intended functions. The staff reviewed each LRA to determine whether the applicant has demonstrated that the civil engineering structural inspection activities will adequately manage the applicable aging effects during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.6.1 Summary of Technical Information in the Application

In Section B2.2.6 of each LRA, the applicant describes the civil engineering structural inspection activities credited for aging management. The applicant states that the purpose of the inspection activities of this program is to assure the continuing capability of civil engineering structures to fulfill their intended functions. The structures monitored include the containment, auxiliary building, fuel building, other Class 1 structures, miscellaneous structures, yard structures, and earthen structures. The applicant listed the specific structural components and systems; which are fabricated from carbon steel, stainless steel, low-alloy steel, galvanized steel, aluminum, bronze, copper alloys, concrete, soil, elastomers, or ceramics, and inspected as part of the civil engineering structural inspection activities in Section 3.5 of each LRA.

The aging effects managed by the civil engineering structural inspection activities are loss of material for concrete and structural steel, cracking for concrete and masonry walls, and loss of material or loss of form for soil. The program provides for visual inspection and examination of accessible surfaces of structural components. Aging management of structural components that are normally 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 civil engineering structural inspection activities will be expanded to bound the scope of inspections required for license renewal. This expansion will be implemented prior to the end of the current operating license term.

3.3.1.6.2 Staff Evaluation

The staff's evaluation of the civil engineering structural inspection activities 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.6 of each LRA identifies the North Anna and Surry structures that are inspected by the civil engineering structural inspection activities. The applicant notes that not all portions or components within the structures that credit this program are within the scope of license renewal. In addition, portions of the structures that credit the civil engineering structural inspection that are infrequently accessed due to radiation, high temperature, or obstructions are covered by the one-time inspections of the infrequently accessed area inspection activities, which is discussed in Section B2.1.2 of each LRA. For structural components that are normally inaccessible for inspection, the applicant relies on the inspection of accessible structural components with similar materials and environments for aging effects that may be indicative of the aging effects for the inaccessible structural components. The applicant states that if an inaccessible area becomes accessible through dewatering, excavation, or installation of shielding, a followup action will be initiated for inspection of this area. Since the civil engineering structural inspection program is an existing program, the applicant states that a followup action is to expand the scope of the program to bound the scope of inspections required for license renewal prior to the end of the current operating license term. The staff finds that the scope of the civil engineering structural inspection activities is acceptable, since it includes an inspection and aging effects assessment of all the structures that credit this program.

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

Parameters monitored or inspected: Section B2.2.6 of each LRA lists the various concrete, masonry wall, steel, and earthen structures that are monitored by the civil engineering structural inspection activities. These include cracks, delaminations, honeycombs, water in-leakage, chemical leaching, peeling paint, and discoloration for concrete structures. For masonry walls, the inspection activities look for cracks of joints and missing or broken blocks. For steel structures the structural inspection activities look for (1) deformation, alteration, and significant rust on structural members, (2) loose, missing, and damaged anchors, fasteners, and pads, (3) missing and degraded grout under base plates, and (4) cracked welds. For earthen structures, the inspection activities cover erosion, cracking, depressed areas, and evidence of shifting, settlement, movement, seepage, and leakage. In addition, for inaccessible structural components exposed to groundwater, the values for sulfate, chloride, and pH in the groundwater are monitored to verify that the exposed components do not experience an aggressive environment. Although the applicant does not expect the groundwater at either North Anna or Surry to become aggressive, routine monitoring of the groundwater chemistry at both sites is presently being conducted and will be conducted on an annual basis during the period of extended operation. In addition, the applicant has committed to monitor the groundwater chemistry at a different time each year so that any seasonal variations in the groundwater chemistry may be detected.

Under the list of parameters monitored for concrete structures, Section B2.2.6 of each LRA, the applicant states that there are no significant aging effects requiring management for structural concrete located in a sheltered-air environment. In RAI 3.5-7, the staff disputed this statement since aging effects can and do occur in concrete in a sheltered-air environment. In response to

RAI 3.5-7, the applicant acknowledged that all accessible concrete components require aging management and, as such, Section A2.2.6 of the UFSAR supplement for the civil engineering structural monitoring inspection program needs to be updated to reflect this commitment.

In addition, under the list of parameters monitored for concrete structures, change in material properties is not listed as an aging effect. As listed above, the applicant examines concrete structures for, among other indicators, chemical leaching and discoloration, which are evidence of change in material properties. In response to RAI 3.5-7, the applicant has committed to credit the civil engineering structural inspection activity to manage change in material properties and the previously cited aging effects (cracking and loss of material) for concrete structures. The applicant's response to the above two issues for concrete structures are acceptable to the staff. In its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.2.6, "Civil Engineering Structural Inspections" has been modified to include change in material properties as an aging effect for both concrete and elastomer sealant and/or gasket materials. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.6-1 closed.

In RAI B2.2.6-1, the staff requested the applicant to discuss the aging of steel supports within some masonry walls. Some masonry walls that credit the civil engineering structural inspection activities have been structurally modified with steel supports to meet the requirements of IE Bulletin 80-11. In its response, the applicant stated that structural supporting steel that is required for masonry wall reinforcement is included within the scope of license renewal and is evaluated as building structural steel. Structural steel that supports these masonry walls is managed for loss of material using the civil engineering structural inspection activities. The staff finds this response to be acceptable.

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 and visual inspections of these aging effects are an effective method to detect degraded conditions.

Detection of aging effects: For Surry, cracking, loss of material, loss of form, and gross indication of change in material properties are identified as the aging effects that are detected by visual inspections. For North Anna, only cracking, loss of material, and loss of form are identified as the applicable aging effects. As noted above, under the staff evaluation of "Parameters Monitored or Inspected", there was an inconsistency for North Anna in that change in material properties is not included as an applicable aging effect. This issue is resolved by the applicant's response to RAI 3.5-7. Therefore, the staff found the applicant's approach for the detection of aging effects to be acceptable.

Monitoring and trending: The applicant states that the structural monitoring activities are intended to assess the overall condition of structures. The inspection activities, which are typically performed every 5 years, rely on visual examinations of components in accessible areas during planned plant walkdowns. Documentation is made of the inspection results, which includes a general description of observed conditions, the location and size of discontinuities, and the noted effects of environmental conditions. The staff concludes that the approach described above for accessible areas and the methods described earlier for inaccessible and infrequently accessed areas are acceptable for monitoring the aging effects identified by the civil engineering structural inspection activity.

Acceptance criteria: Section B2.2.6 of each LRA states that the acceptance criterion for visual inspections is the absence of anomalous indications of degradation. Responsibility for the evaluation of inspection results is assigned to engineering personnel to determine whether analysis, repair, or additional inspection is required to reasonably assure that the structures that credit this program will continue to fulfill their intended functions. In addition, Section B2.2.6 of each LRA states that the acceptance criteria for concrete structures is based on recommendations in American Concrete Institute (ACI) document ACI-349-3R. The staff finds the acceptance criteria for the civil engineering structural inspection program provides reasonable assurance that observed degradation of structures will be adequately evaluated such that the structures that credit this program will continue to fulfill their intended functions during the period of extended operation.

Operating experience: The applicant states in Section B2.2.6 of each LRA that the civil engineering structural inspection activities are founded on the requirements of the Maintenance Rule (10 CFR 50.65). Aging effects of civil engineering structures are noted during routine inspections and corrective actions are taken, as necessary, following engineering evaluation. The applicant states that this is an ongoing process that will continue through the period of extended operation. The applicant also stated that structural inspections have been effective in identifying and correcting structural problems. The staff concludes that the civil engineering structural inspection activities will provide an effective aging management program for license renewal.

3.3.1.6.3 Conclusions

The staff has reviewed the information provided in Section B2.2.6 of each LRA and the summary description of the civil engineering structural inspection activities in Section A2.2.6 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs. On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effects of aging associated with the civil engineering structures will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.6.4 FSAR Supplement

The staff reviewed Section A2.2.6 of the UFSAR supplement and found that the description of the applicant's civil engineering structural inspection activities is consistent with Section B2.2.6 of each LRA. However, in Section B2.2.6 of each LRA, the applicant committed to two licensee followup actions, discussed above, that are not discussed in Section A2.2.6 of the UFSAR supplement. In response to RAI B2.2.9-3, the applicant stated that it would incorporate the followup actions, identified in Table B4.0-1 of each LRA, into the appropriate sections of the UFSAR supplement. In addition, as discussed under the staff's evaluation of "Parameters Monitored or Inspected," change in material properties was not listed as an applicable aging effect for concrete structures. In response to RAI 3.5-7, the applicant committed to credit the civil engineering structural inspection activity to manage change in material properties and the previously cited aging effects of cracking and loss of material for concrete structures. In the SER with open items, the staff indicated that this additional aging effect for concrete structures should be added to Section A2.2.6 of the UFSAR supplement.

In response to RAIs 3.5.5-1 and 3.5.6-4, the applicant committed to manage cracking and change in material properties for elastomer materials used in structures outside the containment. The applicant stated that the scope of the civil engineering and structural inspection activities would be clarified to include elastomers and their associated aging effects in the revised program summary description for the UFSAR supplement. In its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.2.6, Civil Engineering Structural Inspections has been modified to include change in material properties as an aging effect for both concrete and elastomer sealant and/or gasket materials. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.6-1 closed.

3.3.1.7 Fire Protection Program

The applicant describes its fire protection program in Section B2.2.7 of each LRA. The applicant credits this program with managing the potential aging of fire protection components that are within the scope of license renewal. The fire protection program monitors the fire protection systems through visual examinations, flow tests, and pressure monitoring. The staff reviewed each LRA to determine whether the applicant has demonstrated that the fire protection program will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.7.1 Summary of Technical Information in the Application

In Section B2.2.7 of each LRA, the applicant states that the purpose of the fire protection program is to manage the effects of aging associated with components within the scope of the program so that there is reasonable assurance that their intended functions will be performed consistent with the CLB during the period of extended operation. In each LRA, the applicant states that the fire protection program will be used for managing the aging effects of loss of material, separation and cracking/delamination, heat transfer degradation, and change in material properties. The fire protection program includes visual inspections of fire barriers and fire protection equipment, including hose stations, hydrants, and sprinklers. Verification of system performance is accomplished by periodic flow tests. Verification of system piping integrity (to maintain a pressure boundary for the fire protection system) is accomplished by periodic testing and pressure monitoring. The applicant states that the fire protection program includes applicable National Fire Protection Association (NFPA) commitments and maintains compliance with NRC Branch Technical Position (BTP) 9.5-1. The applicant states that the fire protection plan will be revised to include the replacement or testing of a representative sample of sprinklers that have been in service for 50 years. This task will conform to the requirements of Section 2-3.1.1 of NFPA-25 and will be performed during the period of extended operation.

3.3.1.7.2 Staff Evaluation

The staff's evaluation of the fire protection 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.7 of each LRA states that the scope of aging management activities for the Fire protection program includes barriers (i.e., doors, walls, floors, ceilings, penetration seals, fire-retardant coatings, dampers, cable tray covers, and fire stops). Piping systems that are dry or that carry water are evaluated consistently with similar mechanical systems. This includes such components as pump casings, valve bodies, hose stations, hydrants, and sprinklers. The reactor coolant pump oil collection systems, which are installed for fire protection, also are in scope for license renewal.

The Scope section of the fire protection program identifies some of the applicable component groups listed in Tables 3.3.9-1 and 3.5.11-1 of each LRA, but not all of the components. For example, there is no mention of tanks, expansion joints, or seismic gap covers. In a letter dated May 22, 2002 (Serial No. 02-163), the applicant verified that it provides an adequate scope of the program in the scoping summary through the commodities listed in Appendix B and the hyperlinks to the appropriate tables in Chapters 2 and 3 of each LRA. The staff found the applicant's response acceptable and finds the scope of the fire protection program to be acceptable since it includes the appropriate components from the systems and commodities that credit this aging management activity.

Preventative actions: The applicant identified this activity as a condition- and performance-monitoring activity and, therefore, states that no preventive actions are performed. However, since there is no mention in Section B2.2.7 of each LRA for the need to perform periodic flushing of the water-based fire protection systems, the staff asked the applicant to explain the preventive actions used to ensure that no significant corrosion, MIC, or biofouling has occurred in these systems. In a letter dated May 22, 2002 (Serial No. 02-163), the applicant verified that periodic flushing is not performed for these systems. However, the applicant stated that it does perform an annual full-flow test to ensure that no significant corrosion, MIC, or biofouling has occurred and that adequate pressure and flow rates are available to meet the intended function. The staff found the applicant's response acceptable and concluded that appropriate preventive actions are being performed.

Parameters inspected or monitored: The applicant states that fire barriers are examined for cracking, breaks, holes, and gaps. Doors are verified to be capable of complete closure and latching and to fit properly in their frames. Penetration seals are checked for an adequate amount of fire stop material. Section B2.2.7 of each LRA also states that fire-retardant coatings, cable tray covers, and cable tray fire stops are checked for integrity. In addition, components such as hose stations and hydrants are inspected visually for indications of degradation and dampers are verified to be free of corrosion that could interfere with their closure. The water systems for fire protection are monitored for adequate system performance and integrity, as indicated by pressure and flow measurements.

In response to RAI B2.2.7-1, the applicant states that the integrity and absence of fouling of the fuel supply line for the diesel-driven fire pump is confirmed by an operational test of the pump that is performed as part of the fire protection program. The pump is run in the recirculation mode each month and the speed of the pump is verified to be within the expected range for the test, and verifies the ability of the fuel oil line to provide the expected amount of flow to the engine. A local inspection of the fire pump components, including the fuel oil line, is performed during the periodic test. Testing of the diesel-driven fire pump is consistent with NFPA-25. The run capability of the pump each month confirms the integrity and absence of fouling of the line that provides the fuel oil supply. However, Section 5-3.2.2 of NFPA-25 (1998) states that a weekly test of diesel-driven pump assemblies shall be conducted without flowing water. Since the applicant states that testing of the diesel-driven fire pump is monthly and consistent with NFPA-25, the applicant was asked to clarify this discrepancy. In a letter to the NRC dated May 22, 2002 (Serial No. 02-163), the applicant provided a supplemental response to RAI B2.2.7-1 that states that testing of the diesel driven fire pump is consistent with NFPA-25 based on the annual flow testing required by NFPA-25 that is performed by the applicant. As stated above, the applicant also performs monthly recirculation testing of the diesel-driven fire pump as required by the applicant's site-controlled Technical Requirements Manual (TRM). However, due to an oversight during the review of NFPA-25, the RAI response failed to note that the monthly recirculation testing frequency is different from the weekly frequency listed in NFPA-25. Although the applicant's fire protection program does not meet NFPA-25 requirements on this matter, the staff accepts the applicant's testing frequency since monthly testing is adequate to provide reasonable assurance of the integrity and absence of fouling of the fuel supply line for the diesel-driven fire pump for the purpose of managing aging effects.

Based on the information provided in Section B2.2.7 of each LRA and the additional information provided by the applicant in response to RAI B2.2.7-1, the staff finds the parameters monitored and inspected for the fire protection program to be comprehensive and acceptable.

Detection of aging effects: The applicant states that degradation of fire protection components is detected by visual examination to reasonably assure the absence of loss of material, separation and cracking/delamination, and change in material properties. The fire protection water system's performance and pressure boundary integrity are monitored by verifying acceptable values of pressure and flow in the underground fire water distribution system. Testing of the fire protection pumps provides indication of heat transfer degradation, and inspections of the pumps provide indication of loss of material. The applicant also states that air flow testing and visual inspections of sprinklers along dry portions of fire protection piping confirm the absence of blockage. Water flow tests of the deluge system for the station service and main transformers confirm the absence of flow blockage for the entire line from the main header to the spray nozzles.

In each LRA, the applicant states that during the period of extended operation, a representative sample of sprinklers, which have been in service for 50 years, will be replaced or tested in accordance with the requirements of NFPA-25, Section 2-3.1.1. The staff requested that the applicant clarify that the NFPA guidance, to perform this sampling every 10 years after the initial field service testing, will also be followed. In a letter dated May 22, 2002 (Serial No. 02-163), the applicant stated that it did not discuss replacing or testing every 10 years beyond the initial 50-year replacement or test because that would bring them to the end of the period of extended operation. However, the applicant stated that it is committed to NFPA-25, Section 2-3.1.1, and if the plants operate 10 years beyond the 50-year replacement or the test of the sprinkler heads, the applicant will perform the followup 10-year replacement or test. Because the applicant's response fully addressed staff's concerns, the staff found the applicant's response acceptable.

The staff requested the applicant to describe its aging management activities to manage the loss of material on the inside surfaces of piping so that the system's function is maintained. In response to RAI B2.2.7-2, the applicant stated that it would supplement the NFPA pressure and flowrate testing, credited in each LRA as part of the fire protection program activity, with the work control process activity in order to manage aging effects for the fire protection system piping. In addition, the applicant states that the work control process, as described in Section B2.2.19 of each LRA, provides numerous opportunities to perform internal inspections of fire protection piping. During the 7-year period between 1993 and 2000, there were in excess of 100 work orders each for Surry and North Anna for activities involving the internal surfaces of the fire protection system. These work orders provided representative samples of the materials and environments for the fire protection system. The applicant states that the identified frequency of work activities for the 7-year period is expected to continue into the period of extended operation. In addition, in a supplemental response to RAI B2.2.19-3, the applicant stated that as confirmation that the work control process program has inspected representative components from among those components that credit the work control process, the applicant will perform an audit of inspections performed by the work control process. Audits of the work control process, performed prior to year 40 of plant operation and again at year 50, will be used to determine if supplemental inspections of components that credit the work control process are needed. Most opportunities for inspecting the internal surfaces of the fire protection system arise from maintenance of valves performed under the work control process. These inspections are performed by maintenance personnel who are VT-qualified and trained as members of a quality maintenance team (QMT). The applicant further states that maintenance inspection findings of sedimentation or internal degradation are referred to engineering personnel for evaluation. Any corrective action required by the engineering evaluation is implemented through the applicant's corrective action system in accordance with 10 CFR Part 50, Appendix B. Furthermore, the applicant states in a supplemental response to RAI B2.2.19-3 that if ongoing general aging is identified in a system with a certain material and environmental combination, the applicant's corrective action program requires an evaluation of the entire system with the same material and environmental conditions and of other systems with similar material and environmental conditions. The staff concurs with the applicant's conclusion that the ongoing maintenance opportunities to inspect fire protection components in addition to supplemental inspections, as required, through the work control process provide a more continuous indication for the internal condition of piping and valves than would occasional disassembly for the sole purpose of inspection.

The staff found the applicant's fire protection program, as it relates to the detection of aging effects to be acceptable.

Monitoring and trending: The applicant states that fire barriers are typically inspected visually at 18-month intervals, except that doors are inspected more frequently. Various types of fire protection equipment are visually inspected at frequencies that vary from 31 days to 3 years. The integrity and performance of the fire protection systems are monitored by testing, which is typically performed at 18-month intervals. The pressure-retaining capability of the main fire protection loop is provided by continuous monitoring of the level and pressure in the hydro-pneumatic tank.

In its response to RAI B2.2.7-3, the applicant provided more specific information regarding the frequency of inspections for the applicable components. The applicant states that the inspection and testing activities listed below are performed in accordance with the fire protection program and that the testing and inspection frequencies are consistent with guidance provided by NFPA:

(a) Penetration seals are visually inspected to ensure adequate fill material and the absence of cracks or visible damage. At Surry, all seals are inspected every 18 months, except for those that are blocked on both sides with damming material, the removal of which could damage the seal. In these situations, the damming material (such as Marinite) is verified to be intact and free of damage. At North Anna, seals (except those with damming on both sides) are inspected on a rotating basis such that 20% of the seals are inspected every year.

(b) Fire doors are visually inspected to ensure that the doors have proper clearance and are free of obstructions, are intact (i.e., no wear or missing parts), have no holes, and are capable of being closed and latched. These inspections are performed monthly.

(c) Fire doors that have automatic hold-open mechanisms are functionally tested at least monthly to ensure that each auto-close mechanism is intact and capable of performing its intended function. The door-release function is tested, and the door is confirmed to be capable of closing and latching properly.

(d) Visual inspections of yard fire hydrants are performed at least quarterly.

(e) Fire hoses (and associated gaskets) are considered to be consumables that are not subject to an aging management review. Fire hydrant flow tests are performed every 3 years.

(f) The deluge and sprinkler systems are visually inspected every 18 months.

In its response to RAI B2.2.7-3, the applicant stated that testing and inspection frequencies are consistent with guidance provided by NFPA, but they also state under (e) above that fire hydrant flow tests are performed every 3 years. Since Section 4-3.2 of NFPA-25 (1998) states that hydrants shall be tested annually, the applicant was asked to clarify the discrepancy. In a letter to the NRC dated May 22, 2002 (Serial No. 02-163), the applicant provided a supplemental response to RAI B2.2.7-3 that provides surveillance frequencies for a number of components and states that the frequencies are consistent with NFPA. Hydrants are among this listing of components for the RAI response. NFPA-25 requires an annual flow test of hydrants, but the applicant performs the flow testing every 3 years as required by the applicant's TRM. This difference in testing frequency should have been identified as an exception to NFPA in the RAI response. Although the applicant's fire protection program does not meet NFPA-25 requirements on this matter, the staff accepts the applicant's testing frequency since flow testing every 3 years is performed as part of the CLB and is adequate to provide reasonable assurance of the integrity of the fire hydrants for the purpose of managing aging effects.

In its response to RAI B2.2.7-3(e), the applicant stated that it considers fire hoses and associated gaskets to be consumables and not subject to an aging management review. It is the staff's position that fire hoses can be excluded from an AMR provided the applicant (1) identifies in each LRA that all fire hoses are subject to replacement based on performance and condition monitoring programs and (2) explicitly states that the programs conform to NFPA 1962 or another code that provides a similar level of inspection and/or performance testing. Section C2.3 of each LRA states that the fire protection program complies with NFPA 1962 for fire hoses and that fire hoses are periodically inspected and replaced if they do not pass the inspection. Therefore, while these consumables are in the scope of license renewal, they do not require an AMR. This response is acceptable to the staff.

The monitoring activities credited for the fire protection program are consistent with current industry practices, are controlled by the applicant's quality assurance program and, therefore, are acceptable to the staff.

Acceptance criteria: The applicant states that the acceptance criterion for visual inspections is the absence of anomalous indications of degradation. Acceptance criteria for performance tests (i.e., flow and pressure tests) are provided in the appropriate test procedures. Occurrence of degradation that is adverse to quality is entered into the corrective action system. The staff found this to be acceptable.

Operating experience: The applicant states that component inspections and surveillance tests are performed consistently with guidance provided by NFPA. Degradation of fire barriers has occurred at doors and penetration seals, and is corrected promptly when found through routine walkdowns or planned inspections. Surveillance tests have been performed routinely, and have not identified any significant degradation of the fire suppression system.

In order to complete its review of operating experience, the staff requested that the applicant discuss the extent to which the fire barrier experiences reported in NRC Generic Letter 92-08 and NRC Information Notices 88-56, 91-47, 94–28, 97-70 have been incorporated in the fire protection program. In its November 30, 2001, response to RAI B2.2.7-4, the applicant provided the following information:

> (a) NRC Generic Letter 92-08 describes concerns with the integrity of Thermo-Lag 330-I fire barriers used to ensure functionality of electrical cables, particularly with respect to the separation of redundant safe-shutdown trains within the same fire area. Information Notice 91-47 describes a concern at River Bend Station regarding fire endurance testing of Thermo-Lag used for the protection of cabling. While Thermo-Lag 330-I is used as a fire barrier for a single application in the wall of a charging pump cubicle at North Anna, it is not relied upon as a fire barrier for any cabling at Surry and North Anna.
>
> (b) NRC Information Notices 88-56, 94-28, and 97-70 describe potential problems with fire-barrier penetration seals. Periodic surveillance is performed at Surry and North Anna to monitor penetration seals for the presence of voids, cracks, or deficiency of material. Any degradation found during these inspections is evaluated by engineering such that repairs would be implemented through the corrective action system in accordance with 10 CFR Part 50, Appendix B.
>
> (c) the applicant's operating experience has included findings of gaps or an insufficient amount of firestop material in penetration seals during inspections early in the plant history, indicating that these concerns were due to deficiencies in installation rather than aging. These findings were corrected. The frequency of inspection activities has been established consistent with NFPA requirements that take into account aging effects. Findings have been corrected through the

corrective action system in accordance with 10 CFR Part 50, Appendix B; and no changes in the inspection practices have been determined to be necessary. Any findings of deficiencies in the future will be evaluated to determine whether the inspection program needs to be modified.

The staff has found that water-based fire protection systems designed, inspected, tested and maintained in accordance with NFPA minimum standards have demonstrated reliable performance. On the basis of the operating experience described above, the staff concludes that the applicant's aging management activities have been effective in maintaining the intended function of the fire protection components within the scope of this evaluation, and can reasonably be expected to do so for the period of extended operation.

3.3.1.7.3 Conclusions

The staff has reviewed the information provided in Section B2.2.7 of each LRA and the summary description of the fire protection program in Section A2.2.7 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs provided in letters to the NRC dated November 30, 2001, and May 22, 2002 (Serial No. 02-163). On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effect of aging associated with fire protection components will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.7.4 FSAR Supplement

The staff reviewed Section A2.2.7 of the UFSAR supplement and found that the description of the applicant's fire protection program is consistent with Section B2.2.7 of each LRA, except as discussed below.

In each LRA Section B2.2.7, a licensee followup action has been identified to revise the fire protection plan to include the replacement or testing of a representative sample of sprinklers that have been in service for 50 years. This task will conform to the provisions of NFPA-25, Section 2-3.1.1, and will be performed during the period of extended operation. This item is included in each LRA, Table B4.0-1, which contains a comprehensive list of followup action items, but is not discussed in Section A2.2.7 of the UFSAR supplement.

In response to RAI B2.2.9-3, the applicant stated that it would incorporate the followup actions from Table B4.0-1 of each LRA into the UFSAR supplements in each LRA. The applicant committed to describe the followup actions in the appropriate aging management activity summaries provided in Appendix A of the applications.

In addition, in its response to RAI B2.2.7-2 dated November 30, 2001, the applicant stated that it would supplement the NFPA pressure and flowrate testing credited in each LRA as part of the fire protection program activity with the work control process activity in order to manage aging effects for the fire protection system piping. The staff requested that this commitment by the applicant be incorporated into Section A2.2.7 of the UFSAR supplement. In its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1 of the LRAs have been incorporated into the text of their respective AMAs in the UFSAR Supplement. This includes the Fire Protection Program in UFSAR Supplement Section 18.2.7. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.7-1 closed. In the same letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.2.7, "Fire Protection Program," has been modified to credit the Work Control Process. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.7-2 closed.

3.3.1.8 Fuel Oil Chemistry

The applicant describes its fuel oil chemistry program in Section B2.2.8 of each LRA. The applicant also includes relevant materials from Section 3.3.4, "Diesel Generator Support Systems," and Section 3.3.9, "Fire Protection and Supporting Systems," of each LRA and the material applicable to the Surry plant only from Section 3.3.2, "Open Water Systems." This section addresses the procedures for controlling the fuel oil chemistry in order to ensure its compatibility with the materials of construction of the components exposed to the fuel oil environment. The staff reviewed each LRA to determine whether the applicant has demonstrated that the fuel oil chemistry program will adequately manage the applicable aging effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.8.1 Technical Information in Application

In Section B2.2.8 of each LRA, the applicant specifies that the fuel oil chemistry program applies to the alternate AC diesel generator, emergency diesel generator, security, and fire protection systems. The components in these systems that are exposed to fuel oil are listed in Tables 3.3.4-1, 3.3.4-2, 3.3.4-3, and 3.3.9-1, respectively. These components are subject to aging effects which could cause degradation.

The applicant evaluated the methods for controlling fuel oil quality in order to ensure that it is compatible with the materials of construction of the components exposed to fuel oil. Use of improper fuel oil could lead either to corrosion damage of storage tanks or to accumulation of particulates or biological growth that would interfere with the operation of safety-related equipment. In the fuel oil chemistry program, the applicant specified fuel oil analyses, minimum sampling frequencies, and acceptance criteria needed for maintaining the required fuel oil quality. The acceptance criteria for these tests are based, to a great extent, on the ASTM standards listed in each LRA. Also, the applicant identified corrective actions which would be taken if the fuel oil did not meet the prescribed specifications.

3.3.1.8.2 Staff Evaluation

The staff's evaluation of the fuel oil chemistry control 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

The environment in the diesel fuel oil storage and transfer systems consists of fuel oil which occasionally may contain accumulated water and be contaminated with some impurities. Although fuel oil, in its pure form, is non-corrosive to metals, the presence of water, naturally occurring contaminants, or some fuel additives, can create corrosive environments. In the fuel oil storage and transfer system, the components remaining within the scope of license renewal are constructed from carbon steel, low-alloy steel, stainless steel, cast iron, copper, brass, and bronze. These components are subject to aging effects caused by loss of material due to different types of corrosion. However, the operating experience at several plants has indicated a very low incidence of corrosion failure of the components exposed to fuel oil. The most frequent incidents were related to clogging of strainers with sediments and degraded fuel oil.

In order to manage the aging effects due to the presence of water, particulates, and other contaminants in the fuel oil storage and transfer systems, the applicant has a program for testing the oil and taking corrective actions if its chemistry does not meet the prescribed specifications.

Program scope: The scope of the fuel oil chemistry program involves sampling and testing of the systems containing fuel oil, and taking corrective actions, if the specified criteria are not met. More specifically, sampling and testing activities are performed in the following tanks at the North Anna and Surry plants: above-ground storage tank, underground emergency diesel generator fuel tank, diesel generator day tanks, fire pump fuel tank, and security diesel generator fuel tank. They are also performed in the AAC diesel fuel oil tank in the North Anna plant and in the low-level intake structure fuel oil tank for the diesel generator operating service water pumps at the Surry plant.

The staff found the program scope acceptable because the tests and corrective actions specified in the program will ensure effective management of the age-related effects in the systems containing fuel oil.

Preventive actions: Maintaining proper fuel oil chemistry through regular checking for the presence of water, particulates, and other contaminants and taking appropriate corrective actions will mitigate the degradation of the components in the systems containing fuel oil. Use of biocide will minimize corrosion due to MIC and resulting biofouling. The staff finds that these procedures are adequate because they include all the activities needed for maintaining the quality of fuel oil and managing the age-related effects of the components in the systems containing fuel oil.

Parameters monitored or inspected: The fuel oil chemistry program monitors fuel oil quality by performing a number of tests. Most of these tests follow the procedures specified in the ASTM standards. The applicant has indicated that its test program will include testing fuel oil for the aerobic and sulfate reducing bacteria using the methods in vendor literature. For determining water and sediment content and for particulate testing in fuel oil, the applicant will follow the procedures described in ASTM D-1796 and ASTM D-2276, respectively. The staff finds that the procedures used by the applicant for monitoring fuel oil quality with regard to its effect on the components exposed to the fuel oil environment are based on well-established methods and the applicant's inspection program is, therefore, acceptable.

Detection of aging effects: The fuel oil chemistry program is an activity which minimizes deleterious age-related effects by controlling the fuel oil environment and taking appropriate corrective actions. It does not directly detect aging effects. The purpose of the program is to ensure that optimum environment in the systems containing fuel oil exists and that no component degradation due to age-related effects is occurring. The staff found this acceptable because the chemistry program is a preventative program and as such is not credited for detecting aging effects.

Monitoring and trending: In each LRA the applicant described the monitoring and trending requirements for the parameters specifying properties of the fuel oil with respect to its effect on the aging of the components in the fuel oil systems. In the program sampling and testing of stored fuel oil will be performed at a frequency of once per calendar year. The sampling and analysis will provide an opportunity to detect fuel oil conditions that could lead to fuel oil tank degradation so that appropriate corrective actions could be taken in a timely manner. In addition, the freshly delivered oil will be sampled for water and sediment content prior to its transfer to the supply tanks. The staff reviewed the applicant's monitoring and trending program and found that it will provide the applicant with an effective way for controlling fuel oil quality.

Acceptance criteria: In each LRA, the applicant specifies the quality of fuel oil and criteria which should be maintained for minimizing the degradation of the components exposed to the fuel oil environment. Adherence to the criteria will ensure that the quality of fuel oil will be kept at an acceptable level and any departure from it will result in timely corrective action. The criteria follows the ASTM guidelines or guidance literature from the vendor and apply to the parameters that have been shown to contribute to component degradation. They include the requirements for determining the levels of water, sediments, particulates and bacteria causing MIC. The staff found the acceptance criteria for the fuel oil chemistry program, as specified in each LRA, to be effective in controlling aging effects for the components and systems exposed to fuel oil because they have low thresholds to allow for early detection and corrective action of fuel oil chemistry deviations.

Operating experience: Operating experience with the systems covered by the fuel oil chemistry program has demonstrated the effectiveness of the program. The experience at Surry identified a biofouling problem in the underground fuel oil storage tank. However, the corrective action, consisting of cleaning the tank, verifying its integrity, and refilling it with biocide-treated fuel oil, resolved the problem. This also prompted the applicant to enhance its fuel oil chemistry program by addition of bacteria sampling and biocide treatment. Verification of the integrity of fuel oil tanks was extended to the North Anna plant. The tank inspection was performed in accordance with station technical specifications. As a result of operating experience, the staff agrees that the applicant's corrective action program facilitated the development of a successful fuel oil chemistry program.

3.3.1.8.3 Conclusions

The staff has reviewed the information provided in Section B2.2.8 of each LRA and the summary description of the fuel oil chemistry program in Section A2.2.8 of the UFSAR supplement. On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the effects of aging associated with the fuel oil chemistry program structures and components will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.8.4 FSAR Supplement

The staff reviewed the description of the information in the FSAR relevant to the fuel oil chemistry program in the North Anna and Surry plants. It finds that the FSAR contains adequate description of the systems and operations required for supporting the fuel oil chemistry program.

3.3.1.9 General-condition-monitoring Activities

The applicant describes its general-condition-monitoring activities in Section B2.2.9 of each LRA. The applicant credits this program for managing the aging effects of loss of material, change in material properties and cracking for components that are located in normally accessible areas. The applicant also credits this program for managing the aging effect of separation and cracking/delamination for North Anna components that credit the general-condition-monitoring activities. The staff reviewed each LRA to determine whether the applicant has demonstrated that the general-condition-monitoring activities will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.9.1 Summary of Technical Information in the Application

In Section B2.2.9 of each LRA, the applicant states that the purpose of the general-condition-monitoring activities is to provide reasonable assurance that the effects of aging will be managed so that the intended functions of components in normally accessible areas will be maintained consisted with the CLB during the period of extended operation. The applicant identified the following systems, structures, and commodities that credit this program for managing the aging effects of loss of material, change in material properties, and cracking. Additionally, general-condition-monitoring activities are credited for managing the aging effect of separation and cracking/delamination for North Anna fire wraps.

<u>System</u>

- alternate AC diesel generator system
- bearing cooling (SPS 1/2 only)
- blowdown
- boron recovery
- chemical and volume control
- chilled water (NAS 1/2 only)
- circulating water (SPS 1/2 only)
- component cooling water
- condensate (SPS 1/2 only)
- containment spray (SPS 1/2 only)
- containment vacuum
- quench spray (NAS 1/2 only)
- drains - aerated
- drains - gaseous
- emergency diesel generator system
- feedwater
- fire protection

- fuel pit cooling
- gaseous waste (SPS 1/2 only)
- heating (NAS 1/2 only) and ventilation
- high-radiation sampling (NAS 1/2 only)
- instrument air
- leakage monitoring
- liquid and solid waste (NAS 1/2 only)
- neutron shield tank cooling
- post-accident hydrogen removal (NAS 1/2 only)
- primary and secondary plant gas supply
- primary-grade water (SPS 1/2 only)
- radiation monitoring
- refueling purification (NAS 1/2 only)
- reactor cavity purification (SPS 1/2 only)
- reactor coolant system (reactor coolant)
- reactor coolant system (closed-water)
- recirculation spray
- residual heat removal
- safety injection
- sampling system
- security
- service air
- service water
- steam generator water treatment (NAS 1/2 only)
- steam generator recirculation and transfer (SPS 1/2 only)
- vacuum priming (SPS 1/2 only)
- vents - aerated (SPS 1/2 only)

<u>Structure</u>

- auxiliary building
- casing cooling pump house (NAS 1/2 only)
- containment
- quench spray pump house (NAS 1/2 only)
- containment spray pump building (SPS 1/2 only)
- fire pump house (SPS 1/2 only)
- fuel building
- load-handling cranes and devices
- main steam valve house
- safeguards building
- service building
- service water pump house (NAS 1/2 only)
- service water valve house (NAS 1/2 only)
- turbine building

<u>Commodity</u>

- general structural supports
- miscellaneous structural commodities

3.3.1.9.2 Staff Evaluation

The staff's evaluation of the general-condition-monitoring activities 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Scope of program: The applicant states in Section B2.2.9 of each LRA that the general-condition-monitoring activities are performed in three different ways:

- inspections of radiologically controlled areas for borated water leakage in areas outside containment
- periodic walkdown inspections of piping and equipment
- periodic area inspections to determine the condition of supports and doors. Supports for major equipment, piping, cables, and general plant components will be included, and doors within are as being within the scope of license renewal

The applicant further states that the scope of the general-condition-monitoring activities includes managing the aging effect of separation and cracking/delamination for NAS 1/2. Based on a review of the application, the staff observed that this program is credited for managing this aging effect only for fire wraps at NAS 1/2. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant confirmed that SPS 1/2 does not use fire wraps. The applicant also stated that statements in Sections A2.2.7 and B2.2.7 of each LRA that indicate that the fire protection program is used to manage the aging of fire wraps are administrative errors and that the fire protection program is not used to manage aging of fire wraps. Based on the above clarifications, the staff found the scope of the general-condition-monitoring activities to be acceptable.

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

Parameters monitored or inspected: The applicant states that inspections by engineering personnel check the condition of components, equipment, and supports and provide compliance with the requirements of the Maintenance Rule, 10 CFR 50.65. The applicant also states that the following types of degradation or adverse conditions can be detected by visual inspections:

- component leakage
- rust or corrosion products
- peeling, bubbling, or flaking coatings
- indications of chemical attack
- corroded fasteners
- cracking (of concrete, supports, equipment, sealants)
- bubbled, discolored, or cracked electrical insulation

- damaged or missing thermal insulation (the concern being material integrity, but not thermal performance)
- deformed or mispositioned piping and cable supports
- wastage due to boric acid leakage

In a letter dated May 22, 2002 (Serial No. 02-277), the applicant stated that the above-listed degradations and adverse conditions will be detected, as applicable, by the general-condition-monitoring activities. The applicant also states that the cracking of concrete, referenced in the list above, is the concrete associated with anchors, which can affect the intended function of these anchors. Based on the above clarifications, the staff found that the list of the types of degradation or adverse conditions that will be detected by the visual inspections included in this program is comprehensive and acceptable.

Detection of aging effects: For the general-condition-monitoring activities, the external condition of supports, piping, doors, and equipment is determined by visual inspection. The applicant credits these activities for managing the aging effects of loss of material, change in material properties, and cracking for all four units, and for managing the aging effect of separation and cracking/delamination for NAS 1/2 fire wraps. The applicant committed to the development of additional procedural guidance to direct thorough and consistent inspections of component supports and doors. The applicant further commits to completing initial inspections, using the additional guidance, prior to the end of the current operating license term. The staff agrees with the applicant's approach and accepts the commitment to develop further procedural guidance. The use of visual inspection of the external condition of supports, piping, doors, and equipment that credit the general-condition-monitoring activities is considered by the staff to be a reasonable means of detecting the aging effects managed by this monitoring activity.

Monitoring and trending: The applicant states that visual monitoring of the supports, piping, doors, and equipment in normally accessed areas is accomplished with a spaces approach, with an inspection frequency that varies from weekly to once per refueling outage. In response to RAI B2.2.9-1, the applicant states that the term "spaces approach" is defined in document NEI 95-10 and refers to all systems, structures, and components (SSCs) in a particular area of the plant that share a common bounding environmental parameter, such as temperature and are in close proximity, such as within a room or a portion of the floor of a building. The applicant also states that all supports, doors, piping, and equipment in a "space" within the scope of the general-condition-monitoring activities are subject to inspection at least once per refueling outage cycle as part of engineering walkdowns. In addition, the applicant committed in Section B2.2.9 of each LRA to developing, prior to the end of the current operating license term, procedural guidance for engineers and health physics technicians regarding inspection criteria that focus on detection of aging effects during general-condition-monitoring activities. The staff agrees with the inspection frequency used for the general-condition-monitoring activities and accepts the applicant's commitment to develop further procedural guidance.

Acceptance criteria: The applicant states that the acceptance criterion for visual inspections is the absence of anomalous indications of degradation. Evaluations of anomalies found as part of the general-condition-monitoring activities determine whether analysis, repair, or further inspection is required. Occurrence of degradation that is adverse to quality is entered into the applicant's corrective action system. The staff found the acceptance criteria for the general-condition-monitoring activities to be acceptable.

Operating experience: The applicant states that the effects of aging are found in normally accessed areas during routine work tasks and inspections. Engineering evaluations and corrective actions are implemented, as necessary, to correct conditions that are adverse to quality. The applicant also reports that inspection results for visits from outside organizations such as INPO confirm a continuing high level of management attention to maintaining plant integrity.

In its response to RAI B2.2.9-2, in a letter dated November 30, 2001, the applicant provided specific information regarding the operating experience for this existing program. The following three examples were described to demonstrate the effectiveness of the general-condition-monitoring activities in identifying aging-related problems before loss of system intended function and subsequent programmatic improvements: (1) cracking in the flexible ventilation connections, (2) loss of material from the flood control throttle shields, and (3) loss of material from the service water vent line. These examples also demonstrated the use of the applicant's corrective action system in identifying effective corrective actions that prevent future degradation throughout the plant. However, during a general inspection of equipment in containment at Surry Unit 2 on April 2, 2002, the NRC staff identified external corrosion on the coated component cooling system piping. Since the aging management of the component cooling water piping is part of the general-condition-monitoring program, the staff was initially concerned that the walkdowns performed as part of the general-condition-monitoring program may have been inadequate. However, during discussions with the applicant, the NRC inspectors determined that the external corrosion of the component cooling water piping was identified through refueling outage walkdowns and entered into the applicant's corrective action program as far back as 1992. These outage walkdowns are part of the general-condition-monitoring activities. In addition, the NRC inspectors noted that the applicant has inspected and documented the condition of the component cooling water piping several times over the past ten years. To ascertain the extent of the corrosion of the component cooling water piping, the applicant has made several wall-thickness measurements. The NRC inspectors determined that in all cases since 1992, the wall-thickness measurements, taken at areas of coating degradation and corrosion, showed the pipe-wall thickness to be well above minimum thickness and, therefore, no operability issued were identified. The NRC inspectors concluded that the coating of the component cooling water piping may need to be refurbished to ensure that the required minimum-wall-thickness is maintained during the period of extended operation. The applicant is currently evaluating this issue within its corrective actions program.

3.3.1.9.3 Conclusions

The staff has reviewed the information provided in Section B2.2.9 of each LRA and the summary description of the general-condition-monitoring activities in Section A2.2.9 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs provided in a letter dated November 30, 2001. On the basis of this review and the above evaluation, the staff finds that the applicant has demonstrated that the program can adequately manage the aging effects in the systems, structures and commodities that credit the general-condition-monitoring activities so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.9.4 FSAR Supplement

The staff reviewed Section A2.2.9 of the UFSAR supplement and found that the description of the applicant's general-condition-monitoring activities is consistent with Section B2.2.9 of each LRA. However, in Section B2.2.9 of each LRA, the applicant committed to the following two licensee followup actions that are not discussed in the UFSAR: (1) Additional procedural guidance will be developed to direct thorough and consistent inspections of component supports and doors (initial inspections will be completed, using the additional guidance, prior to the end of the current operating license term), and (2) Procedural guidance will be developed for engineers and health physics technicians regarding inspection criteria that focus on detection of aging effects during general-condition-monitoring activities. The guidance will be developed prior to the end of the current operating license term. These two items are included in each LRA, Table B4.0-1, which contains a comprehensive list of followup action items.

In its response to RAI B2.2.9-3, in a letter dated November 30, 2001, the applicant stated that it will incorporate the licensee followup actions from Table B4.0-1 of each LRA into the UFSAR supplements for the Surry and North Anna Power Stations. The applicant committed to describe the followup actions in the appropriate Aging Management Activity summaries provided in Appendix A of the applications. In its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1 of the LRAs have been incorporated into the text of their respective AMAs in the UFSAR Supplement. This includes General Condition Monitoring in UFSAR Supplement Section 18.2.9. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.9-1 closed.

3.3.1.10 Inspection Activities - Load-handling Cranes and Devices

The applicant describes its inspection activities for load-handling cranes and devices in Section B2.2.10 of each LRA. The applicant credits this inspection activity with managing the aging effect of loss of material for cranes, monorails, and their associated components. The staff reviewed each LRA to determine whether the applicant has demonstrated that the inspection activities for load-handling cranes and devices will adequately manage the aging effect of loss of material during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.10.1 Summary of Technical Information in the Application

In Section B2.2.10 of each LRA, the applicant states that the purpose of the inspection activities for load-handling cranes and devices is to provide reasonable assurance that the aging effect of loss of material will be managed so that the intended functions of the load-handling cranes and devices will be maintained consistent with the CLB during the period of extended operation. The applicant states that the aging management documents for this program have been developed in compliance with ASME B30.2, "Overhead and Gantry Cranes," for cranes and ASME B30.11, "Monorail Systems and Underhung Cranes," for monorails. The inspection activities also address the applicable load-handling concerns identified in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." The applicant states that it uses its work control process to direct the structural integrity inspections of applicable cranes which includes steps to check the condition of the structural girders on the cranes, and the runways along which the cranes move.

The applicant states that the following load-handling cranes and devices are within the scope of the inspection activities for this program:

- containment polar cranes
- containment jib crane
- containment annulus monorail
- refueling manipulator crane
- fuel handling bridge crane
- new fuel transfer elevator
- spent fuel crane
- auxiliary building monorails

3.3.1.10.2 Staff Evaluation

The staff's evaluation of the inspection activities for load-handling cranes and devices focused on how the program manages the aging effect of loss of material 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 applicant indicates that the corrective actions, confirmation process, and administrative controls, are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.2.10 of each LRA identifies the load-handling cranes and their associated components, such as rails, towers, load trolley steel, fasteners, base plates, and anchorages, that credit these inspection activities. The staff finds the scope of the inspection activities for load-handling cranes and devices to be acceptable since it includes all of the load-handling cranes subject to an AMR.

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

Parameters monitored or inspected: The applicant indicates that the inspection activities for load-handling cranes and devices determines the overall condition of the cranes and monorails. In addition, the inspection activities include specific steps for checking the condition of the structural members (i.e., rails and towers) and fasteners on the cranes and lifting devices, the runways along which the cranes move, and the baseplates and anchorages for the runways and monorails. From the structural items listed above, it was not clear to the staff whether the examination of the condition of the anchorages includes the grout and concrete surrounding the anchors. Based on the applicant's response to RAI 3.5.10-2, the general condition activities will be used to manage the potential cracking of concrete associated with piping and equipment anchors. The applicant states in Section B2.2.10 of each LRA that a followup action will be initiated to implement a one-time inspection of a representative sample of the box girders for the polar cranes. The inspection will be performed between year 30 and the end of the current operating license term. Since visual inspections can be used to verify the overall condition of the cranes and monorails, such inspections carried out by the inspection activities for load-handling cranes and monorails are acceptable to the staff.

Detection of aging effects: Loss of material is identified as the aging effect associated with the load-handling cranes and devices. The loss of material is found by visual inspections. The staff agrees with the use of visual inspection of the cranes and devices to identify loss of material.

Monitoring and trending: The applicant states that the cranes and devices located inside containment are inspected at a frequency of once per fuel cycle. The cranes outside containment are inspected annually. The applicant uses its work control process to direct the inspections of the applicable cranes. In RAI B2.2.10-1 the staff requested that the applicant clarify the interaction between the inspection activities for load-handling cranes and devices and the work control process as it relates to the inspection frequencies for the cranes and monorails. In response, the applicant stated that the inspections are implemented using the work control process. Since the response provided by the applicant to the staff's RAI was inadequate, the staff requested further clarification concerning the interaction between these two aging management activities. In response to Supplemental RAI B2.2.10-1, dated May 22, 2002 (Serial No. 02-277), the applicant stated that the aging management activities for the load-handling cranes and devices take advantage of inspections that are scheduled through the work control process. The inspection frequencies for the load-handling cranes and devices are as stated in Section B2.2.10 of each LRA; however, the inspection activities for the load-handling cranes and devices do not schedule inspections independently of the work control process. Since the applicant stated that it would adhere to the inspection frequencies stated in Section B2.2.10 for the load-handling cranes and devices, the staff finds that the applicant's response to RAI B2.2.10-1 is acceptable.

Acceptance criteria: The applicant states that the acceptance criterion for visual inspections is the absence of anomalous indications of degradation. Identified discrepancies are corrected. If the discrepancy cannot be resolved as part of the inspection, appropriate notations are made in the inspection procedure or work control document, and the discrepancy is evaluated by engineering personnel. Occurrence of degradation adverse to quality is entered into the applicant's corrective action system. Since the acceptance criterion is consistent with the degradation of concern and detectable by visual inspections, this approach is consistent with current industry practices and, therefore, the acceptance criterion is acceptable to the staff.

Operating experience: The applicant states that anomalous conditions with cranes and lifting devices have been identified. These anomalies have principally involved misaligned runways. Such misalignment is not a result of age-related degradation and is not a concern for license renewal. The observed runway discrepancies were resolved either during the inspection process or through the applicant's corrective action system. Operating experience confirms the absence of significant structural degradation of cranes. Based on the operating experience presented by the applicant, the staff finds that the applicant's operating experience has demonstrated that the inspection activities for the load-handling cranes and devices can reasonably be expected to maintain the intended functions of the cranes and monorails that are within the scope of this program for the period of extended operation.

3.3.1.10.3 Conclusions

The staff has reviewed the information provided by the applicant in Section B2.2.10 of each LRA and the summary description of the inspection activities for load-handling cranes and devices in Section A2.2.10 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs. On the basis of this review and the above evaluation, the staff finds that there is reasonable assurance that the applicant has demonstrated that the aging effect of loss of material associated with the load-handling cranes and devices will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.10.4 FSAR Supplement

The staff reviewed Section A2.2.10 of the UFSAR supplement and found that the description of the applicant's inspection activities with respect to load-handling cranes and devices are consistent with Section B2.2.10 of each LRA. However, in Section B2.2.10 of each LRA, the applicant committed to one licensee followup action that is not discussed in the UFSAR supplement. The licensee followup action is to implement a one-time internal inspection of a representative sample of the box girders for the polar cranes. The inspection will be performed between year 30 and the end of the current operating license term. This item is included in each LRA, Table B4.0-1, which contains a comprehensive list of followup action items, but is not discussed in Section A2.2.10 of the UFSAR supplement.

In its response to RAI B2.2.9-3 in a letter to the NRC dated November 30, 2001, the applicant stated that it would incorporate the licensee followup actions from Table B4.0-1 of each LRA into the UFSAR supplements for the Surry and North Anna Power Stations. The applicant committed to describe the followup actions in the appropriate aging management activity summaries provided in Appendix A of the applications. In its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1 of the LRAs have been incorporated into the text of their respective AMAs. The UFSAR Supplement Section 18.2.10, "Inspection Activities - Load Handling Cranes and Devices" has been modified to include the box girder inspections. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.10-1 closed.

3.3.1.11 ISI Program - Component and Component Support Inspections

The applicant describes its ISI program for component and component support inspections in Section B2.2.11 of each LRA. The applicant credits this inspection program with managing the potential aging of ASME Class 1 and Class 2 components and component supports by assuring compliance with the provisions of ASME Section XI, Subsections IWB, IWC, and IWF. Inservice inspections are performed by the ISI program to detect component degradation prior to loss of intended function. The staff reviewed each LRA to determine whether the applicant has demonstrated that the ISI program for component and component support inspections will adequately manage the applicable aging effects during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.11.1 Summary of Technical Information in the Application

In Section B2.2.11 of each LRA, the applicant states that the purpose of the ISI program for component and component support inspections is to manage the aging of ASME Class 1 and Class 2 components and component supports by assuring compliance with the requirements of Subsections IWB, IWC, and IWF of ASME Section XI (1989 edition for North Anna Unit 1 and Surry Units 1 and 2, and 1995 edition with 1996 addenda for North Anna Unit 2). The scope of the program includes Class 1 components, Class 2 carbon steel piping in the feedwater and main steam piping systems, and component supports. The program is implemented in accordance with the individual inservice inspection plan for each unit. The ISI requirements may be modified by applicable code cases and relief requests approved by the staff specifically for each unit. These are subject to re-evaluation for use during subsequent 120-month inspection intervals. In addition, as a licensee followup action, the applicant has committed to following industry activities related to failure mechanisms for small-bore piping and will evaluate changes to inspection activities based on industry recommendations. This activity is outlined in Appendix B4.0 of each LRA, "Licensee Followup Actions."

The applicant also states that a transition to risk-informed inservice inspection (RI-ISI) is currently underway. The RI-ISI program evaluates the nondestructive examination (NDE) of components specified by ASME Section XI, Categories B-F and B-J. The component inspections are in accordance with the requirements specified in NRC-approved Westinghouse Topical Report WCAP-14572, Revision 1-NP-A. As required by the topical report, examinations performed are based upon the postulated failure mechanism associated with the piping being inspected. ASME Code Case N-577 contains a table that describes the failure mechanisms and associated examination requirements. Surry Unit 1 is a full-scope RI-ISI program covering piping in Class 1, 2, 3 and non-class systems. The Surry Unit 1 program has been approved by the NRC. Surry Unit 2 has also been approved but includes Class 1 systems only. The inspection programs at the two North Anna units will include risk-informed inspections of Class 1 components. The process of developing the scope for the risk-informed inspection program includes not only an evaluation of risk significance and failure probability, but also considers operating experience.

Surface examinations for Class 1 piping less than 4-inch NPS are performed as part of the ASME Section XI inservice inspection program. Volumetric examinations of these small-bore pipes will be added to the scope of ISI based upon risk significance and probability of failure. At this time, no small-bore butt welds or socket welds have been designated high-safety-significant, and no volumetric inspections of Class 1 small-bore piping welds are planned. However, Surry Unit 1 is performing volumetric examinations on a sample population of welds in several 3-inch lines in the safety injection, and chemical volume and, control systems. These are Class 2 lines but are used as leading indicators for small-bore piping conditions in Class 1 systems. As a followup action, the applicant is committed to following industry activities related to failure mechanisms for small-bore piping and will evaluate changes to inspection activities based on industry recommendations. This activity is outlined in Appendix B4.0 of each LRA, "Licensee Followup Actions."

3.3.1.11.2 Staff Evaluation

The staff's evaluation of the ISI program for component and component support inspections 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: The following systems, structures, commodities, and major components credit the ISI program for component and component support inspections for managing the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indication of reduction in fracture toughness.

System	AMR Results Section
chemical and volume control	Section 3.3.1, "Primary Process Systems"
feedwater	Section 3.4, "Steam and Power Conversion Systems"
main steam	Section 3.4, "Steam and Power Conversion Systems"
reactor coolant System	Section 3.1.1, "Reactor Coolant System"
residual heat removal	Section 3.2, "Engineered Safety Features"
safety injection	Section 3.2, "Engineered Safety Features"
sampling system	Section 3.3.1, "Primary Process Systems"

Structures	AMR Results Section
NSSS equipment supports	Section 3.5.9, "NSSS Equipment Supports"

Commodity	AMR Results Section
general structural supports	Section 3.5.10, "General Structural Supports"

Major Component	AMR Results Section
pressurizer	Section 3.1.4, "Pressurizer"

The applicant stated: "License renewal concerns with respect to Subsection IWC include only the carbon steel piping that is susceptible to high energy line breaks in the feedwater and main steam systems." Subsection IWC identifies a number of examination categories applicable to Class 2 systems in general. Therefore, the staff issued RAI B2.2.11-1(a) requesting that the applicant either (1) describe the AMA credited to manage aging of Class 2 systems, in lieu of IWC, or (2) explain the technical basis for concluding that Class 2 systems do not require aging management. In addition, the ISI program for component and component support inspections does not reference ASME Section XI, Subsection IWD, applicable to Class 3 systems. 10 CFR 50.55a includes Section IWD inspection requirements for Class 3 systems. Therefore, the staff issued RAI B2.2.11-1(b) requesting that the applicant either (1) describe the AMA credited to manage aging of Class 3 systems, in lieu of IWD, or (2) explain the technical basis for concluding that Class 3 systems do not require aging management. In response the applicant states that the mechanical components, other than ASME Class 1, were not specifically identified in the application by their ASME Class designation. However, Class 2 and Class 3 components have been determined to be subject to aging effects, such as loss of material and cracking, and these effects will be managed as indicated in the aging management review results tables provided in the application. The staff considers the applicant's response to be acceptable. The staff finds the scope of the ISI program for component and component support inspections to be acceptable since it includes the applicable ASME Class 1 and Class 2 components. ASME Class 2 and Class 3 components not covered by this program but subject to aging management for license renewal are covered by other aging management activities described in Appendix B to each LRA.

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

Parameters monitored or inspected: The types of components and component support examinations performed, which are prescribed by ASME Section XI, include visual inspection, surface examinations, and volumetric examinations. The extent of inspection for each component is defined in the inservice inspection plan for each unit. The staff finds this to be acceptable.

Detection of aging effects: Inservice inspections are performed to detect component degradation prior to loss of intended function. The examinations specified by ASME Section XI utilize visual, surface, and volumetric inspections to detect loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness, which presents itself as cracking of cast-austenitic stainless steel valve bodies due to thermal embrittlement. Surface examinations extend 1/2 inch on each side of welds. The volumetric examinations include a region equivalent to 1/2 of the material thickness on each side of welds for Class 1 components, and 1/2 inch on each side of welds for Class 2 components. The applicable categories from ASME Section XI, and the required examination types in each category, are listed in Section B2.2.10 of each LRA.

ASME Code Case N-481, "Alternate Examination Requirements for Cast Austenitic Pump Casings," lists steps that can be taken in lieu of the volumetric examination requirement of IWB 2500-1 for pump casings. The applicant invokes this code case for the inspection of reactor coolant pump casings. The alternate steps include:

- VT-2 examination of the exterior of pumps during pressure testing
- VT-1 examination of external surfaces of one pump casing
- VT-3 examination of internal surfaces whenever a pump is disassembled for maintenance
- evaluation to demonstrate safety and serviceability of pump casings

In a letter from C. I. Grimes to D. J. Walters (Nuclear Energy Institute), the NRC staff stated that detection of a reduction of fracture toughness for cast stainless steel pump casings and valve bodies can be adequately detected by existing ASME Code inspections. No additional evaluation for reduction of fracture toughness is required for these cast stainless steel components.

The staff found the applicant's approach for the detection of aging effects acceptable.

Monitoring and trending: Details of the scope of the ASME Section XI inservice inspections are documented in the inservice inspection plan. During the course of the inspections, the extent of surface or volumetric flaws is characterized by the nondestructive examinations. Anomalous indications of degradation are recorded on nondestructive examination (NDE) reports, which are kept in the applicant's station records. Table IWB 2500-1 of Subsection IWB describes the inspection sampling requirements, the examination methods, and the examination frequencies for Class 1 components. Subsection IWC addresses the Class 2 carbon-steel piping of the feedwater and main steam systems and Subsection IWF addresses component supports. Inspection results that do not satisfy the acceptance standards of Section XI, Subsections IWB, IWC, and IWF, are evaluated by engineering personnel to determine if action is required. An anomalous indication that is a sign of degradation will require a disposition of acceptability, component repair, or component replacement, as determined by engineering evaluation. Reportable weld indications, which are revealed by the inservice inspections in Class 1 components, require additional inspections of similar components in accordance with IWB 2430. The staff finds the monitoring and trending activities of the ISI program for component and component support inspections to be acceptable.

Acceptance criteria: Acceptance standards for inservice inspections are identified in Subsection IWB for Class 1 components, Subsection IWC for Class 2 components, and Subsection IWF for component supports. Table IWB 2500-1 refers to acceptance standards listed in Paragraph IWB 3500 for Class 1 components. Similarly, acceptance standards for Class 2 welds are listed in Section IWC 3500. Anomalous indications that are signs of degradation that are revealed by the inservice inspections would require additional inspections of similar components in accordance with Section XI. Evidence of loss of material and cracking and gross indication of loss of pre-load or reduction of fracture toughness would require engineering evaluation for determination of the appropriate corrective action. The occurrence of degradation adverse to quality will be entered into the applicant's corrective action system. The staff finds that the acceptance criteria for the ISI program for component and component support inspections is adequate because that the intended functions of the components that credit this program will be maintained during the period of extended operation.

Operating experience: The applicant has extensive operating experience and ASME Section XI inspection histories indicating a minimal number of leaks at the reactor coolant system pressure boundary. This experience includes data from reactor coolant system leakage monitoring as required by Technical Specifications and a determination of the source of leakage if an event occurs during power operation. Degradation of components and component supports that is found through these inspections is recorded and corrected as directed by engineering evaluations to maintain component intended functions. Early detection of component degradation confirms the effectiveness of the inspection program. This is typical of the inservice inspections that have been performed throughout the utility industry. Flaws exceeding the allowable flaw size are evaluated for acceptability. Continued service is allowed based on the evaluation along with reexamination during future inspection periods as specified by ASME Section XI. If the subsequent examinations reveal that the flaw has not grown, it is considered stable and no further monitoring of that flaw is necessary. With the exception of recent inspection results of the North Anna 2 reactor vessel head penetrations and welds, the applicant has no known flaws exceeding ASME Section XI acceptance criteria that have not been evaluated and reinspected in accordance with ASME Section XI provisions.

The weld area cracking event that was observed in the RCS hot leg piping at the V.C. Summer plant resulted, in part, from the use of Inconel welds. This issue is discussed in IN 2000-17. The applicant used this IN and other operating experience reports provided by INPO to evaluate the potential impact for Surry and North Anna. While alloy 82/182 are not used on the hot leg or cold leg piping at Surry and North Anna, there are other locations within the boundary of the RCS in which alloy 82/182 welds are present at Surry and North Anna.

In order to ensure that possible leakage at the dissimilar metal piping weld locations is detected, the applicant remains committed to the provisions of ASME Section XI, Subsection IWA-5000, which specifies hold times during hydrostatic testing. For insulated components, a hold time of four hours is specified after attaining system temperature and pressure. If the component is uninsulated, the hold time is 10 minutes. The applicant is committed to maintain compliance with the provisions of IWA-5000. In addition, the applicant plans to achieve conformance with ASME Section XI, Appendix VIII, Supplement 10, which identifies new requirements to be implemented by November 22, 2002. These requirements describe updated qualification blocks and personnel qualification for examining dissimilar-metal welds. The applicant also continues its involvement with the Materials Reliability Project (MRP), and will evaluate any new recommendations that may be developed with respect to dissimilar-metal piping welds.

Based on the applicant's operating experience, the staff concludes that the ISI program for components and component supports should be an effective aging management program for license renewal.

3.3.1.11.3 Conclusions

The staff has reviewed the information provided in Section B2.2.11 of each LRA and the summary description of the ISI program for component and component support inspections in Section A2.2.11 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs. On the basis of this review and the above evaluation, the staff finds that there is reasonable assurance that the applicant has demonstrated that the aging effects associated with the ISI program for component and component support inspections will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.11.4 FSAR Supplement

The staff reviewed Appendix A2.2.11 of the UFSAR supplement and found that the description of the applicant's ISI program for component and component support inspections is consistent with Section B2.2.11 of each LRA. However, in Section B2.2.11 of each LRA, the applicant committed to a followup action that is not discussed in the UFSAR supplement. This followup action commits the applicant to follow industry activities related to failure mechanisms for small-bore piping and evaluate changes to inspection activities based on industry experience. This item is included in each LRA, Table B4.0-1, which contains a comprehensive list of followup action items, but is not discussed in Section A2.2.11 of the UFSAR supplement.

In response to RAI B2.2.9-3, the applicant stated that it would incorporate the followup actions from Table B4.0-1 of each LRA into the UFSAR supplements for the Surry and North Anna Power Stations. The applicant committed to describe the followup actions in the appropriate Aging Management Activity summaries provided in Appendix A of the applications. In its letter dated July 25, 2002, the applicant stated that all items originally in Table B4.0-1 of the LRAs have been incorporated into the text of their respective AMAs. The UFSAR Supplement Section 18.2.11, "ISI Program – Component and Component Support Inspection" has been modified to include the use of industry activities and guidance related to small-bore piping issues and inspections. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.11-1 closed.

3.3.1.12 ISI Program - Containment Inspection

The applicant describes its ISI program for containment inspection in Section B2.2.12 of each LRA. The applicant credits this program with managing the aging effect of loss of material for containment surfaces and pressure-retaining bolting and components. The staff reviewed each LRA to determine whether the applicant has demonstrated that the ISI program for containment inspection will adequately manage the aging effect of loss of material during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.12.1 Summary of Technical Information in the Application

In Section B2.2.12 of each LRA, the applicant states that the purpose of the ISI program for containment inspection is to provide reasonable assurance that the aging effect of loss of material will be managed so that the intended functions of the containment and pressure-retaining bolting and components will be maintained consistent with the CLB during the period of extended operation. The applicant states in Section B2.2.12 of each LRA that the ISI program for containment inspection for concrete containments and containment steel liners implements the requirements in 10 CFR 50.55a and Subsections IWE and IWL of ASME Section XI, 1992 edition through 1992 addenda. The program incorporates applicable code cases and approved relief requests. The provisions of 10 CFR 50.55a are invoked for inaccessible areas within the containment structure. For license renewal, only Subsection IWE is credited for managing aging effects for the containment structure.

3.3.1.12.2 Staff Evaluation

The staff's evaluation of the ISI program for containment inspection 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: The applicant states that the scope of the Subsection IWE Inspection Program for the containment steel liner is in compliance with the requirements of 10 CFR 50.55a, which invokes ASME Section XI. The scope of Subsection IWE inspections described in LRA Section B2.2.12 is a (1) visual (VT-3) inspection of containment surface (Category E-A), (2) visual (VT-1) and volumetric inspections of containment surfaces requiring augmented inspections (Category E-C), (3) visual (VT-1) inspection of pressure-retaining bolting (Category E-G), and (4) visual (VT-2) inspection of all pressure-retaining components (Category E-P). These IWE inspections are implemented only for accessible areas.

The first item listed above, visual (VT-3) inspection of containment surface (Category E-A), contains a footnote, which states that examination includes attachment welds between structural attachments and the pressure-retaining boundary (i.e., the containment liner). The staff notes that the above footnote should also indicate that the examination includes the reinforcing structures and attachment welds to reinforcing structures (e.g., stiffening rings, manhole frames, and reinforcement around openings) as required by Footnotes 2 and 5 of ASME Subsection IWE, Table IWE-2500-1. In addition, the examination of welds should include the weld metal and base metal for 1/2 inch beyond the edge of the weld. In response to RAI B2.2.12-1(a), the applicant states that it implements the requirements of Footnote 2 of ASME Subsection IWE, Table IWE-2500-1, by performing examinations of reinforcing structures and attachments to reinforcing structures (including stiffening rings and reinforcement around openings for the Surry and North Anna containment buildings). As required by Footnote 5, these examinations include the weld metal and base metal for 1/2 inch beyond the edge of the weld. The staff found this response to be acceptable.

The list of component type categories for the ISI program for containment inspection does not include seals, gaskets, and moisture barriers, identified as Examination Category E-D in ASME Subsection IWE. LRA Table 3.5.1-1 indicates that aging effects for containment O-rings are managed by the applicant's work control process aging management activity. Therefore, the staff issued RAI B2.2.12-1(b) requesting that the applicant describe the scope and implementation of the work control process as it applies to seals, gaskets, and moisture barriers used in the containment structure. In response, the applicant states that it uses the work control process to manage the aging of containment seals and gaskets, identified as O-rings in Table 3.5.1-1 of each LRA, since that activity involves more thorough and more frequent inspection of the seals and gaskets provided by the inservice inspections, which are required only once per 10-year interval. In addition the applicant states that there are no moisture barriers incorporated into the design of the containment structures for Surry or North Anna that are within the scope of ISI-IWE, Category E-D inspections. The staff found this response to be acceptable.

The ISI program for containment inspections implements visual examination, VT-1, for pressure-retaining bolting. The staff notes that for bolted connections that are not disassembled and reassembled during the inspection interval, the examination method should require a bolt torquing or tension test in accordance with the requirements contained in ASME Subsection IWE, Table IWE-2500-1. In response to RAI B2.2.12-1(c), the applicant states that ASME Subsection IWE, Table IWE-2500-1, Subcategory E-G, requires bolt torquing or tension testing for bolted connections that are not disassembled and reassembled during the inspection interval. For Surry and North Anna, the applicant submitted relief request IWE-5 in 1998 to permit reliance upon 10 CFR Part 50 Appendix J (Type B) testing in lieu of bolt torque or tension testing for bolted connections that are verified by Appendix J results to not experience unacceptable leakage. This relief request was approved by the NRC staff as indicated in NRC letter no. 99-256, dated April 21, 1999, and establishes the current licensing basis requirement for testing of bolted connections that are not disassembled or reassembled during the inspection interval. The staff found this response to be acceptable.

In Section B2.2.12 of each LRA, the applicant states that only Subsection IWE (steel portions of containment) is credited for managing aging effects of the containment structure. During the staff's review of LRA Section 3.5.1, "Containment," a number of questions were raised regarding aging effects of the concrete portions of containment and the basis for limiting the aging management of containment to only the steel elements of containment. In response to RAI 3.5-3, the applicant stated that it would credit the examinations specified by ASME Section XI, Subsection IWL, Examination Category L-A, to manage the potential aging effects of concrete structural members of the containment. The applicant states that these examinations will be added to the ISI program for containment inspections aging management activity.

The staff finds the scope of the ISI program for containment inspections, as augmented by the applicant's response to the staff's RAIs, to be acceptable.

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

Parameters monitored or inspected: The ISI program for containment inspection specifies that the required inservice examinations for the containment steel liner are listed in Table IWE 2500-1 of ASME Section XI, as modified by applicable code cases and relief requests. Visual and volumetric inspections are described. Exempted items, such as inaccessible areas, are listed in Paragraph IWE 1220. Table IWE 2500-1 identifies inspection sampling requirements, examination methods, and examination frequencies. The applicant also indicates that in accordance with IWE-3511, when areas of the liner to be inspected are painted or coated, the examination also checks for evidence of flaking, blistering, peeling, discoloration, and other signs of stress. The staff considers the parameters monitored for the ISI program for containment inspection to be acceptable.

Detection of aging effects: The applicant states that loss of material is the aging effect for the containment steel liner. Surface degradation and wall thinning are two indications of this aging effect. They are determined by visual and volumetric examinations. The frequency and scope of examination requirements specified in 10 CFR 50.55a and Subsection IWE provide reasonable assurance that the aging effect is detected prior to compromising design basis requirements. The component material degradation conditions, which the inspections are intended to detect, are listed in Subsection IWE for the containment steel liner. Guidance for performing VT examinations, and evaluating VT results with respect to the acceptance standards of IWE, is provided in an administrative procedure. The staff finds that the aging effect of loss of material will be adequately managed by the ISI program for containment inspection.

Monitoring and trending: The applicant indicates that the details of the scope for the ASME Section XI, Subsection IWE inspections are documented in the IWE/IWL program plan for each station. The inspections are performed to identify degraded conditions in areas that are accessible. The evaluations of these accessible areas provide the basis for extrapolation to the expected condition of inaccessible areas and an assessment of degradation in such areas. The applicant indicated that the surface condition is characterized using visual examinations during IWE inspections. Anomalous indications of degradation are recorded on inspection reports that are kept in the applicant's station records. Engineering evaluations are performed for inspection results that do not meet established acceptance standards.

Regarding the schedule and frequency of the examinations, the applicant states that the inspection program required by Subsection IWE is divided into 120-month (10-years) intervals. The 10-year interval for IWE is further divided into three periods. However, the initial implementation of these inspections on September 9, 1996, allowed 5 years for the initial IWE inspection period, and 12 years for the first interval. Portions of the IWE examinations are performed during each 40-month (i.e., 3-year) period such that the entire scope of examinations is completed during the 10-year interval. Prior to the end of each interval, the IWE/IWL Program Plan for each unit is revised to reflect the appropriate update of the ASME Code, and to reflect any revised inspection requirements.

The applicant indicates that the IWE/IWL program plan for each unit will be revised prior to the end of each interval to reflect the appropriate update of the ASME Code, and to incorporate any revised inspection requirements. The revision to the IWE/IWL Program Plan should be consistent with the current approved editions of the ASME Code, in accordance with revisions to 10 CFR 50.55a. The staff issued RAI B2.2.12-2 requesting that the applicant clarify its statement to confirm that it is consistent with this staff position, or provide a more detailed explanation as to why it is different from the staff's position. The applicant's response to RAI

B2.2.12-2 states that they will ensure that the IWE/IWL program plan is consistent with the currently approved edition of the ASME Code in accordance with 10 CFR 50.55a and in effect during the respective 10-year interval for the Surry and North Anna units. The staff finds this response to be acceptable.

Acceptance criteria: The ISI program for containment inspection indicates that the acceptance standards for the IWE inspection are identified in ASME Section XI, Table IWE 2500-1 and refers to 10 CFR 50 Appendix J, Option B. Section B2.2.12 of each LRA also states that the occurrence of degradation that is adverse to quality will be entered into the applicant's corrective action system. The use of the acceptance standards as defined in ASME Section XI, Subsection IWE and in 10 CFR Part 50, Appendix J, which is referred to in Subsection IWE, is acceptable to the staff.

Operating experience: The ISI program for containment inspection indicates that compliance with the inspection provisions of ASME Section XI, Subsection IWE, since September 9, 1996. Any degradation of the containment steel liner that is found during inspections is noted and corrected, as necessary, to preclude adverse effects on plant safety and operability.

Previous containment liner inspections at Surry Units 1 and 2 have occasionally found corroded areas of the steel liner. Such areas have been cleaned and recoated. IWE inspection results for Unit 1 in 1998 and for Unit 2 in 1999, found no significant degradation down to the level of the interface joint with the floor. In addition, the applicant decided to excavate several areas of concrete to check the condition of the steel liner below the interface joint. Excavation of concrete in seven areas of the Unit 1 containment confirmed the absence of significant degradation for the liner. Wall thickness measurements showed that considerable margin remains with respect to minimum acceptable values. Observations of the condition of the interface joint for Unit 2 similarly confirmed good material condition and concluded that no further destructive examination was warranted based on the favorable findings for Unit 1.

During the North Anna Unit 2 refueling outage in 1999, a localized area of the Containment liner was found to be corroded. Successful restoration efforts were completed.

From the information provided it is apparent that loss of material of the containment liner has occurred, although the degradation was not significant. Therefore, continued examinations in accessible and inaccessible areas of the containment is crucial to ensure that the intended functions of the containment will be maintained during the period of extended operation. The staff finds that the demonstrated operating experience for the ISI program for containment inspection is adequate to ensure that the intended functions of the containment will be maintained consistent with the CLB during the period of extended operation.

3.3.1.12.3 Conclusions

The staff has reviewed the information provided in Section B2.2.12 of each LRA and the summary description of the ISI program for containment inspection in Section A2.2.12 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs. On the basis of this review and the above evaluation, the staff finds that there is reasonable assurance that the applicant has demonstrated that the aging effects associated with the ISI program for containment inspection will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.12.4 FSAR Supplement

The staff reviewed Section A2.2.12 of the UFSAR supplement and found that the description of the applicant's ISI program for containment inspection is consistent with Section B2.2.12 of each LRA. However, the applicant's response to RAI 3.5-3 states that they will credit the examinations specified by ASME Section XI, Subsection IWL, Examination Category L-A, to manage the potential aging effects of concrete structural members of the containment and that these examinations will be added to the ISI program for containment inspection aging management activity. The applicant further states in its response to this RAI that will change the UFSAR supplement that will be presented to the NRC staff in a future revision. In its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.2.12, "ISI Program – Containment Inspection" has been revised to incorporate ASME Section XI, Subsection IWL. Since the applicant has completed this action, the staff considers confirmatory action 3.3.1.12-1 closed.

3.3.1.13 ISI Program - Reactor Vessel

The applicant describes its inservice inspection (ISI) program for the reactor vessels in Section B2.2.13 of the LRAs. This section of the LRAs describes the applicant's evaluation of this program in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal. The applicant credits this program for managing the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness for all four units.

The staff reviewed the applicant's description of the program in Appendix B2.2.13 of the LRAs to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.13.1 Summary of Technical Information in the Application

In accordance with 10CFR50.55a, the ISI program is implemented to meet the requirements of ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components. For North Anna 1, the 1989 edition of the ASME Code is applicable, whereas for North Anna 2 the 1995 edition with the 1996 Addenda are applied. For Surry 1 and 2, the 1989 edition of the ASME Code is used. Each of the four units has its own individual ISI plan which describes the procedure for implementing the provisions of ASME Section XI, Subsection IWB (Class 1). Each ISI Plan is approved by the NRC for a 120-month inspection interval. Additional augmented inspection activities have been included in the ISI Plans to address industry concerns regarding the RVs. These areas are for the control rod drive housings on the upper head, and the incore flux thimble tubes in the reactor vessel bottom. NRC Bulletin 88-09, "Thimble Tube Thinning in Westinghouse Reactors," and Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations," provide the basis for these augmented inspections.

3.3.1.13.2 Staff Evaluation

The staff's evaluation of the reactor vessel ISI 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 defects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

The staff reviewed the information included in Section B2.2.13 of the LRAs. The review was performed to verify that the ISI program for the reactor vessel will ensure that the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation for all four reactor vessels.

Program scope: This AMP is credited with managing the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness. The applicant stated that the reactor vessel ISI program reasonably assures the pressure-retaining capability of the reactor vessel welds; the studs, nuts and washers that are used for vessel closure; the surface and attachments on the interior of the vessel; the housings and housing tubes for CRDMs on the upper head; incore flux thimbles and guide tubes that penetrate the lower head; and the seal table and fittings. Among the vessel welds included in the scope of license renewal for the North Anna are the head-to-flange weld, the shell-to-flange weld, the nozzle welds, the circumferential vessel welds, and the integrally-welded attachments. These same welds are inspected for the Surry, but since they also have longitudinal welds these are also included in the inspection program.

The relevant ASME Section XI categories of examinations that address aging effects in RV subcomponents are listed in each LRA as:

Component Type Category	Category	Method
Pressure-retaining welds in reactor vessel	B-A	Volumetric/surface
Full-penetration welds of nozzles in vessels	B-D	Volumetric
Pressure-retaining partial penetration metal welds in vessels	B-E	Visual
Pressure-retaining dissimilar metal welds	B-F	Volumetric/surface
Pressure-retaining bolting greater than 5.08 cm (2 inches) in diameter	B-G-1	Visual/surface/volumetric
Interior of reactor vessel	B-N-1	Visual
Integrally welded core support structures and interior attachments	B-N-2	Visual

in reactor vessel		
Pressure-retaining welds in control rod housings	B-O	Volumetric/surface
All-pressure-retaining components	B-P	Visual

Preventive actions: The applicant stated that the current AMP is for condition monitoring only and has included no preventive actions. As such, there are no preventive or mitigative actions nor did the staff identify a need for such action.

Parameters monitored or inspected: The ISI program - reactor vessel, in accordance with ASME Section XI, inspects the following components using a combination of surface, volumetric, and visual examinations:

- reactor vessel welds
- reactor vessel studs, nuts, and washers
- incore flux thimble guide tubes
- peripheral CRDM locations

Augmented inspection activities are also performed on the RV upper head region to visually check for leakage at mechanical closures and to provide compliance with NRC GL-97-01 and to perform eddy current examinations on the incore flux thimble tubes to check wall thickness in compliance with NRC Bulletin 88-09.

The reactor vessel ISI program examinations are performed during each refueling outage at both North Anna and Surry sites. One exception is the SPS 1/2 incore flux thimble guide tubes which are inspected every other refueling cycle. This is because the guide tubes at Surry are double walled and are expected to have higher integrity than the single-walled North Anna tubes.

In Table B4.0-1 of each LRA, Licensee Followup Action, the applicant committed to follow industry efforts to stay aware of new recommendations (in addition to existing reliance on chemistry control and existing ASME Section XI inspections) regarding inspection of core support lugs. Industry recommendations will be considered by the applicant to determine the need for enhanced inspection.

The staff found the parameters monitored to be acceptable because ISI examination of reactor vessel welds, reactor vessel studs, nuts, and washers. incore flux thimble guide tubes and peripheral CRDM locations will ensure adequate RV integrity during the period of extended operation.

Detection of aging effects: The applicant stated that the ASME Section XI visual, surface, and volumetric examinations are utilized to detect loss of material, cracking, and gross indications of loss of pre-load (as indicated by bolt loosening). Augmented inspection activities include bare-metal visual examination of the vessel head, non-visual nondestructive examination (NDE) inspection of the reactor vessel head and penetrations, and under-the-head volumetric and surface examinations. An additional augmented inspection activity involves eddy current testing of the incore flux thimble tubes to detect loss of material. Finally, as part of a licensee followup action the applicant committed to remain active in industry groups in order to stay aware of any new industry recommendations regarding inspection of core support lugs. Industry recommendations will be considered to determine the need for enhanced inspections. The staff finds this approach acceptable. Compliance with the ASME Code Section XI requirements and performance of visual examination, bare-metal visual examination of the vessel head, non-visual NDE inspection of the reactor vessel head and penetrations, and under-the-head volumetric and surface examinations of the vessel head will detect cracking and the presence of boric acid accumulations due to leakage through the pressure boundary.

Monitoring and Trending: The applicant stated that the ASME Section XI inspections are performed once every ten years. Anomalous indications that are signs of degradation are documented and kept in station records. Engineering evaluations are performed for inspection results that do not meet established acceptance standards. These evaluations take into account the extent of degradation, so that timely corrective or mitigative actions are taken. The staff finds this approach to be acceptable because it is based on methods that are sufficient to provide predictability of extending of degradation so that the timely corrective or mitigative actions are possible.

Acceptance criteria: The applicant stated that the acceptance criterion for the non-destructive examination is the absence of anomalous indications that are signs of degradation. Acceptance standards for the inspections of RV pressure retaining welds are provided in ASME Section XI, Subsection IWB 3500. For visual inspection activities, the acceptance criterion for inspection of the vessel head area is absence of evidence of leakage. In the case of the inspections for the incore flux thimble tubes the acceptance criterion is for the tubes to remain above the minimum allowable wall thickness value. The staff finds the above listed acceptance criteria to be appropriate to ensure the integrity of the RV.

Operating experience: In the LRAs, the applicant stated that operating experience and inspection histories indicate the lack of reactor RV degradation. Operating experience includes (a) reactor pressure boundary leakage monitoring as required by Technical Specifications, and (b) RV inspections during refueling outages as well as augmented inspection activities on the RV upper head and incore flux thimble tubes. Industry experiences will be monitored at the North Anna and Surry plants to determine whether additional inspection activities will be need in the future. Operating experience at the North Anna and Surry plants is stated to have shown that there has been no significant indication of loss of material, cracking, gross loss of pre-load, or gross loss of fracture toughness in the RVs at the North Anna and Surry plants. With the exception of September 2002 reactor vessel head inspection findings at North Anna 2, the staff found that operating experience at North Anna and Surry supports the attributes of this program.
The staff is currently reviewing the issues associated with NRC bulletin 2001-01, 2002-01, and 2002-02. Any future regulatory actions that may be required as a result of those reviews will be addressed by the staff in a separate regulatory action.

The three attributes of the quality assurance program namely, corrective actions, confirmation process, and administrative controls have been separately evaluated in Section 3.3.2 of this SER.

As part of its review of operating experience at the four units, the applicant addressed the vessel head penetration (VHP) concerns raised by the NRC in GL 97-01. The applicant provided the following information pertinent to the period of extended operation. The criteria for ranking the VHPs are based on establishing a benchmark probability that a 75% through-wall crack would be detected and exist in the most PWSCC-degraded CRDM nozzle at D.C. Cook 2 relative to the time of VHP inspections at this plant in 1994. NEI normalized nozzle failure at the U.S. reactors relative to the date of January 1, 1997. The most susceptible reactors are placed in Tier 1 which predicts reaching the probability of a 75% through-wall failure in five years. For intermediate susceptibility reactors (Tier 2) reaching the probability would take between five and ten years. The applicant provided a response to NRC requests for its four reactors regarding the following items:

1. "An assessment of the susceptibility of your VHPs to develop PWSCC during the period of extended operation."

The applicant's response to the NRC indicated that Surry 1 and North Anna 1 were grouped in the industry category for most susceptible to PWSCC. Surry 2 and North Anna 2 were placed in the intermediate category for susceptibility to cracking. Review of these rankings was carried out at the May 10, 2000, by the Materials Research Project (MRP) CRDM/Alloy 600 Issues Task Group (ITG) meeting in Washington, DC. After further analyses it was concluded that the rankings for the four vessels would remain the same. The rankings are reflected in the augmented inspections for the VHPs.

2. "A confirmation that the VHPs at you facilities are included under the scope of your boric acid corrosion inspection program."

The applicant has developed Augmented Inspection Manual Attachment 36 for Surry, and Attachment 18 for North Anna to address cracking concerns for VHPs as identified in GL 97-01. Modified visual (VT-2) inspections are carried out every refueling outage to identify the presence of boric acid crystals. This inspection is carried out as part of the augmented inspection activities, and is not part of the boric acid corrosion surveillance program.

3. "A summary of the results of inspections that have been completed on your VHPs prior to the license renewal application, as appropriate."

In 1997, Virginia Power provided a summary of the VHP inspection results through the fall 1995 outage for Surry 1, the fall 1997 outage for Surry 2, the spring 1997 outage for North Anna 1, and the fall 1996 outage for North Anna 2. The VHPs are inspected at every refueling outage in accordance with the requirements of Attachment 18 of the augmented inspection activities.

The North Anna 2 VHP nozzles inspection was performed during the September 2002 refueling outage. The applicant performed a bare-metal inspection on the reactor vessel head and penetrations. The inspection showed indications of leakage from the head penetration nozzles. The applicant performed visual and eddy current inspections of 65 penetrations in the reactor vessel head. The applicant identified indications in the weld surface of 63 penetrations. Six of the penetrations showed leakage above the head. The applicant plans to replace the reactor vessel head.

The staff is currently reviewing the issues associated with NRC bulletin 2001-01, 2002-01, and 2002-02. Any future regulatory actions that may be required as a result of those reviews will be addressed by the staff in a separate regulatory action.

3.3.1.13.3 Conclusions

On the basis of the review of the reactor vessels ISI program described above, the staff finds that the program will adequately manage the loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness for the RV subcomponents. Therefore, the staff concludes that the applicant has demonstrated that the above aging effects associated with the RV subcomponents that credit this activity will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

3.3.1.13.4 FSAR Supplement

The staff reviewed Section A2.2.13 of the UFSAR supplement and found that the description of the applicant's ISI program for reactor vessels is consistent with Section B2.2.13 of each LRA.

3.3.1.14 Reactor Vessel Integrity Management

The applicant describes its reactor vessel integrity management program (RVIMP) in Section B2.2.14 of the LRAs. This section of the LRAs describes the applicant's evaluation of this program in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal. The applicant credits this program for managing the aging effect of the reactor vessel neutron embrittlement for both North Anna and Surry plants.

The staff reviewed the applicant's description of the program in Appendix B2.2.14 of the LRAs to determine whether the applicant has demonstrated that it will adequately manage the applicable effect of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.14.1 Summary of Technical Information in the Application

The applicant states that it includes radiation capsule surveillance activity, the reactor vessel fast neutron fluence calculations, the analysis to determine the temperature for nil-ductility transition (RT_{NDT}) for the reactor vessel beltline materials, the analysis to determine the Charpy upper shelf energy (C_VUSE) for the reactor vessel beltline materials, the analysis to determine reactor coolant system pressure-temperature operating limits and low temperature overpressure protection system (LTOPS) setpoints, and pressurized thermal shock (PTS) screening calculations. The applicant states that surveillance capsules were placed in each of the North Anna and Surry reactors and post-irradiation testing of Charpy V-notch and tensile specimens is carried out. Radiation damage is measured by comparing the results obtained with those from unirradiated specimens. The applicant states that the testing program fulfills the requirements of ASTM E-185, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," which is endorsed by 10 CFR Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements."

In this AMP, the applicant calculates vessel fluence using an in-house neutron transport code in accordance with the approved reactor vessel fluence analysis methodology. The applicant states that the analysis is performed according to the draft NRC Regulatory Guide DG-1053, "Calculational and Dosimeter Methods for Determining Pressure Vessel Neutron Fluence." The calculated fluencies are benchmarked using dosimeter information from the irradiation surveillance activities.

3.3.1.14.2 Staff Evaluation

The staff's evaluation of the RVIMP 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 defects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below. The staff reviewed the information included in Section B2.2.14 of the LRAs, regarding the applicant's demonstration of the RVIMP to ensure that the aging effects of reactor vessel neutron embrittlement will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation for all four reactor vessels.

Program scope: The applicant states that the scope of the AMP to manage the effects of reduction of fracture toughness for the North Anna and Surry reactor vessels is covered by the reactor vessel integrity management program. This AMP is focused on assuring adequate fracture toughness of the reactor vessel beltline plate and weld materials. The neutron dosimetry and materials property data derived from the surveillance tests are used in calculations and evaluations that demonstrate compliance with applicable regulations. The staff found the scope of RVIMP acceptable because the neutron dosimetry and materials property data derived from the surveillance tests will demonstrate compliance with the NRC regulations.

Preventive actions: The applicant states that the reactor vessel integrity management program AMP are for condition monitoring of the vessel, so that preventive actions are not required. The staff found the applicant's conclusion acceptable that preventive actions are not required.

Parameters monitored or inspected: The applicant states that the parameter monitored at the North Anna and Surry RVs is the RV material fracture toughness, based on the Charpy V-notch and tensile test results for specimens of RV plate and welds material. The staff agrees with the applicant that the Charpy V-notch and tensile test results for irradiated specimens of RV plate and weld material will provide information about RV materials fracture toughness.

Detection of aging effects: The aging effect for RV steel is stated by the applicant to be reduction in fracture toughness. The extent of aging is determined by testing and evaluating irradiated samples of RV material. The staff finds this approach acceptable because testing will determine reduction in fracture toughness.

Monitoring and Trending: The applicant states that neutron dosimetry and materials property data derived from the surveillance program are use to evaluate the RV and surveillance capsule neutron fluencies, RT_{NDT}, and C_VUSE. This information is used to develop reactor coolant pressure-temperature limits and LTOPS setpoints, and to demonstrate compliance with regulations governing RV integrity. The staff finds this to be acceptable. The staff finds this approach to be acceptable because it is based on methods that are sufficient to provide predictability of the extend of degradation so timely corrective or mitigative actions are possible.

Acceptance criteria: The applicant sates that the North Anna and Surry RV capsule surveillance activities are used to establish acceptance values for the following parameters:

- heatup and cooldown limits, as implemented by Technical Specifications, to reasonable assure vessel integrity.
- a pressurized thermal shock reference temperature that is within the scoping criteria of 10 CFR 50.61
- a fast fluence value for the surveillance capsule that bounds the expected fluence at the affected vessel beltline material through the period of extended operation
- compliance with the acceptance criteria governing the Charpy V-notch upper shelf energy given in 10 CFR 50, Appendix G.

The applicant stated that, based on established parameters, calculations are performed to reasonably assure that the units will remain within acceptable values. The staff found that acceptance criteria based on the results of the North Anna and Surry RV capsule surveillance activities to be acceptable.

Operating experience: The heatup and cooldown curves that are used for station operation are updated by using the results from the vessel surveillance specimen evaluations. The applicant stated that evaluations for RT_{PTS} confirm compliance with acceptance criteria in 10 CFR 50.61. Values for C_VUSE either have been verified to remain above the limit in 10 CFR 50, Appendix G, or an equivalent margin analysis has been performed. The staff agrees with the applicant's conclusions. The staff has approved the North Anna and Surry P-T curves which are based upon the results of the vessel surveillance specimen evaluation.

The three attributes of the quality assurance program namely, corrective actions, confirmation process, and administrative controls have been separately evaluated in Section 3.3.2 of this SER.

3.3.1.14.3 Conclusions

On the basis of the review of the reactor vessel integrity management program described above, the staff finds that the program will adequately manage the reactor vessel neutron embrittlement in the beltline region. Therefore, the staff concludes that the applicant has demonstrated that the above aging effect associated with the RV beltline region that credit this activity will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

3.3.1.14.4 FSAR Supplement

The staff reviewed Section A2.2.14 of the UFSAR supplement and found that the description of the applicant's reactor vessel integrity management program is consistent with Section B2.2.14 of each LRA.

3.3.1.15 Reactor Vessel Internals Inspection

The applicant describes its reactor vessel internals inspection program in Section B2.2.15 of the LRAs. This section of the LRAs describes the applicant's evaluation of this program in terms of aging management program attributes provided in the Standard Review Plan for license renewal. The applicant credited this program for managing the effects of aging for the reactor vessel internals at both stations.

The staff reviewed the applicant's description of the program in Section B2.2.15 of the LRAs to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.15.1 Summary of Technical Information in the Application

The applicant stated that this AMP is primarily comprised of the inservice inspection program in accordance with ASME Section XI requirements, a one time focused inspection of the reactor vessel internals, and an Augmented Inspection Activity as part of the licensee follow-up actions for the core barrel holddown spring.

The reactor vessel internals inspection is implemented to meet the requirements of Subsections IWB, Table IWB 2500-1 (Examination Category B-N-3) of IWB-3520 of ASME Section XI. For North Anna 1 and Surry 1 and 2, this is in accordance with the 1989 Edition and for North Anna 2, the 1995 Edition with the 1996 Addenda.

The applicant performs visual inspections on the surfaces of the reactor vessel internals in accordance with the ISI requirements listed in ASME Section XI, Subsection IWB, Examination Category B-N-3. These inspections check for: 1) structural distortion or displacement of parts to the extent that component function may be impaired, 2) loose, missing, cracked, or fractured parts, bolting, or fasteners, and 3) structural degradation of interior attachments such that the original cross-sectional area is reduced. The applicant stated that it would remain active in industry groups to stay aware of new industry developments regarding such issues as void swelling, neutron embrittlement of baffle and barrel bolting, and thermal embrittlement of CASS components.

3.3.1.15.2 Staff Evaluation

The staff's evaluation of the ISI program, reactor vessel 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 defects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

The staff reviewed the information included in Section B2.2.15 of the LRAs, regarding the applicant's demonstration of the reactor vessel internals inspection program to ensure that the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indications of reductions in fracture toughness will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation for reactor vessel internals components within the scope of license renewal.

Program scope: The ISI Program for reactor vessel internals is implemented in accordance with the individual ISI Plan for each unit. In accordance with 10CFR50.55a, the Reactor Vessel Internals Inspection for the Surry and North Anna , the ISI Plan is implemented to meet the requirements of Subsections IWB of ASME Section XI. Each ISI Plan provides details for the implementation of inspections specified by ASME Section XI, Subsections IWB (Class 1). Table IWB 2500-1 includes Examination Category B-N-3, Removable Core Support Structures. The acceptance standards for the visual examinations (VT-3) of Category B-N-3 are summarized in paragraph IWB-3520. Each ISI Plan is developed and approved by the staff for a 120-month inspection interval, as modified by applicable relief requests and Code Cases.

In addition to this, a one-time focused inspection of the reactor vessel internals will be performed between year 30 and the end of the current operating license term for a single Surry or North Anna reactor that is evaluated to be most susceptible to identified aging effects. An additional augmented inspection activity will include an inspection of the core barrel holddown spring to address the aging effect of gross indication of loss of pre-load.

The applicant will also follow industry events to remain cognizant of any new developments regarding such issues as neutron embrittlement of baffle and barrel bolting, void swelling, and thermal embrittlement of the reactor vessel internals components made of CASS. The scope of this one time inspection will be consistent with industry developments on these issues. The staff finds the scope acceptable for this AMP because the scope is comprehensive in that it includes a variety of reactor internals.

Preventive/mitigative actions: There are no preventative/mitigative actions associated with this program, nor did the staff identify a need for such.

Parameters monitored: The applicant performs visual inspections on the surfaces of the reactor vessel internals in accordance with the ISI requirements listed in ASME Section XI, Subsection IWB, Examination Category B-N-3. These inspections check for: 1) structural distortion or displacement of parts to the extent that component function may be impaired, 2) loose, missing, cracked, or fractured parts, bolting, or fasteners, and 3) structural degradation of interior attachments such that the original cross-sectional area is reduced. The applicant stated that it would remain active in industry groups to stay aware of new industry developments regarding such issues as void swelling and thermal embrittlement of cast austenitic stainless steel components. The staff finds that the inspection parameters are acceptable because the inspections check for variety of degradation effects that may affect the reactor internals.

Detection of aging effects: The applicant performs visual inspections to detect loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness. An additional augmented inspection activity is performed for the core barrel hold-down spring to check for gross indications of loss of pre-load. The staff finds the applicants methods for detection of aging effects acceptable. Performance of visual inspections will detect loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness.

Monitoring and trending: The applicant states that ASME Section XI inspections will be performed at a frequency of once per 10-year interval. Anomalous indications that are signs of degradation are documented on non-destructive examination reports which are kept in Station

Records. Engineering evaluations are performed for inspection results that do not meet established acceptance standards. These evaluations consider the extent of degradation to reasonably assure that timely corrective action or mitigative actions are taken. An additional task of a one-time focused inspection of the internals will check for all five of the aging effects by applying an inspection activity based on the leading indicator approach. The applicant states this approach will be based on factors including fluence, stress, and material susceptibility, and will identify subcomponents judged to be most susceptible. This inspection will be performed between year 30 and the end of the current operating license term on the single Surry or North Anna reactor determined to be most susceptible to the aging effects identified. The results of the inspections will determine the need for inspections at the other reactors. If future industry developments suggest the need for an alternate inspection plan during the period of extended operation, or negate the need for a one-time inspection, the applicant will modify the proposed inspection program. The staff finds this approach to be acceptable because it is based on methods that are sufficient to provide predictability of the extend of degradation so timely corrective or mitigative actions are possible.

Acceptance criteria: The applicant states that the acceptance standards are per ASME Section XI, Subsection IWB-3500. The staff finds this acceptance criteria to be acceptable.

Operating experience: The applicant states that compliance with ASME Section XI has been in place at North Anna and Surry plants since initial operation. The Inspection results have not indicated any age-related degradation problems with the reactor vessel internals. Industry experience has indicated a concern regarding degradation of the control rod guide tube split pins that are used in the upper internals. The nickel-based alloy X750 split pins are susceptible to stress corrosion cracking. Replacement split pins were installed at Surry 1, but examination of the original split pins found no degradation. Similarly, replacement split pins, with improved heat treatment characteristics, were installed at North Anna 1 and 2. One incidence of an original split pin failure was seen at North Anna 1, however examination of the remaining original split pins found no additional problems. The applicant states that based on the favorable examinations of the split pins for Surry 1, and the North Anna pins, and that the fact that split pin cracking has no adverse effect on safety-related functions since the internals package would maintain the original configuration, the split pins have not been replaced at Surry 2. The staff found that operating experience had confirmed the adequacy of the reactor vessel internals inspection program.

3.3.1.15.3 Conclusions

On the basis of the review of the reactor vessel internals inspection program described above, the staff finds that the program can adequately manage the loss of material, cracking, gross indications of loss of pre-load, and gross indications of reductions in fracture toughness for RV internals subcomponents. Therefore, the staff concludes that the applicant has demonstrated that the above aging effects associated with the RV internals that credit this activity will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

3.3.1.15.4 FSAR Supplement

The staff reviewed Section A2.2.15 of the UFSAR supplement and found that the description of the applicant's reactor vessel internals inspection program is consistent with Section B2.2.15 of each LRA.

3.3.1.16 Secondary Piping and Component Inspection

The applicant describes its secondary piping and component inspection program in Section B2.2.16 of each LRA. The applicant credits this inspection program with implementing a standardized method of identifying and inspecting components that are susceptible to flow-accelerated corrosion (FAC). The staff reviewed each LRA to determine whether the applicant has demonstrated that the secondary piping and component inspection will adequately manage loss of material due to FAC during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.16.1 Summary of Technical Information in the Application

The applicant states in Section B2.2.16 of each LRA that the secondary piping and component inspection program implements a standardized method of identifying, inspecting, and tracking components which are susceptible to FAC in both single- and two-phase flow conditions. This program has been developed in accordance with NRC Generic Letter 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning," NUREG-1344, "Erosion/Corrosion Induced Pipe Wall Thinning in U.S. Nuclear Power Plants," and EPRI guideline NSAC-202L, "Recommendations for an Effective Flow-accelerated Corrosion Program."

The program is used to identify piping locations, and pumps and valves, that are susceptible to FAC degradation. By performing ultrasonic measurements on piping segments, as directed by the AMP procedures, piping components are identified for repair or replacement prior to reaching minimum allowable wall thickness. Visual inspections of the internals of nonpiping components, such as valves, are performed as the equipment is opened for other repairs and/or maintenance, to determine whether FAC degradation is occurring. The applicant considers pump casings and valve bodies retaining pressure in high energy systems as being bounded by the piping inspections performed for the program.

The following systems credit this AMP for managing the aging effect of loss of material:

- auxiliary steam
- blowdown
- feedwater
- main steam
- steam drains (NAS 1/2 only)

3.3.1.16.2 Staff Evaluation

The staff's evaluation of the secondary piping and component inspection 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Scope of program: The applicant states in Section B2.2.16 of each LRA that the secondary piping and component inspection program evaluates the FAC-susceptible portions of the systems identified in Section B2.2.16.1 above. The scope of the inspection program is developed based on the following considerations:

- piping components that have been categorized as "potential replacement" during previous inspection periods
- piping components that have not been inspected during previous inspection periods
- piping components that were inspected during previous inspection period and rated as requiring inspection during the current inspection period
- piping components that have been replaced in previous inspection periods but require an inspection to verify projected wear rate
- piping adjacent to pumps and valves that have been previously repaired or replaced
- lessons learned from previous inspection periods and from industry experience
- input from a FAC-monitoring computer code (i.e., CHECKWORKS-FAC)
- the requirement for baseline inspections on selected components that have been replaced
- carbon steel or low-alloy steel piping components located immediately downstream of FAC-resistant materials
- consideration of changes in operating conditions that may cause FAC
- other appropriate selection tools as may be developed by the industry in the future

The staff finds the scope of the AMP to be acceptable in that it includes the applicable components in the systems that credit this program and follows the recommendations in NRC GL 89-08, NUREG-1344, and EPRI guideline NSAC-202L.

Preventive actions: The applicant identified this activity as condition monitoring. Accordingly no preventive actions are required, and the staff did not identify the need for such action. However, it is noted that the applicant reduces the susceptibility to FAC by controlling the feedwater pH value to be toward the upper end of the acceptable range that is listed in the applicant's chemistry control program for secondary systems, which is described in Section B2.2.5 of each LRA.

Parameters monitored or inspected: The applicant performs visual inspections to determine if degradation of the internal surface is occurring. Ultrasonic thickness measurements are made to determine if loss of material due to wall thinning is occurring. The staff finds that ultrasonic testing will be capable of determining the remaining wall thickness in the components within the scope of this program; therefore, the parameters monitored are acceptable.

Detection of aging effects: The aging effect of loss of material due to FAC is detected by volumetric inspections and, where possible, internal visual inspections. The staff finds this approach acceptable for detecting wall thinning.

Monitoring and trending: The applicant develops inspection plans using results of past inspections, predictions from the CHECKWORKS-FAC computer code, results of water chemistry analyses, and industry experience. Trending of ultrasonic wall thickness measurements are used to provide reasonable assurance that structural integrity will be maintained between inspections. Examination results are evaluated and inspection, repair, and replacement plans are developed by the applicant at a frequency of at least once per 18 months (refueling interval) for each unit. The staff has found that the use of CHECKWORKS is acceptable because it provides a bounding analysis for FAC. The staff concludes that the inspection plans and schedule developed by the applicant on the bases of the results of such a predictive code, and the other factors considered by the applicant, provides reasonable assurance that structural integrity will be maintained between inspections.

Acceptance criteria: The applicant uses engineering evaluations of trend projections, along with code minimum wall thickness requirements, to determine when component repair or replacement is needed. The acceptance criterion for visual inspections is the absence of visible degradation. The staff concludes that this acceptance criteria is adequate to demonstrate that a loss of material due to wall thinning will be managed for the period of extended operation.

Operating experience: The applicant has reported that wall thinning and pitting have occurred in plant components that are within the scope of the secondary piping and component inspection program. The major through-wall failure of condensate piping that occurred at Surry in 1986 resulted in the issuance of NRC Bulletin 87-01, "Thinning of Pipe Walls in Nuclear Power Plants," and initiated the current FAC inspection and repair activities. Since this AMP has been implemented, the applicant has reported that the continued improvement in the management of FAC has significantly reduced the likelihood of the recurrence of such an event. The applicant uses FAC-resistant material for replacement components to reduce the susceptibility of these components and the extent of reinspections. The applicant states that repairs and replacements have occurred in the condensate, feedwater, extraction steam, and steam drain systems as a result of early detection and implementation of the corrective action system for each unit. The staff concludes that the applicant has demonstrated that the secondary piping and component inspection program has been effective in managing FAC in carbon steel piping and components.

3.3.1.16.3 Conclusions

The staff has reviewed the information provided in Section B2.2.16 of each LRA and the summary description of the secondary piping and component inspection program in Section A2.2.16 of the UFSAR supplement. On the basis of this review, the staff finds that the applicant has demonstrated that loss of material due to FAC will be adequately managed for the components that credit this program so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.16.4 FSAR Supplement

The staff reviewed Section A2.2.16 of the UFSAR supplement and found that the description of the applicant's secondary piping and component inspection program is consistent with Section B2.2.16 of each LRA and that no changes were needed.

3.3.1.17 Service Water System Inspections

The applicant describes its service water system inspections in Section B2.2.17 of each LRA. The applicant credits this program for managing the aging effects of change in material properties, loss of material and heat transfer degradation for components cooled by service water. The staff reviewed the applicant's description of the program in Section B2.2.17 of each LRA to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.17.1 Summary of Technical Information in the Application

In Section B2.2.17 of each LRA, the applicant states that all four units maintain compliance with NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment." The primary objectives of the applicant's service water system inspections are to (1) remove excessive accumulations of biofouling agents, corrosion products, and silt; and (2) repair defective protective coatings and degraded service water system piping and components that could adversely affect performance. The applicant states that preventive maintenance, inspection, and repair procedures have been developed to provide reasonable assurance that any adverse effects of exposure to service water are adequately addressed. Furthermore, the applicant adds biocide to the service water system of all four units to reduce biological growth (including MIC) that could lead to degradation of components exposed to the service water.

The following systems credit this AMP for managing the aging effects of change in material properties, loss of material, and heat transfer degradation:

- heating (NAS 1/2) and ventilation
- service water
- component cooling water
- instrument air (NAS 1/2 only)
- circulating water (SPS 1/2 only)
- vacuum priming (SPS 1/2 only)

3.3.1.17.2 Staff Evaluation

The staff's evaluation of the service water system inspections 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Scope of program: Section B2.2.17 of each LRA identifies the systems that credit the service water system inspections for managing the aging effects of change in material properties, loss of material and heat transfer degradation. The applicant identified the components in the systems that credit this AMP in Sections 3.3 and 3.4 of each LRA. These components are included in the program since they could experience degradation because of their contact with service water. The staff finds the scope of the program to be acceptable because it maintains compliance with the requirements of GL 89-13.

Preventive actions: The applicant states in Section B2.2.17 of each LRA that the inspections and testing of components affected by service water are designated condition monitoring and performance monitoring, respectively and, accordingly, no preventive actions are performed.

The staff observed during the review that the recommendations of GL 89-13 include control or preventive measures and that some measures are included in this AMP. In order to complete the review of this AMP attribute, the staff requested the applicant to (a) explain why the addition of biocide to the service water system to reduce biological growth (including MIC) is not considered a preventive action, and (b) clarify if the program includes flushing of infrequently used systems as recommended by GL 89-13. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant (a) agreed that they should have considered injection of a biocide to be a preventive action, and (b) explained that the only infrequently used system that falls within the scope of GL 89-13 is the containment recirculating spray heat exchange service water supply line, which is maintained in dry layup and, therefore, does not need to be flushed. The staff found the additional clarifications provided by the applicant to be acceptable and concludes that appropriate preventive actions are being performed in accordance with the requirements of GL 89-13.

Parameters monitored or inspected: In Section B2.2.17 of each LRA, the applicant states that inspections of components exposed to service water are performed to check for changes in material properties for components made of copper and copper alloys and for loss of material which could be a result of biofouling or occur in metallic components due to defects in protective coatings. Furthermore, the applicant states that heat transfer performance parameters for selected components cooled by service water are periodically monitored.

In order to complete the review of this AMP attribute, the staff requested that the applicant explain why inspections for cleanliness of the piping, components, heat exchangers, and the internal linings and coatings are not included in the program. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant explained that, for the purpose of license renewal, it is concerned with maintaining the intended function of the components of concern. Maintaining a cleanliness standard is beyond the scope of license renewal. However, the applicant restated that its program is consistent with the requirements and guidance in GL 89-13, and will provide the necessary cleanliness to provide reasonable assurance that the intended function is maintained.

The staff found parameters monitored or inspected, coupled with the requirements and guidance in GL 89-13, to be acceptable.

Detection of aging effects: In Section B2.2.17 of each LRA, the applicant states visual inspections are performed to check for loss of material and changes in material properties and that heat transfer testing is performed to identify the aging effects of loss of material and heat transfer degradation. Furthermore, the applicant states that volumetric inspections are also performed to check for loss of material due to MIC for NAS 1/2 only. In the section on "Confirmation Process" in Section B2.2.17 of each LRA, the applicant states that periodic inspections of the service water system are performed to assess the degree of biofouling, the integrity of surface coatings, and the extent of pipe surface damage or wall thinning; and to provide confirmation of previous corrective actions. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant explained that operating experience has shown that NAS 1/2 lake water creates an environment where MIC is a concern in its service water system, making volumetric exams necessary to provide reasonable assurance that the associated aging will be properly managed for the period of extended operation. However, SPS 1/2 operating experience shows that MIC is not a concern for the river water used at SPS 1/2 and, therefore, volumetric exams are not necessary to provide reasonable assurance that MIC will be properly managed for the period of extended operation at SPS 1 /2. The staff found the applicant's approach for the detection of aging effects to be acceptable.

Monitoring and trending: In Section 2.2.17 of each LRA, the applicant states that inspections and testing are performed at different frequencies that range from weekly to every refueling outage for components exposed to service water. Inspection and heat exchanger testing results are recorded in procedures that are retained in records for all four units. Furthermore, engineering evaluations are performed for anomalous inspection or heat transfer testing results. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant confirmed that the inspection and testing frequencies for the extended period of operation will continue to be accordance with the applicant's commitments under NRC GL 89-13.The staff found this commitment to be acceptable.

Acceptance criteria: The acceptance criterion for visual inspections is the absence of anomalous indications of degradation. In the case of service water, degradation includes biofouling, and material degradation. Engineering evaluations determine whether observed deterioration of material condition is sufficiently extensive to lead to loss of intended function for components exposed to the service water. The degraded condition of material or of heat transfer capability may require prompt remediation. Occurrence of degradation that is adverse to quality is entered into the applicant's corrective action system.

In its response to RAI B2.2.17-1, in a letter dated November 30, 2001, the applicant states that the objectives of the service water inspection activity are to remove accumulations of biofouling agents, to inspect for degradation of protective coatings, and to repair degraded protective coatings. The applicant further states that inspection and cleaning procedures require that component surfaces be free of visible debris, adherents, slime layers, or other foreign material. The staff finds that the applicant's commitment to NRC GL 89-13, including acceptance criteria based on effective cleaning of biological fouling organisms and maintenance of protective coatings, to be acceptable.

Operating experience: The applicant states in Section B2.2.17 of each LRA that inspections and tests have led to numerous piping repairs and design changes that have been implemented to replace degraded portions of the service water system. The inspection and testing results have been used as input to the engineering evaluation process to make necessary adjustments to inspection and testing frequencies and scopes. As discussed above, all four units maintain compliance with the requirements of NRC Generic Letter 89-13. The guidance of NRC GL 89-13 has been implemented for approximately 10 years and has been effective in managing aging effects due to biofouling, corrosion, erosion, protective coating failures, and silting in structures and components serviced by open-cycle cooling water systems.

3.3.1.17.3 Conclusions

The staff has reviewed the information provided in Section B2.2.17 of each LRA and the summary description of the service water system inspections in Section A2.2.17 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs. On the basis of the review of the service water system inspections described above, the staff concludes that the applicant has demonstrated that the program can adequately manage the aging effects in the systems that credit this activity so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.1.17.4 FSAR Supplement

The staff reviewed Section A2.2.17 of the UFSAR supplement and found that the description of the applicant's service water system inspections is consistent with Section B2.2.17 of each LRA and that no changes were needed.

3.3.1.18 Steam Generator Inspections

The applicant describes its steam generator inspections program in Section B2.2.18 of the LRAs. This section of the LRAs describes the applicant's evaluation of this program in terms of aging management program attributes provided in the Standard Review Plan for license renewal. The applicant credits this program as managing the effects of aging for the steam generators at all four units.

The staff reviewed the applicant's description of the program in Section B2.2.18 of the LRAs to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging in the plants during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.18.1 Summary of Technical Information in the Application

The applicant states that, in accordance with 10 CFR 50.55a, the steam generator inspections AMP is implemented to meet the requirements of Subsections IWB (Class 1) and IWC (Class 2) of ASME Section XI. The inspection activities are conducted in accordance with the individual ISI plans for each unit. Each plan provides details of the required inspections. One of the aging concerns for the steam generator is cracking of the primary coolant nozzles (which are carbon steel clad with stainless steel), and safe ends (with stainless steel or Inconel buttering). The applicant states that weld areas in the steam generator have the highest stress levels and, consequently, have the highest potential for crack initiation and growth. Cladding is not highly stressed because of post-weld heat treatments along with the vessel. Additional steam generator inspections are carried out according to plant Technical Specifications, guidelines given in NEI 97-06, and Electric Power Research Institute Steam Generator Inspection Guidelines. Augmented inspection activities for steam generator supports and feedwater nozzles are performed and are described in Section B2.2.1 of the LRAs.

3.3.1.18.2 Staff Evaluation

The staff's evaluation of the steam generator inspections 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 defects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of the quality assurance program is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: The scope of the steam generator inspections AMP covers primary and secondary systems. Inspections for the primary side include the following:

- general inspection of the full length of the tubes
- special interest inspections of suspected anomalous indications in accordance with site-specific guidelines
- U-bend areas of anti-vibration bar contact points
- critical area inspections at the U-bend transition of Row 1 tubes
- critical area inspections of the hot leg top-of-tubesheet expansion area
- video inspections for general condition assessment of the tubesheet and tubesheet plugs
- weld inspections
- bolting

Secondary side inspections are focused on:

- inner radii inspections of feedwater and main steam nozzles.
- weld inspections.
- supports.
- routine video inspections of the tubesheet area and the annulus area, as necessary, to detect the presence of deposits, sludge, foreign material, or other general degradation.

The three categories of inspection are listed below as:

Component Type Category	Category	Method
	Class 1	
Pressure-retaining welds in vessels other than reactor vessels	B-B	Volumetric
Welds of nozzles in vessels	B-D	Visual (VT-1 in lieu of volumetric)
Pressure-retaining dissimilar metal welds	B-F	Volumetric/Surface
Pressure-retaining bolting 2-inches and less in diameter	B-G-2	Visual
Steam generator tubing	B-Q	Volumetric
	Class 2	
Pressure-retaining welds in pressure vessels	C-A	Volumetric
Pressure-retaining nozzle welds	C-B	Volumetric/Surface

in vessels

	Component Supports	
Supports	F-A	Visual

The staff found the scope of this program acceptable because the applicant has included all major steam generator components within the scope of the program.

Preventive actions: The applicant states that there are no preventive actions in the steam generator inspections AMP because this AMP is designated as condition monitoring. The staff concurs with this statement.

Parameters monitored or inspected: The applicant states that surface conditions of subcomponents in both the primary and secondary sides of the steam generator are monitored for indications of degradation. Volumetric examinations are also performed for the steam generator tubes and for Section XI IWB and IWC welds. The staff found that the inspection parameters are acceptable because the steam generator components are monitored for indication of degradation.

Detection of aging effects: Aging effects, which include loss of material, cracking, and gross indications of loss of pre-load are stated to be detected by a combination of visual inspections, surface examinations, and volumetric examinations. Inspections for tubing degradation are conducted in accordance with ASME Section XI, Subsection IWB. The staff found that the applicant has proposed acceptable detection techniques which will detect degradation of steam generator components.

Monitoring and trending: In this section of the steam generator inspections AMP, the applicant briefly describes the types of non-destructive tests that are used for the various subcomponent monitoring activities. From the descriptions given, the staff finds these monitoring activities to be acceptable. However, the staff issued an RAI to obtain clarification regarding the trending practices. In response to RAI Item B2.2.18-3, the applicant stated that the results of non-destructive examinations and videotaped inspections are retained and utilized to provide a basis for trending and development of plans for subsequent inspections and anticipatory repairs. The staff finds this approach acceptable because the results of nondestructive examinations will be used to provide basis for trending to provide predictability of the extend of degradation so timely corrective or mitigative actions are possible

Acceptance criteria: The applicant states that acceptance criteria for steam generator subcomponent inspections are provided in ASME Section XI, Subsections IWB 3500 and IWC 3500. Results for steam generator inspections that are outside the scope of ASME Section XI are stated to be dispositioned by the applicant's engineering department. In response to RAI Item B2.2.18-4, the applicant stated that engineering evaluations are performed considering the original design basis of the component. Any corrective actions resulting from the engineering evaluation are implemented through the corrective action system. The staff found the applicant's acceptance criteria acceptable because it uses acceptance criteria included in ASME Code, Section XI.

Operating experience: The applicant states that the Surry 1 steam generators were replaced in 1981 and Surry 2 in 1980. Extensive cumulative inspections in accordance with ASME Section XI and plant technical specifications resulted in less than 1% of the total tubes being plugged in the two steam generators. The North Anna 1 steam generators were replaced in 1993 and the North Anna 2 steam generators were replaced in 1995. One tube in the new steam generators at North Anna Unit 1 was preventively plugged due to an anomalous inspection finding. Another single tube at North Anna 2 was plugged during the 2001 refueling outage because of localized wear at the support plate. The applicant states that these inspection results attest to the excellent performance of the steam generator tubes.

In the steam generator inspections AMP, the applicant notes that there have been no detected flaws in the non-tube subcomponents at North Anna. Some secondary-side flaws were detected in non-tube subcomponents at Surry, which were either repaired or accepted after evaluation. No other problems were reported for the North Anna and Surry steam generator subcomponents.

In response to Information Notice 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds," which states that UT examination of these welds, specified by ASME Section XI, may not be sufficient to differentiate between isolated cracks and inherent geometric conditions, the applicant performed enhanced inspections (MT examination) on the North Anna and Surry girth welds. No degradation indications were found for any of these steam generators. The staff found that the North Anna and Surry operating experience and their reliance on accepted industry inspection methods captured in ASME Section XI, EPRI Guidelines, NEI 97-06, and plant TS confirms the adequacy of the steam generator inspection program to identify flaws in steam generator components.

3.3.1.18.3 FSAR Supplement

The staff reviewed Section A2.2.18 of the UFSAR supplement and found that the description of the applicant's reactor vessel internals inspection program is consistent with Section B2.2.18 of each LRA.

3.3.1.18.4 Conclusions

On the basis of the review of the steam generator inspections program described above, the staff finds that the program can adequately manage the loss of material, cracking, and loss of pre-load for the steam generator subcomponents. Therefore, the staff concludes that the applicant has demonstrated that the above aging effects associated with the steam generator subcomponents that credit this activity will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

3.3.1.19 Work Control Process

The applicant describes its work control process aging management activity in Section B2.2.19 of each LRA. The applicant credits the work control process with managing the potential aging of a wide variety of mechanical systems and selected metallic and nonmetallic elements of structures within the scope of license renewal. The staff reviewed each LRA to determine whether the applicant has demonstrated that the work control process activities will adequately manage the applicable aging effects during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.19.1 Summary of Technical Information in the Application

In Section B2.2.19 of each LRA, the applicant states that performance testing and maintenance activities, both preventive and corrective, are planned and conducted in accordance with the station's work control process. The work control process integrates and coordinates the combined efforts of the applicant's maintenance, engineering, operations, and other support organizations to manage maintenance, predictive analysis, and testing activities. The applicant states that its maintenance activities provide opportunities to visually inspect the surfaces (internal and external) of plant components and adjacent piping. Adjacent piping is primarily the internal piping surface immediately adjacent to a system component accessible through the component for visual inspection. Visual inspections performed through the work control process provide data that can be used to determine the effectiveness of aging management activities to detect the aging effects of cracking, loss of material, gross indications of change of material properties, and separation and cracking/delamination. Performance testing on heat exchangers evaluates the heat transfer capability of the components to determine if heat transfer degradation is occurring. In addition, the applicant states that the work control process also provides opportunities through preventive maintenance sampling (predictive analysis) to collect lubricating oil and engine coolant samples for analysis. Identification of contaminants would provide early indication of an adverse environment that can lead to material degradation.

The applicant cites EPRI Technical Report TR-107514, "Aging-Related Degradation Inspection Methodology and Demonstration," as a basis for using the sampling opportunities of the work control process as an aging management tool. Rather than scheduling specific inspections of components that credit the work control process for aging management, the applicant uses work control opportunities as a means of inspecting passive components during the planned maintenance activities implemented through the work control process. EPRI TR-107514 provides a relationship of required sample size versus sample population size for a 90/90 confidence level that the sample population adequately identifies occurrences of interest, which in this case are the effects of aging. In Section B2.2.19 of each LRA, the applicant listed the number of work control opportunities within material/environment combinations at Surry Power Station from June 1993 to September 2000. The applicant states,

> The selected systems identified in the table represent the range of material/environment combinations that were considered during the aging management review of structures and components. *The results of component behavior for each material/environment combination are valid regardless of the system in which the component exists.* As indicated in the table, the extent of material/environment combinations, and the ample number of work control opportunities that exist, *eliminates the need to schedule specific inspections.* The scope and frequency of the work control process are adequate to detect aging and provide reasonable assurance that the intended functions are maintained [*emphasis added*].

3.3.1.19.2 Staff Evaluation

The staff's evaluation of the work control process 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: The applicant uses the work control process to manage the aging effects of several of the component groups listed in Section 3 of each LRA. Specifically, the work control process manages, either by itself or in conjunction with other AMAs, about 45% of all of the Section 3.3, "Aging Management of Auxiliary Systems," component groups and about 88% of all of the Section 3.4, "Steam and Power Conversion Systems" component groups. In total, about 400 of the component groups subject to an AMR (approximately 200 component groups for each LRA) credit the work control process AMA. In Section B2.2.19 of each LRA, the applicant listed the specific systems that credit the work control process and also provides a more general list of the "sample opportunities" for each system through the application of the work control process. The latter list identifies the work control process sample opportunities for specific material and internal environment combinations for each system. The applicant uses performance testing and maintenance activities, both preventive and corrective, that are scheduled through the work control process to perform and document visual inspections of the internal and external surfaces of the components and adjacent passive components. The applicant states that the scope of the work control process includes (1) visual examinations of the internal and external surfaces of mechanical components and adjacent piping, (2) performance tests of mechanical components and heat exchangers, and (3) routine maintenance sampling of motor lubricating oil and engine coolant.

The staff had several concerns with the scope of the work control process AMA. Through the work control process, the applicant takes credit for the inspection of components that may not be actually examined via this aging management activity. Under the work control process, components within a given system are categorized by their material/environment combination such that the inspection of, for example, a carbon steel component in treated water within the feedwater system is credited by the applicant as being indicative of all carbon steel components in treated water within the feedwater system. The applicant credits the number of sample opportunities provided by the work control process for a given material/environment combination within a system as assurance that the aging effects for the components that credit this AMA are adequately managed. The staff was concerned that with this approach not all of the components that credit the work control process will be directly examined at some time during the period of extended operation. Specifically, the staff was concerned that the similarity of given material/environment combinations, as a justification for not directly inspecting certain components, would result in the inadequate managing of the aging effects for the components that credit the work control process. Also, since the work control process categorizes components by their material/environment combination rather than by their component group designations that are listed in Section 3 of each LRA, the staff was concerned that some component groups that credit the work control process may not be adequately tracked by this AMA. In a supplemental RAI, the staff requested that the applicant confirm that all of the component groups, listed in Section 3 of each LRA, that credit the work control process are covered by the planned maintenance portion (i.e., preventive maintenance, predictive analysis, periodic surveillance) of the work control process such that these components will be periodically inspected during the period of extended operation. In a May 22, 2002 (Serial No. 02-163), response to the staff's RAI, the applicant provided the following information concerning the scope of the work control process:

> The basis for the Work Control Process (WCP) as an aging management activity (AMA), as described in LRA Section B2.2.19, is that all material and environment combinations for component groups that credit the WCP are included within the scope of the WCP AMA. The WCP AMA focus is on material/environment combinations because the materials of construction in conjunction with the environmental stressors associated with the structure or component are the basis for determining applicable aging effects and the management of those aging effects. However, at the staff's request, we have reviewed the systems and material-environment combinations to help the staff determine the completeness of the WCP.
>
> The Work Control Process, as it applies to general aging, uses a number of different types of maintenance activities. The primary intent of this program is to use planned maintenance activities that are performed on a frequency of 3 months to 120 months. The planned work control activities provide opportunities to inspect and monitor the material condition of plant systems, component groups, and the predominant material-environment combinations located throughout the systems that use this AMA to manage general aging. Planned maintenance activities can be categorized into three programmatic categories:
>
> - preventive maintenance activities
> - predictive analysis maintenance activities
> - periodic surveillance testing
>
> The Work Control Process supplements the planned maintenance activities with corrective maintenance activities. Numerous opportunities arise to inspect structures and component groups that are managed by the WCP. In addition to the structures and components that are subject to an AMR, the corrective maintenance activities also provide opportunities for inspecting active and/or short-lived components with the same materials and environments identifying ongoing aging in the components groups subject to aging. Although these corrective maintenance activities are not performed at preplanned locations or at specific frequencies, the Work Control Process AMA requires the applicant to take advantage of every opportunity to ensure aging is being managed. A maintenance history review from 1993 to the present has verified that corrective maintenance has provided ample opportunities to periodically inspect systems, component groups, and material-environment combinations throughout the systems monitored by the Work Control Process.
>
> Although these corrective maintenance activities are performed at random locations with no specific frequencies, statistically the number of opportunities and diverse sampling of systems are reliable for the purpose of aging

management. As the plant ages, maintenance activities are not expected to decline and it is reasonable to assume that the maintenance history is reflective with respect to the numbers and diverse locations of anticipated maintenance for future years. Therefore, corrective maintenance activities will contribute to the management of aging effects such that there is reasonable assurance that intended functions will be maintained.

Along with the planned and corrective maintenance activities, the applicant's Corrective Action System requires an evaluation of aging to ensure that aging is not occurring in other locations with the same material and environment. These evaluations are not limited by system boundaries. Aging identified in a location within a system that cannot be explained by environmental/operational conditions at that specific location will require additional inspections within the same system and other systems with the same material environmental conditions.

Additionally, based on maintenance history reviews and an assessment of the breadth of the planned maintenance performed at the Surry and North Anna stations, when supplemented by the numerous inspection opportunities afforded by corrective maintenance activities and the stringent requirements of the corrective action system, the WCP AMA provides adequate management of aging effects such that there is reasonable assurance that intended functions will be maintained throughout the period of extended operation.

As confirmation that the Work Control Process has inspected representative components from each component group for which WCP is credited to manage the effects of aging, the applicant will perform an audit of inspections actually performed and, if WCP activities are found not to be representative, supplemental inspections will be performed. Two audits of the WCP are anticipated, and each will consist of a review of 10 years of historical data. One audit will be performed prior to 40 years of plant operation, and another will be performed at approximately 50 years of plant operation. Any required supplemental inspections would be completed within 5 years after the audit is performed.

The applicant's response to the staff's RAI is important in establishing that observed degradation of a component will require the inspection of similar components with the same material/environment combination both within and outside the system boundaries. In addition, the work control process will be audited to ensure that "representative components from each component group for which WCP is credited to manage the effects of aging" have been inspected. The applicant states that supplemental inspections will be completed within 5 years of the audit if the work control process activities are found not to be representative of all the component groups that credit this AMA. These additional commitments will need to be included in the UFSAR Supplement for the Work Control Process AMA.

In RAI B2.2.19-1, the staff requested that the applicant withdraw its reference to EPRI Technical Report TR-107514, since this technical report has not been reviewed or approved by the staff. In response, the applicant states that it is revising its work control process activity to eliminate reference to the statistical guidance of EPRI TR-107514. Instead, the applicant provides an extensive summary of the number of inspection opportunities that have occurred during work control activities from June 1993 through August 2001. The staff noted in this summary of inspection opportunities provided by the applicant that several additional systems, in addition to those listed in Section B2.2.19 of each LRA were listed as being part of the work control process AMA. In its response to the staff's inquiry regarding these additional systems, the applicant states:

> The response to RAI B2.2.19-3 included the Work Control Process activities for systems and components that are not listed in LRA Section B2.2.19 as crediting the WCP for managing the effects of aging. A number of additional systems and components were added to the scope of license renewal by the response to RAI 2.1-3, and the WCP was credited for managing aging effects for fire protection system components by the response to RAI B2.2.7-2. Additionally, WCP provides confirmation of the effectiveness of the Chemistry Control Programs for primary systems, secondary systems, and fuel oil, as described in LRA Sections A2.2.19 and B2.2.19. The systems and components for which the chemistry control program are credited for management of aging effects are also included in the response to RAI B2.2.19-3
>
> The basis of the WCP as an AMA, as described in LRA Section B2.2.19, includes the results of work control activities performed on components for which the WCP is not credited to manage aging. These activities are considered in the representative inspections when a material and environment combination is representative of in-scope components. Therefore, the inspection opportunities provided in the response to RAI B2.2.19-3 are relevant to the basis of WCP as an effective AMA, even for systems and components for which the WCP is indirectly credited to manage aging effects.

The applicant's response concerning the additional systems that credit the work control process AMA, as a result of staff RAIs for Section 2 of each LRA, will need to be documented in the UFSAR Supplement for this AMA. In addition, the applicant's removal of references to EPRI TR-107514 will need to be documented in the UFSAR Supplement for the work control process AMA. Also, since the applicant stated that it would audit the inspection activities of the work control process to ensure that all of the component groups that credit this AMA are adequately sampled, the use of inspection results for components that do not credit the work control process as an indication for component groups with a similar material/environment combination is acceptable.

Once these additional commitments, as stated above, are incorporated into the work control process and also into the UFSAR Supplement for the work control AMA, the staff finds that the scope of the work control process is adequate to ensure that the component groups that credit this AMA will be monitored during the period of extended operation.

Preventive actions: The applicant identified the inspection activities as condition monitoring, the testing activities as performance monitoring, and the maintenance activities, performed under the work control process, as mitigative actions. The staff accepts this characterization.

Parameters monitored or inspected: The applicant states that visual inspections of internal and external surfaces are performed for mechanical components and their adjacent piping during the performance of maintenance, in accordance with the work control process, to determine the presence of cracking, loss of material, and gross indications of change in material properties. Visual inspections of structural components are performed to check for cracking, separation and cracking/delamination, change in material properties, and loss of material. Performance testing for various heat exchangers check heat transfer performance parameters for indications of heat transfer degradation. Lubricating oil and engine coolant samples are analyzed to detect contaminants as an indication of an adverse environment that can lead to material degradation. The staff agrees that the parameters monitored or inspected are acceptable because they are directly related to the aging effects to be managed by this program.

Detection of aging effects: The applicant states that cracking, separation and cracking/delamination, loss of material, and gross indications of change in material properties are the aging effects that are monitored by internal and external maintenance inspections for mechanical components and inspections of structural components. Changes in heat transfer capability are monitored through periodic performance testing of heat exchangers. Lubricating oil and engine coolant samples provide indication of an adverse environment that can lead to material degradation.

The applicant provided additional information related to the detection of aging effects in its November 30, 2001, response to RAI B2.2.19-3, the applicant states that visual inspections performed by VT-qualified personnel monitor system aging for cracking, loss of material, and change of material properties. Additionally, the work control process provides visual inspections to supplement the primary, secondary, and fuel oil chemistry control programs. The applicant's maintenance program uses quality maintenance teams (QMTs) to enhance the quality and thoroughness of maintenance activities. The QMTs consist of trained and certified craftsmen who have the authority to perform maintenance and to perform a quality check on the work of other maintenance personnel. QMT personnel are provided technical training, which includes inspector certification and visual testing (VT) certification in accordance with station administrative procedures. Additionally, QMT personnel are required to attend annual retraining and to recertify their VT qualifications every three years.

The applicant also states that the periodic testing monitors for heat transfer degradation of coolers and heat exchangers. Additionally, fluid samples (oil and coolant) are collected for analysis of contaminants and chemical properties. These tests and samples are used to monitor the physical condition of system components in support of aging mitigation programs.

The staff finds that the inspection, testing, and sampling activities described for this AMP are acceptable for detecting the applicable aging effects.

Monitoring and trending: In each LRA Section B2.2.19, the applicant states that a review of maintenance data for the past 7 years at SPS indicated that the inspection opportunities available through the work control process exceeded the minimum number of random samples necessary to obtain a 90/90 confidence level that aging effects would, if present, be identified. Therefore, the applicant believes that sufficient inspection opportunities are available to provide reasonable assurance that systems are adequately monitored.

To demonstrate that the work control process provides sufficient opportunity to adequately manage the applicable aging effects, the staff requested the applicant to provide a summary of its operating experience for the past 7 years for systems and structures that credit the work control process in order to specifically show that the work control process provides sufficient opportunity to examine the different materials and environments so that there is reasonable assurance that the applicable effects of aging will be managed and the intended function will be maintained during the period of extended operation. To demonstrate reasonable assurance, the staff requested the applicant to characterize the type of maintenance as predictive, preventive, or periodic corrective maintenance. In the response to RAI B2.2.19-3, in a letter to the NRC dated November 30, 2001, the applicant provided tables of data to demonstrate that numerous system, component, and material and environment inspection opportunities are available, as verified by the applicant's work order database (June 1993 through August 2001). The applicant concluded that these inspection opportunities provide reasonable assurance that the applicable effects of aging will continue to be managed such that the intended functions will be maintained throughout the period of extended operation. The staff has reviewed the information in these tables, as well as supplemental information provided by the applicant in a letter to the NRC dated May 22, 2002 (Serial No. 02-163). Based on the information provided, the staff has determined that once the provision for auditing the work control process at years 40 and 50 is added to the program, this AMA will provide sufficient monitoring activities for the components that credit this program. The applicant's commitment to audit the work control process is discussed in greater detail in the Scope section above.

Prior to the end of the current operating license term, the applicant committed to implementing changes in the maintenance procedures to provide reasonable assurance that consistent internal inspections will be completed during the process of performing maintenance tasks. In order to understand the intent of this commitment, the staff requested the applicant to explain the type and corresponding purpose of the changes that will be implemented. In the response to RAIs 2.2.19-2 and 3, in a letter to the NRC dated November 30, 2001, the applicant states that the inspection steps are presently included in maintenance procedures, but the level of guidance for the performance of inspections is not consistent. For the period of extended operation, consistency will be provided by changes that are being made to the maintenance procedures. The revised guidance will improve monitoring and trending capability. The additional steps being placed into preventive maintenance and corrective maintenance procedures direct maintenance personnel to visually inspect internal and external surfaces of components being disassembled (including the piping adjacent to these components) to ensure that there are no indications of loss of material (corrosion or wear), cracking, or separation of material. Internal areas also are inspected for sedimentation or corrosion product buildup. The inspection steps direct the maintenance department personnel to notify engineering if any such conditions are found. Since no unique set of acceptance criteria can be established for the myriad situations that arise from inspections of components and structures, the requirement to perform an engineering evaluation of inspection results will ensure that intended functions are maintained. The engineering evaluation determines the appropriate course of action through the applicant's corrective action system in accordance with 10 CFR Part 50, Appendix B. The staff found this response to be an acceptable explanation of the intent of the planned changes to the maintenance procedures.

Acceptance criteria: The acceptance criterion for visual inspections, testing, or sampling is the absence of anomalous indications that are signs of degradation. The staff finds this to be acceptable.

Operating experience: The applicant states that the work control process activities that involve component inspections, performance testing, and maintenance sampling are performed routinely and that the number of inspection opportunities afforded is statistically significant. The applicant reports that the excellent physical condition of all four units indicates successful experience with the implementation of the work control process.

In order to complete its review, the staff requested that the applicant provide additional information regarding operating experience with the existing work control process at North Anna and Surry. In the response to RAI B2.2.19-3, in a letter to the NRC dated November 30, 2001, the applicant described the following four operating experiences as examples to demonstrate the effectiveness of the work control process in identifying age-related concerns, before loss of intended function and making programmatic improvements: (1) loss of material in extraction steam piping, (2) loss of material in service water strainers, (3) loss of material from the main control room chiller condenser, and (4) cracking of the residual heat removal pipe. The staff review of these examples demonstrates the effectiveness of the applicant's work control process and its use of the corrective action system. The applicant states that its history of successful use of work control process at the North Anna and Surry Power Stations demonstrates that the work control process is effective in managing the aging effects of structures, systems, and components.

On the basis of the operating experience described above, the staff concludes that the applicant's aging management activities have been effective in maintaining the intended function of the systems, structures, and commodities within the scope of this evaluation, and can reasonably be expected to do so for the period of extended operation.

3.3.1.19.3 Conclusions

The staff has reviewed the information provided in Section B2.2.19 of Appendix B to each LRA and the summary description of the work control process activities in Section A2.2.19 of the UFSAR Supplement. In addition, the staff considered the applicant's November 30, 2001, response to the staff's RAIs and the applicant's May 22, 2002 (Serial No. 02-163), response to the staff's supplemental RAIs. On the basis of this review and the above evaluation, the staff finds that once the applicant incorporates the commitment to audit the work control process, as discussed above, the effects of aging associated with the component groups that credit the work control process will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.3.1.19.4 FSAR Supplement

The staff reviewed Section A2.2.19 of the UFSAR Supplement and found that the description of the applicant's work control process activities is consistent with Section B2.2.19 of each LRA. However, the staff identified six areas that UFSAR supplements needed revision. These areas have been explained below.

1. In Section B2.2.19 of each LRA the applicant states: "As a Licensee Follow-up Action, changes will be implemented into the maintenance procedures to provide reasonable assurance that consistent internal inspections will be completed during the process of performing maintenance tasks. These changes will be implemented prior to the end of the current operating license term." This item is included in each LRA Table B4.0-1 but is not discussed in Section A2.2.19 of the UFSAR Supplement. The staff asked the applicant to add this item into UFSAR supplements.

2. In response to RAIs 2.1-3, B2.2.7-2, and B2.2.19-3, a number of additional systems and components were added to the scope of the work control process. The staff asked the applicant to list these added systems to the scope of the work control process in the UFSAR supplements for the Surry and North Anna Power Stations.

3. In response to RAIs 2.1-3, B2.2.7-2, and B2.2.19-3, the applicant committed to audit the work control process at years 40 and 50 and to perform supplemental inspections, as necessary, within 5 years of the audit. The staff asked the applicant to revise the UFSAR supplements for the work control process AMA to include this commitment.

4. In response to RAIs 2.1-3, B2.2.7-2, and B2.2.19-3, the applicant committed to inspect similar material/environment components, both within the system and outside the system, if aging identified in a location within a system cannot be explained by environmental/operational conditions at that specific location. The staff asked the applicant to revise the UFSAR supplements for the work control process AMA to include this commitment.

5. In response to RAIs 2.1-3, B2.2.7-2, and B2.2.19-3, the applicant committed to remove references to EPRI TR-107514 from the work control process description. The staff requested the applicant to revise the UFSAR supplements accordingly.

6. Finally, in Section A2.2.19 of each LRA included two items related to "water treeing." Water treeing is a degradation and long-term failure phenomenon that has been documented for medium-voltage electrical cable with certain extruded polyethylene and EPRI insulations. Similar information was not included in Section B2.2.19 of the LRA. In the SER with open items issued in June 2002, the staff asked the applicant to revise the UFSAR supplements to incorporate requested information.

In response to this confirmatory action (3.3.1.19-1), in its letter dated July 25, 2002, the applicant stated:

1. The Licensee Follow-up Action for changes to maintenance procedures to assure consistent internal inspections has been added to Section 18.2.19 of the UFSAR Supplement. The applicant has completed this action.

2. The systems and components originally identified in the LRAs for which the work control process was credited were not identified in the proposed UFSAR Supplement provided as Appendix A to the LRAs. The systems identified as expanded scope or a new scoped-in systems in response to RAI 2.1-3 were documented in a license renewal technical report. This document will be one of the basis documents used in the periodic auditing of the scope of the work control process as committed to in RAI Response B2.2.19-3. The commitment to audit has been incorporated into the UFSAR Supplement. (Reference Item #3 below.) The Response to RAI B2.2.19-3 also credited the work control process for the fire protection system. This commitment has also been incorporated into the UFSAR Supplement. (Refer to Confirmatory Action 3.3.1.7-2.) Therefore, no additional revision to the UFSAR supplement is necessary to address this issue.

3. RAI responses made a commitment to audit the work control process at years 40 and 50 and to perform supplemental inspections, as necessary, within 5 years. This commitment has been incorporated into Section 18.2.19 of the UFSAR Supplement. The audit will ensure that all systems and components for which the work control process was credited, including all systems identified in RAI responses, will be represented in the program. The applicant has completed this action.

4. RAI responses made a commitment that if aging identified in a location within a system cannot be explained by environmental/operational conditions at that location, an inspection of similar material/environmental components, both within and outside the system, would be performed. This commitment has been incorporated into Section 18.2.19 of the UFSAR Supplement. The applicant has completed this action.

5. RAI responses withdrew the use and reference to EPRI report TR-107514. No reference to this report was made in the proposed UFSAR Supplement (Appendix A) which accompanied the LRAs. Therefore, no revision to the UFSAR Supplement is necessary. No additional action is required.

6. The USFAR Supplement has been revised to remove the "boxed areas" (North Anna specific info) for "water treeing" from the Work Control Process AMA in Section 18.2.19. However, water treeing is addressed in Section18.1.4 of the UFSAR Supplement, "Non-EQ Cable Monitoring program." The applicant has completed this action.

Since the applicant has completed these actions, the staff considers confirmatory action 3.3.1.19-1 closed.

3.3.2 Quality Assurance Program

The NRC staff has reviewed each LRA's Section 2.0 of Appendix B, "Aging Management Activities," in accordance with 10 CFR 54.21(a)(3) and 10 CFR 54.21(d). In Section 2.0 of Appendix B to each LRA, the applicant describes its quality assurance program information with respect to the various aging management programs. The staff's evaluation of the aging management programs focused on how the program manages aging effects through the effective incorporation of the following 10 elements: program scope, preventative actions, parameters monitored or inspected, detection of aging effect, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. 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.

Summary of Technical Information in Application

The applicant stated that the quality assurance program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Section A.2 of the Standard Review Plan for License Renewal. The quality assurance program includes the elements of corrective action, confirmation process, and administrative controls. These elements are applicable to the safety-related and non-safety-related structures, systems, and components that are within the scope of license renewal.

For each program described in Section 2.0 of Appendix B to each LRA, the applicant provides a general description of the corrective actions, administrative controls, and confirmation process common to all aging management programs for SSCs within the scope of license renewal.

The applicant's programs and activities that are credited with managing the effects of aging can be divided into new and existing programs. As described in Section 2.0 of Appendix B to each 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.

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 management programs.

For all of the aging management programs, three attributes (corrective actions, confirmation process, and administrative controls) are specifically addressed by reference to the applicant's quality assurance programs. However, Section 2.0 of Appendix B of each LRA did not specifically describe in detail how the quality assurance programs address the three elements. During the scoping and screening methodology audit conducted on September 10-14, 2001, the NRC staff reviewed the applicant's implementation of the corrective actions, administrative controls, and confirmation process described in Section 2.0 of Appendix B of each LRA. During the audit, the applicant stated that the attributes of corrective action, confirmation process, and document control were developed and are integral to the site quality assurance programs. The staff confirmed that the applicant credited this process for both the safety-related and non-safety-related SSCs within the scope of license renewal. In addition the staff verified that the definitions for each of the attributes of the AMPs were consistent with those definitions in Section A.2 of the SRP for Review of License Renewal Applications. In a letter dated October 22, 2001, the NRC staff requested that the applicant provide a description of how the quality assurance program specifically addresses the three elements consistent with the staff's understanding as a result of the audit discussions. In response to that request, the applicant further described the three elements in a letter dated January 16, 2002. The applicant stated that the corrective actions for conditions that are adverse to quality are performed in accordance with the corrective action system as part of the quality assurance program. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The corrective action system identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence. With respect to administrative controls, the applicant stated that the administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the quality assurance program. For the confirmation process attribute, the applicant states that the confirmation process is integral to the corrective action system. Evaluation of post-maintenance conditions that occur as a result of required repairs or replacements, including inspections and tests, where appropriate, provide reasonable assurance that required repairs or replacements have been satisfactorily implemented and therefore reasonable assurance that the corrective actions have been satisfactorily implemented. Additionally, for those programs where sampling and testing on a periodic basis is used to provide reasonable assurance that parameters remain within acceptable limits, the confirmation process requires followup sampling and testing to confirm the completeness of any corrective actions which may need to be taken.

Based on the information provided in each LRA, as supplemented by the applicant's January 16, 2002, response to the staff's RAI, 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 the aging management programs for SSCs within the scope of license renewal are subject to the requirements of the applicant's quality assurance program.

Section A2.0, Programs and Activities, 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 18, which is also included in Appendix A to each 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 attributes of aging management programs, as defined in NEI 95-10 and SRP-LR, such as inspections and techniques used to identify aging effects. The quality assurance programs, with respect to three attributes of the AMPs (corrective actions, confirmation process, and administrative controls), are briefly described in the UFSAR supplement. However, the applicant has provided a more detailed description of the technical and quality assurance attributes in Appendix B to each LRA.

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 draft 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 2.0 of Appendix B to each LRA. The staff has verified that the applicant did expand the scope of quality assurance program to include both safety-related and non safety-related SSCs within the scope of license renewal. Therefore, committing to the applicant's quality assurance program for all aging management programs for safety- and non-safety-related SSCs within the scope of license renewal is an acceptable approach to meeting Branch Technical Position IQMB-1.

Conclusion

The staff finds that the quality assurance attributes are consistent with 10 CFR 54.21(a)(3). Therefore, the applicant's quality assurance description for its aging management programs is acceptable. The staff finds that the applicant's UFSAR Chapter 18 supplement and its January 16, 2002, response to the staff's RAI provides a sufficient description of the quality assurance programs and attributes and activities for managing the effects of aging.

3.3.3 Time-limited Aging Analyses (TLAA) Support Activities

3.3.3.1 Environmental Qualification Program

In the LRAs, Section B3.1, "Environmental Qualification Program," the applicant describes the aging management activities used to manage aging associated with the environmentally qualified equipment that is within the scope of license renewal and subject to an AMR. This program is consistent with the requirements of 10 CFR 50.49, and will be continued throughout the period of extended operation. In addition, the applicant provides a summary description of the environmental qualification (EQ) program in Appendix A of each LRA, the "UFSAR supplement," Section B2.1.

3.3.3.1.1 Summary of Technical Information in the Application

In each LRA Section 4.4, the applicant identified the NAS 1/2 and the SPS 1/2 10 CFR 50.49 Environmental Qualification (EQ) Program as a Time-Limited Aging Analyses (TLAA) in accordance with 10 CFR 54.3 and 54.21(c) for the purpose of license renewal. To meet the requirements of 10 CFR 54.21(c)(1), the applicant chose option iii ("to demonstrate that the effects of aging on the intended functions will be adequately managed for the period of extended operation") using its EQ program to manage the effects of aging. In Section B3.1 of each LRA, the applicant describes its EQ program using the 10 elements of an effective aging management program described in the standard review plan. The applicant states that the purpose of the EQ program is to provide reasonable assurance that the effects of aging will be managed so that the intended function will be maintained consistent with the CLB during the period of extended operation for the EQ equipment that are considered TLAAs and within the scope of license renewal. The applicant further states that it provides this reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification is adequately managed now and for the period of extended operation. In addition, qualification records will be maintained for all equipment subjected to the EQ rule, and the qualification process will be used to verify that the EQ components are capable of performing its safety function when subjected to various postulated environmental conditions.

The environmental conditions and the resulting aging effects managed by the EQ program include the aging resulting from the expected ranges of temperature, pressure, humidity, radiation, and accident conditions such as chemical spray and submergence.

The applicant identified the SSCs that are managed by the EQ Program to include safety-related equipment, non-safety-related electrical equipment whose failure could prevent accomplishments of safety functions and certain post-accident monitoring equipment as described in Regulatory Guide 1.97. However, only those EQ components that are within the scope of license renewal and have a qualified life of greater than 40 years are considered long-lived and, therefore, are within the scope of the EQ program for the purpose of TLAAs for license renewal. Components with a qualified lifetime of less than 40 years are included in a periodic replacement program, and are not considered TLAAs.

3.3.3.1.2 Staff Evaluation

The staff's evaluation of the NAS 1/2 and the SPS 1/2 EQ program focused on how the applicant demonstrated that the program can be used to manage the applicable aging effect through incorporation of the 10 elements of an effective aging management program as described in the standard review plan: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. Because the applicant has credited its 10 CFR Part 50, Appendix B program for the implementation of the corrective actions, confirmation process, and administrative controls, the following staff evaluation will only address the remaining seven elements. The staff's evaluation of EQ program components that are TLAAs for the purpose of license renewal is provided in Section 4.4 of this SER. The staff's evaluation of the applicable aging effects are provided in Section 3.3.3.1 of this SER. The following is the staff's evaluation of each of the seven elements for the EQ equipment as submitted by the applicant in Section B3.1 of each LRA to fulfill the requirements of 10 CFR 54.21(c)(1)(iii)

Program scope: As previously stated, the applicant credits the EQ program activities with managing aging of safety-related equipment, non-safety-related electrical equipment whose failure could prevent accomplishments of safety functions, and certain post-accident monitoring equipment as described in Regulatory Guide 1.97 EQ components that are within the scope of license renewal and that have a qualified life of greater than 40 years. Components with a qualified lifetime of less than 40 years are included in a periodic replacement program, and are not considered TLAAs. In addition, the applicant states that the EQ program manages aging resulting from the expected ranges of temperature, pressure, humidity, radiation, and accident conditions such as chemical spray and submergence. The staff's evaluation of the scope of the program is further evaluated below, under other related program elements. However, the staff's evaluation verified that the scope of the applicant's program included the long-lived EQ components required under 10 CFR 50.49 and has no concerns with the applicant not including those components that are included within a periodic replacement program and is, therefore, acceptable.

Preventive actions: The applicant states that the component that have been determined by EQ evaluation to have age-related limitations or restrictions are refurbished, re-qualified, or replaced prior to exceeding its qualified life, and becoming incapable of performing its intended functions. The staff agrees that refurbishing, re-qualifying, or replacing a component prior to exceeding that component's qualified life are preventive actions. This approach is consistent with the requirements of 10 CFR 50.49 and 10 CFR 54.21(c)(1) and, therefore acceptable.

Parameters monitored or inspected: The applicant states that the service histories for EQ components are monitored by the preventive maintenance program to reasonably assure that the components are refurbished, re-qualified, or replaced prior to reaching the end of their established qualified lifetime. The use of preventive maintenance activities to identify the need to review the environmental qualifications of EQ components with sufficient time to refurbish, re-qualify, or replace a component prior to exceeding its qualified life are consistent with the requirements of 10 CFR 50.49 and 10 CFR 54.21(c)(1) and, therefore acceptable to the staff.

Detection of aging effects: The applicant states that EQ program is used to manage aging resulting from the expected ranges of temperature, pressure, humidity, radiation, and accident conditions such as chemical spray and submergence through the use of environmental qualification calculations. Therefore, the EQ program is not used to detect any specific ongoing aging for the purpose of TLAAs and, therefore, this program element is not applicable to the EQ program for TLAAs. The staff recognizes that consistent with 10 CFR 50.49, the EQ program is not used to detect ongoing aging. Therefore, the staff found the applicant's response acceptable.

Monitoring and trending: The EQ Program involves monitoring the installed time of EQ components, comparing this duration to the established qualified lifetime for the component, and providing reasonable assurance that refurbishment, re-qualification, or replacement occurs prior reaching the qualified lifetime limit. Monitoring the installed time and the established qualified life of each EQ component is consistent with the requirements of 10 CFR 50.49 and 10 CFR 54.21(c)(1) and is, therefore, acceptable to the staff. The applicant did not identify any trending activities, and the staff does not see the need for trending in this application.

Acceptance criteria: The applicant identified that the acceptance criteria for EQ components is not to let the installed time exceed the qualified life. The applicant states that EQ components must be refurbished, re-qualified, or replaced prior to reaching the end of their established qualified lifetime. This acceptance criteria is consistent with the requirements of 10 CFR 50.49 and 10 CFR 54.21(c)(1) and is, therefore, acceptable to the staff.

Operating experience: The applicant states that the EQ program has been effective in maintaining the qualified life of EQ components consistent with the EQ requirements of 10 CFR 50.49 in the past. This past success provides reasonable assurance that EQ program will continue to ensure the following: 1) maintain the qualification documentation reviews for affected electrical components, 2) evaluate the qualified lifetime for affected components, and 3) provide for equipment refurbishment, re-qualification, or replacement prior to the expiration of the qualified lifetime. The preventive maintenance, incorporation of relevant industry information and experience, and implementation of corrective actions when necessary have been successful in maintaining the qualification of electrical equipment and will continue into the period of extended operation. On the basis of this operating experience, the staff concludes that the EQ program can continue to be effective in maintaining the intended function of EQ components that are qualified for the current operating term, and can continue to do so for the period of extended operation.

3.3.3.1.3 Conclusion

The staff has reviewed the information provided in each LRA, Section B3.1, "Environmental Qualification Program," and the summary description of the EQ program provided by the applicant in Appendix A, the "UFSAR supplement," Section A3.1. The staff has also evaluated the scope of EQ components that meet the requirements of 10 CFR 54.3 and 54.21(c)(1), and the associated AMR of these components, and documented these evaluation separately in Sections 2.5 and 3.3.3.1 of this SER, respectively. On the basis of the review of this information and the above evaluation, the staff finds that the applicant has demonstrated that the effects of aging on the intended functions of the EQ components within the scope of this review will be adequately managed for the period of extended operation.

3.3.3.1.4 FSAR Supplement

The staff reviewed the FSAR supplement and determined that it provides a sufficient summary description of the EQ program to satisfy the requirements of 10 CFR 54.21(d).

3.3.3.2 Transient Cycle Counting Program

3.3.3.2.1 Summary of Technical Information in the Application

The applicant described its Transient Cycle Counting Program (TCCP) in Section B3.2 of the NAS and SPS LRAs. The TCCP is designed to track cyclic and transient occurrences to ensure that reactor coolant pressure boundary components will remain within ASME, Section III fatigue limits.

3.3.3.2.2 Staff Evaluation

The staff's evaluation of the TCCP focused on how the program manages fatigue through effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, corrective actions, confirmation process, administrative controls, and operating experience.

Program scope: The scope of the TCCP at both stations includes reactor coolant pressure boundary components for which the design analysis assumes a specific number of transients for fatigue. The staff considers the scope of the TCCP, which includes reactor coolant pressure boundary components with fatigue analyses, to be acceptable.

Preventive and mitigative actions: The applicant indicated that the TCCP is mitigative because it provides reasonable assurance of compliance with design assumptions for NAS and SPS during the lifetime of the plants. The staff did not identify the need for any additional preventive or mitigative actions.

Parameters inspected or monitored: The program records the number of the following normal and upset operational transients for NAS and SPS:

- heatup/cooldown
- step load increase/decrease of 10%
- large load reduction of 50%
- loss of load > 15%
- loss of flow in one loop
- full-power reactor trip
- inadvertent auxiliary pressurizer spray
- loss of AC power

The NAS TCCP includes the following additional transients:

- inadvertent safety injection
- normal charging and letdown return to service
- charging trip with delayed return to service

Section 4.3 of this SER contains a discussion of the transients that are monitored by the TCCP. The staff considers the monitoring of these transients at NAS and SPS is appropriate because the objective of the program is to provide assurance that the design fatigue analyses remain valid.

Detection of aging effects: The program monitors the number of design transients at NAS and SPS used in the fatigue analysis of components. This provides assurance that the fatigue analyses of record remain valid during the period of extended operation. The staff finds this monitoring appropriate.

Monitoring and trending: According to the applicant, the number of transient cycles is updated quarterly for NAS and SPS for comparison with the design limit. As discussed for the corrective action element, the applicant intends to initiate corrective actions if the number of transient cycles approaches the number assumed in the analysis. The staff finds that the applicant's quarterly updating is sufficient to allow for timely corrective action. Therefore, the staff finds this program element acceptable.

Acceptance criteria: The acceptance criteria are the magnitude and number of cycles of each transient assumed in the design analyses for NAS and SPS components. By meeting these criteria, the applicant provides assurance that the plants will stay within the design limits. Therefore, the staff considers these criteria acceptable.

Corrective actions: The applicant indicated that, if the number of transient cycles approaches the number assumed for the plant design, further analysis will be performed to account for the magnitude of these cycles. The applicant indicated that, if warranted, component repair or replacement would be initiated. A further description of the staff review of the corrective action program is contained in Section 3.3.2 of this SER.

Confirmation process: The applicant indicated that a formal log is maintained to record transient cycles and that periodic reviews of the logged information are performed. A further description of the staff review of the confirmation process is contained in Section 3.3.2 of this SER.

Administrative controls: The applicant indicated that implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process. A further description of the staff review of the administrative controls is contained in Section 3.3.2 of this SER.

Operating experience: The applicant's program tracks design transients to provide assurance that the design transient limits are not exceeded during the period of extended operation. The applicant indicated that, based on operating experience at NAS, it has identified charging line flow isolation events for further monitoring. The applicant has instrumented the charging line nozzle to evaluate the impact of these transients. In response to RAI 4.3-1, the applicant indicated that temperature data from the existing plant instrumentation is being collected to validate the NAS design transients. The staff finds that the applicant has adequately addressed operating experience.

3.3.3.2.3 FSAR Supplement

The staff reviewed the FSAR supplement and determined that it provides a sufficient summary description of the TCCP to satisfy the requirements of 10 CFR 54.21(d).

3.3.3.2.4 Conclusions

The staff has reviewed the information in LRA Section B3.2 regarding the TCCP. The applicant references the TCCP in its discussion of the fatigue TLAAs as a method to manage the fatigue usage of reactor coolant pressure boundary components. The staff considers the applicant's program, which counts plant transients to ensure that the number does not exceed the number assumed in the fatigue design of reactor coolant pressure boundary components, to be an acceptable program for managing the fatigue TLAA during the period of extended operation.

The staff concludes that the TCCP will adequately manage thermal fatigue of RCS components for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.4 New Aging Management Programs and Activities

3.3.4.1 Buried Piping and Valve Inspection Activities

The applicant describes its buried piping and valve inspection activities in Section B2.1.1 of each LRA. The applicant credits this inspection activity with managing potential aging on the exterior surface of buried piping and valves that are within the scope of license renewal. The staff reviewed each LRA to determine whether the applicant has demonstrated that buried piping and valve inspection activities will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21 (a)(3).

3.3.4.1.1 Summary of Technical Information in the Application

In Section B2.1.1of each LRA, the applicant identified the buried piping and valve inspection activities as a new initiative that will be used for managing the aging effects of loss of material on external surfaces of buried components of the systems and structures that credit this program. In addition, in the SPS LRA, the applicant credits these inspection activities for managing the aging effect of change in material properties for some piping materials that are used at SPS but not used at NAS.

Prior to the period of extended operation, the applicant stated that it would use the newly developed inspection activities to confirm the integrity of buried piping and valves due to the existence of aging effects requiring management. These activities include examining representative samples of buried piping and valves consisting of various materials, with various protective measures, in different soil conditions. The applicant will perform one-time inspections of representative valves and a sample length (i.e., several feet) of piping for each combination of material and burial condition. An engineering evaluation of the inspected components will be performed to determine the need for future actions, if any. The applicant states that the development and implementation of these inspection activities will be completed prior to entering into the period of extended operation.

The applicant stated that it would implement the buried piping and valve inspection activities for the buried portions of the following systems that are subject to an AMR at both NAS and SPS:

- emergency diesel generator system
- fire protection
- safety injection
- service water
- containment/quench spray

The buried piping and valve inspection activities will be implemented on the buried portions of the following systems that are subject to an AMR at North Anna (only):

- recirculation spray
- residual heat removal

The buried piping and valve inspection activities will be implemented on the buried portions of the following systems that are subject to an AMR at Surry (only):

- condensate
- feedwater
- security

The buried piping and valve inspection activities will also be implemented on the buried flood wall carbon steel culvert west of the turbine building at North Anna (only).

The inspections will be performed on representative samples of SCs with the following material/burial condition combinations:

- carbon steel, coated (includes cast iron)
- carbon steel, coated, wrapped
- stainless steel, coated, wrapped
- carbon steel, coated, wrapped, with cathodic protection (NAS 1/2 only)
- copper-nickel, uncoated (Surry only - not initially identified in Section B2.1.1 of neither LRA, but confirmed In its response to RAI B2.1.1-1 in a letter to the NRC dated September 27, 2001)

3.3.4.1.2 Staff Evaluation

The staff's evaluation of the buried piping and valve inspection activities 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: In Section B2.1.1 of each LRA, the applicant identified the systems, structures, and material/burial combinations of the SCs that are within the scope of license renewal and subject to an AMR, and that credit the buried piping and valve inspection activities. In a letter to the staff dated September 27, 2001, the applicant responded to staff RAI B2.1.1-1 asking the applicant to identify if any copper-nickel alloy materials in a buried environment is within the scope of license renewal and subject to an AMR. The applicant responded that copper-nickel (uncoated) is a buried material used at SPS that was administratively overlooked in the LRA.

The staff requested a clarification of whether the buried pipe inspection program includes periodic inspections when components in the applicable systems are excavated for any reason, and how often the applicant expects these inspections to take place. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant stated that the work control process program includes the inspection of components when they are excavated. However, the applicant stated that neither NAS nor SPS has needed to excavate buried components very often in the past. Therefore, the applicant's program will ensure that a sample of each component, based on material and environment, will be excavated at least once prior to the period of extended operation to ensure adequate aging management prior to entering the period of extended operation.

The staff requested the applicant to clarify the criteria that will be used to select the representative samples of buried pipes. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant indicated that the representative samples for buried pipes will be solely based on the material of the buried components and the burial conditions of each component. The applicant also confirmed that there is no significant difference in the soil conditions at the different sites that would make a difference in the aging management activities needed at each site.

The staff finds the scope of this AMP acceptable because the scope of the program and the applicant's responses to the staff are comprehensive in that they include the systems and structures of the exterior surface of buried piping and valves that are subject to an AMR.

Preventive actions: The applicant identified that the external surfaces of buried piping and valves typically have been coated, wrapped with a protective material, and/or protected with a cathodic protection system during installation to prevent buried components from being exposed to a potentially aggressive soil environment. Although these preventive measures are identified as part of the applicant's description of burial conditions, the applicant does not consider the actual inspection activities as preventive actions. The staff considers inspection activities as a means of detecting, not preventing aging, and, therefore, agrees that there are no preventive actions associated with the buried piping and valve inspection activities.

Parameters monitored or inspected: In Section B.2.1.1 of each LRA, the applicant states that the external surfaces of the buried components that will be sampled as part of this aging management activity will be inspected for evidence of degradation such as damaged coating and/or wrap and aging. Visual inspections and nondestructive examination (NDE) would be used to identify a loss of material due to excessive corrosion and increased susceptibility to loss of material as indicated by damaged coating and/or wrap. Visual inspection would also be used to identify changes in material properties of 90/10 copper-nickel alloy components. Because visual inspection and NDE can detect damage to protective coating and wrap, ongoing corrosion, and discoloration from changes in material properties, and is consistent with current industry practice, the use of these inspection techniques on excavated components is acceptable to the staff.

Detection of aging effects: The applicant states that the external condition of buried components will be examined using a one-time inspection performed in accordance with the Work Control Process. The one-time inspection will be performed on representative samples of each of the materials and burial conditions (independent of the system) that are identified in Section B2.1.1 of each LRA. The one-time inspection will be performed between year 30 and the end of the current operating license term. Because the concern of aging is dependent on the materials and burial conditions, and not on system boundaries, the staff finds that it is not necessary for the applicant to sample based on system boundaries.

In addition to the information provided in each LRA, the applicant responded to a staff's request for additional information in a letter to the NRC dated September 27, 2001. In its response, the applicant informed the staff that ongoing maintenance activities for buried components predominantly involve the excavation of valves, including visual inspections of the internal and external surfaces of adjacent piping. These tasks occur at an average frequency of three times per year (primarily on the fire protection system) at both Surry and North Anna, and provide the opportunity to examine the integrity of the components, coatings, and wraps on buried piping and valves. These maintenance activities and practices are expected to continue into the period of extended operation at a similar frequency of occurrence, enhancing the aging management of the buried piping and valves that are within the scope of license renewal throughout the period of extended operation.

The applicant states that visual inspections will be used to detect cracking of protective coatings and loss of material from protective coatings or the substrate material. For Surry, visual inspections will also be used to detect gross indications of change in material properties for the copper-nickel pipe. The staff requested a clarification as to the use of visual inspections to detect gross indications of changes in material properties for copper-nickel components. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant stated that copper-nickel piping is primarily used underground and in air environments with intermittent wetted conditions in service water lines that connect to chillers that are within the scope of license renewal. The applicant stated that it does not expect to see any changes in material properties (such as selective leaching) in the buried copper-nickel piping, and that the changes in material properties of the service water lines to the chillers will be the lead indication of any potential aging. Because the service water lines to the chillers are available for visual inspections, the applicant will be able to observe any changes in material properties. In a September 27, 2001, response to RAI B2.1.1-2 to NRC, the applicant further states that a 90/10 alloy of copper-nickel is used as buried piping at Surry and that operating experience confirms that the 90/10 alloy is much less susceptible to selective leaching than is aluminum-bronze alloy.

The buried components include cast iron and copper-nickel material. Since these materials are susceptible to selective leaching, the staff requested that the applicant explain why the program does not include hardness measurements of a selected set of components to determine whether loss of material due to selected leaching is not occurring for the period of extended operation. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant stated that the buried piping inspection activities are intended to detect any damage to the protective coating that would allow damage to the buried piping. If damage to the coating is found, the applicant would then take the appropriate steps, including hardness testing when appropriate, to identify any damage to the pipe as a result of the piping being exposed to underground conditions.

The use of a one-time inspection prior to, and the ongoing inspection activities during the period of extended operation is consistent with industry practice, and is considered by the staff to be a reasonable means of detecting aging before the loss of intended function. The staff agrees that this one-time inspection can be performed just before the end of the license for North Anna and Surry because no problems have been identified with prior operating experience and any mechanisms of degradation would be slow acting.

Monitoring and trending: Inspection results are documented in accordance with the applicant's Work Control Process that is within the scope of the applicant's 10 CFR Part 50, Appendix B, quality assurance program. If additional NDE is performed, anomalous indications of degradation will be documented in NDE reports that also are maintained in accordance with the applicant's quality assurance program. No trending is performed for the buried piping and valve inspection activities, and none is required by current industry practice for visual and NDE inspection activities in similar applications. The monitoring activities credited that are controlled by the applicant's quality assurance program and are consistent with current industry practices and, therefore, are acceptable to the staff.

In the North Anna LRA, the applicant states that some of the buried piping uses cathodic protection. The staff recognizes that monitoring cathodic current is a good means of identifying potential damage to coating material of buried components and asked the applicant why it did not take advantage of this indication in its aging management activities. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant explained that its current aging management activities are adequate as described in each LRA. However, the applicant stated that it monitors cathodic protection current along with pipe-to-soil potential current as a means of identifying degradation of buried component coating but do not take credit for these activities as aging management activities. The staff found this response acceptable because monitoring cathodic protection is not required. Furthermore, the applicant's use of the one-time inspection, prior to and the ongoing inspection activities during the period of extended operation, is consistent with industry practice.

Acceptance criteria: In Section B2.1.1 of each LRA, the applicant states that the acceptance criterion for the visual inspections discussed above is the absence of anomalous indications of degradation. A trained coatings/materials engineer will perform the inspections and determine whether the observed condition is acceptable. In addition, the applicable NDE acceptance criterion is the absence of any anomalies that is an indication of degradation, as well. Any indication of degradation that is adverse to quality will be entered into the applicant's corrective action system. Because degradation to wrap, coating, and component surfaces is detectable by visual inspections and NDE performed by trained individuals, and this approach is consistent with current industry practices, the acceptance criteria are acceptable to the staff.

Operating experience: In Section B2.1.1 of each LRA, the applicant states that significant external degradation of buried piping due to the aging effects requiring management has not been found. In a September 27, 2001, response to RAI B2.1.1-3, the applicant further describes its operating experience. Maintenance activities for buried carbon steel (including cast iron) piping and valves have principally involved fire protection components at Surry and North Anna Power Stations. The service water system at North Anna also includes buried carbon steel components, which are coated or wrapped similarly to fire protection components to prevent water intrusion that could lead to loss of material from the metallic surfaces. Maintenance activities for buried components predominantly involve the excavation of valves; however, visual inspections of the internal and external surfaces of adjacent piping are also performed. These tasks occur at an average frequency of three times per year at both Surry and North Anna, and provide the opportunity to examine the integrity of wrappings and coatings and the material condition of the valves and adjacent piping. A review of operating experience has identified failure of buried piping; however, these failures were not attributed to aging or failure of coating material.

On the basis of this operating experience resulting from the implementation of the work control process described above, and the added aging management activities (one-time inspections) that will be implemented by the buried piping and valves inspection activities, the staff concludes that the aging management activities described above have been effective at maintaining the intended function of the buried components within the scope of this evaluation, and can reasonably be expected to do so for the period of extended operation.

3.3.4.1.3 Conclusions

The staff has reviewed the information provided in Section B2.1.1 of each LRA and the summary description of the buried piping and valve inspection activities in Section A2.1.1 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs provided in a letter to the NRC dated September 27, 2001 and information provided in a letter dated May 22, 2002 (Serial No. 02-277). On the basis of this review and the above evaluation, the staff finds that there is reasonable assurance that the applicant has demonstrated that the effect of aging associated with the buried piping and valves within the scope of this evaluation will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.4.1.4 FSAR Supplement

The staff reviewed Section A2.1.1 of the UFSAR supplement and found that the description of the applicant's buried piping and valve inspection activities is consistent with Section B2.1.1 of each LRA and that no changes were needed.

3.3.4.2 Infrequently Accessed Area Inspection Activities

The applicant describes its infrequently accessed area inspection activities in Section B2.1.2 of each LRA. The applicant credits this inspection activity with managing the potential aging of structures and components that are within the scope of license renewal but not readily accessible because of physical and environmental limitations. The inspection activity monitors and assesses the condition of infrequently accessed structures and components affected by aging, which may cause loss of material. The staff reviewed Section B2.1.2 of each LRA to determine whether the applicant has demonstrated that infrequently accessed area inspection activities will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.4.2.1 Summary of Technical Information in the Application

In Section B2.1.2 of each LRA, the applicant states that the purpose of the infrequently accessed area inspection activities is to provide reasonable assurance that the effects of aging will be managed so that the intended functions of equipment and components, which are not readily accessible will be maintained consistent with the CLB during the period of extended operation. The applicant identified these inspection activities as a new initiative that will be used to manage the aging effects of loss of material on the external surfaces of the infrequently accessed components that are subject to an AMR and credit this program. These activities are one-time inspections prior to the end of the current license period to assess the aging of the components located in areas not routinely accessed due to high radiation, high temperature, confined spaces, location behind security or missile barriers, or normally flooded conditions. The applicant will perform an engineering evaluation of the inspection results to determine the potential need for any subsequent inspections.

The applicant stated that it would implement the inspection activities for the infrequently accessed portions of the following systems, structures and commodities that are subject to an AMR and credit this program at NAS and SPS:

- feedwater (NAS 1/2 only)
- recirculation spray
- safety injection
- service water
- neutron shield tank cooling
- auxiliary feedwater tunnel (NAS 1/2 only)
- containment
- service water expansion joint enclosure (NAS 1/2 only)
- service water tie-in vault (NAS 1/2 only)
- yard valve pit (NAS 1/2 only)
- NSSS equipment supports
- general structural supports

The applicant identified the infrequently accessed areas to include representative regions and equipment in the following areas:

- reactor containment sump
- reactor containment keyway (including the integrity of the neutron shield tank)
- cover for containment dome plug
- volume control tank cubicle
- black battery building (SPS 1/2 only)
- cable-spreading rooms, cable tunnels, upper areas of emergency switchgear rooms
- new fuel storage area
- auxiliary building filter and ion exchanger cubicles
- tunnel from turbine building to auxiliary building

In addition, the following infrequently accessed areas are specific to North Anna:

- emergency diesel generator exhaust bunkers
- service water (SW) expansion joint vault
- SW tie-in vault
- auxiliary SW valve pit
- turbine building SW valve pit
- SW valve house lower level
- SW pump house lower level
- spray array structure in SW reservoir
- auxiliary SW expansion joint vault
- charging pump pipe chase
- auxiliary feedwater piping tunnel

3.3.4.2.2 Staff Evaluation

The staff's evaluation of the infrequently accessed area inspection activities 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 applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Program scope: Section B2.1.2 of each LRA identifies the systems, structures, and commodities that credit the infrequently accessed area inspection activities for managing the aging effect of loss of material. The applicant also states that the scope of these activities includes "representative regions and equipment in the following areas." The specific areas for North Anna and Surry are identified in Section B.2.1.2.1 of each LRA. In a letter dated May 22, 2002 (Serial No. 02-277), the applicant stated that the list provided in Section B2.1.2 of each LRA is a complete list of infrequently accessed areas. The applicant also explained that any area of the plant that contains any SSCs within the scope of license renewal and subject to an AMR which is not routinely accessible because of radiation levels, temperature, operationally flooded areas, or physical obstructions (behind or beneath concrete walls) was considered an infrequently inspected area. In the same letter, the applicant explained that it did not mean to limit the scope of SSCs by the use of "representative regions and equipment," and that all of the structures, supports, piping, and equipment within each specific area/region are included within the scope of the inspection.

The staff's evaluation of the scope of this program verified that the infrequently accessed area inspection activities were implemented using acceptable criteria for determining infrequently accessed areas. In addition, the applicant identified a large number of infrequently accessed areas containing structures and components that are subject to an AMR. The staff finds the scope of the programs to be acceptable.

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

Parameters monitored or inspected: In Section B2.1.2 of each LRA, the applicant identified the following types of degradation or adverse conditions that can be detected by visual inspections:

- component leakage
- rust or corrosion products
- peeling, bubbling, or flaking coatings
- indications of chemical attack
- corroded fasteners
- cracking (of concrete, supports, equipment, sealants)
- bubbled, discolored, or cracked electrical insulation
- damaged or missing thermal insulation (focus on material integrity, not thermal
- performance)
- deformed or mispositioned piping and cable supports
- wastage due to boric acid leakage

In a letter dated May 22, 2002 (Serial No. 02-277), the applicant clarified that the above list of degraded or adverse conditions is a complete list of aging effects that will be managed by the infrequently accessed areas inspection activity. In the same letter, the applicant also explained that the cracking of concrete referenced under this AMP refers to the concrete associated with the applicable piping and equipment anchors that can potentially affect the intended function of the associated anchor. Because visual inspection can be used to identify each of the types of degradation and adverse conditions noted by the applicant, such inspections of structures and components in infrequently accessed areas are acceptable to the staff.

Detection of aging effects: The applicant states that visual inspection of the external condition of structures, supports, piping, and equipment will be used to detect the aging effect of loss of material. The applicant's response to RAI 3.5-1 states that the potential aging effects of loss of material, cracking, and change in material properties related to the concrete access shafts of the subsurface drainage system will be managed by the infrequently accessed area inspection activity. In addition, the applicant's response to RAI 3.5-7 states that they will credit the civil engineering structural inspection activity and the infrequently accessed area inspection activity, described in Sections B2.2.6 and B2.1.2 of each LRA, respectively, to manage the aging effects of loss of material, cracking and change in material properties of concrete.

The description of the infrequently accessed area inspection activities in Section B2.1.2 of each LRA only identifies "loss of material" under "scope" and "detection of aging effects." In the SER with open items issued in June 2002, the staff stated that to be consistent with the new commitments made in its response to RAIs 3.5-1 and 3.5-7, the applicant needed to clarify that the scope of the infrequently accessed area inspection activities would be revised to include management of the aging effects of loss of material, cracking and change in material properties of concrete. In its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.1.2, "Infrequently Accessed Area Inspection Activities" has been modified to include cracking and change in material properties as aging effects requiring management for concrete. Since the applicant has completed this action, the staff considers confirmatory action 3.3.4.2-1 closed.

The use of visual inspection of the external condition of infrequently accessed structures, supports, piping, and equipment is consistent with industry practices, and is considered by the staff, to be a reasonable means of detecting loss of material, cracking, and change in material properties before the loss of intended function.

Monitoring and trending: In Section B2.1.2 of each LRA, the applicant states that the monitoring of the structures, supports, piping, and equipment in infrequently accessed areas will be accomplished using the applicant's work control process, which is presented in Section B2.2.19 of each LRA, to perform one-time inspections. The applicant committed to conducting the inspections between year 30 and the end of the current operating license term and will document the results for evaluation and retention. If degradation is identified, it will be evaluated and corrected in accordance with the applicant's corrective action program. Trending is currently not part of this program and none is required by current industry practices for visual inspection activities in similar applications. The monitoring activities credited are controlled by the applicant's quality assurance program, are consistent with current industry practices and, therefore, are acceptable to the staff.

Acceptance criteria: In Section B2.1.2 of each LRA, the applicant states that the acceptance criterion for visual inspections is the absence of anomalous indications of degradation. Furthermore, responsibility for the evaluation of visual indications will be assigned to "Engineering." In a letter dated May 22, 2002 (Serial No. 02-277), the applicant explained that the qualifications of the personnel performing the inspections and evaluating the associated indications will be consistent with the applicable ASME Code qualifications for inspectors. Evaluations of indications of degradation found during these activities will determine whether analysis, repair, or further inspection will be required. Because the acceptance criterion is consistent with the degradation of concern and detectable by visual inspections, and will be performed by trained individuals, this approach is consistent with current industry practices and, therefore, the acceptance criterion is acceptable to the staff.

Operating experience: In Section B2.1.2 of each LRA, the applicant reports that in 1999, a visual inspection at North Anna found degraded supports in the auxiliary feedwater piping tunnel. The applicant cites the resultant corrective actions for the supports and the establishment of a surveillance activity for the auxiliary feedwater pipe tunnel as an example for demonstrating appropriate resolution of the observed degraded condition. This one-time inspection activity is a new program to be applied by the applicant. However, the elements of these inspections as discussed above are consistent with years of industry practice that has been effective in maintaining similar structures and components and, therefore, can reasonably be expected to be effective at maintaining the intended functions of the structures and components that are within the scope of this evaluation for the period of extended operation.

3.3.4.2.3 Conclusions

The staff has reviewed the information provided in Section B2.1.2 of each LRA and the summary description of the infrequently accessed area inspection activities in Section A2.1.2 of the UFSAR supplement. In addition, the staff considered the applicant's November 30, 2001, response to the staff's RAIs provided in a letter to the NRC dated November 30, 2001 and additional information provided in a letter dated May 22, 2002 (Serial No. 02-277). On the basis of this review and the above evaluation, the staff finds that the effect of aging associated with infrequently accessed structures and components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.4.2.4 FSAR Supplement

The staff reviewed Section A2.1.2 of the UFSAR supplement and found that the description of the applicant's infrequently accessed areas inspection activities is consistent with Section B2.1.2 of each LRA. However, the applicant's response to RAI 3.5-1 states that the potential aging effects of loss of material, cracking, and change in material properties related to the concrete access shafts of the subsurface drainage system will be managed by the infrequently accessed area inspection activity. The applicant's response to RAI 3.5-7 states that it will credit the civil engineering structural inspection activity and the infrequently accessed area inspection activity, described in Sections B2.2.6 and B2.1.2 of each LRA, respectively, to manage the aging effects of loss of material, cracking, and change in material properties of concrete. The description of the infrequently accessed area inspection activities in Section B2.1.2 of each LRA only identifies loss of material as the aging effect to be managed by this aging management activity.

In the SER with open items issued in June 2002, the staff stated that to be consistent with the new commitments made In its response to RAIs 3.5-1 and 3.5-7, the applicant needed to clarify that the infrequently accessed area inspection activities would be revised to include management of these two additional aging effects (cracking and change in material properties). In its response to the RAIs, the applicant acknowledged that its responses would require changes to the UFSAR supplement and committed to submit these changes to the NRC staff in a future revision. In response to this concern, in its letter dated July 25, 2002, the applicant stated that the UFSAR Supplement Section 18.1.2, "Infrequently Accessed Area Inspection Activities," has been modified to include cracking and change in material properties as aging effects requiring management for concrete.

Since the applicant has completed this action, the staff considers confirmatory action 3.3.4.2-1 closed.

3.3.4.3 Tank Inspection Activities

The applicant describes its tank inspection activities in Section B2.1.3 of each LRA. The applicant credits this inspection activity with managing the potential aging of in-scope tanks associated with various systems. In addition, the applicant provides a summary description of the tank inspection activities in Section A2.1.3 of the UFSAR supplement. The staff reviewed the applicant's description of the program in Section B2.1.3 of each LRA to determine whether the applicant has demonstrated that it will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.4.3.1 Summary of Technical Information in the Application

In Section B2.1.3 of each LRA, the applicant states that the purpose of the tank inspection activities is to perform inspections of above-ground and underground tanks to provide reasonable assurance that the tanks will perform their intended functions consistent with the current licensing basis throughout the period of extended operation. The tank inspections will be one-time inspections and will use a representative sampling of each type of tank. The applicant committed to perform the tank inspection activities between year 30 and the end of the current operating license term. The applicant will perform an engineering evaluation of the inspection results to determine the potential need for any subsequent inspections.

The applicant stated that it would implement the tank inspection activities for tanks located in the following systems that are subject to an AMR and credit this program at both NAS and SPS:

- alternate AC diesel generator system (diesel generator support systems)
- condensate (steam and power conversion systems)
- quench spray (engineered safety features)
- emergency diesel generator system (diesel generator support systems)
- feedwater (steam and power conversion systems)
- fire protection (fire protection and supporting systems)
- recirculation spray (engineered safety features)
- security (diesel generator support systems)

3.3.4.3.2 Staff Evaluation

The staff's evaluation of the tank inspection activities focused on how the program manages aging effects through the effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The applicant indicates that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these program attributes is provided separately in Section 3.3.2 of this SER. The remaining seven elements are discussed below.

Scope of program: Section B2.1.3 of each LRA identifies the following representative tanks to be inspected for the tank inspections activities:

- emergency diesel generator fuel oil tanks
- alternate AC diesel generator fuel oil tanks
- security diesel generator fuel oil tanks
- emergency diesel generator and alternate AC diesel generator starting air tanks
- emergency diesel generator and alternate AC diesel generator coolant tanks
- underground fuel oil storage tanks
- diesel-driven fire pump fuel oil storage tank
- refueling water storage tanks
- chemical addition tanks
- emergency condensate storage tanks
- casing cooling tanks (NAS only)
- service water pump house air receiver (NAS only)

The applicant states that the choice of representative tanks to be inspected will be dependent on the tank's material of construction, its contents, the foundation upon which the tank is based, and the type of coating. In addition, the applicant may select substitute tanks, that have the same construction, contents, and foundation/coatings as the in-scope tanks, but are more easily accessed. The applicant states that this substitution will occur only after an engineering evaluation to determine the appropriateness of inspecting the substitute tanks. The staff's evaluation of the scope of this program verified that the tank inspection activities will provide an adequate assessment of the different in-scope above-ground and underground tanks.

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

Parameters monitored or inspected: The applicant states that uncoated surfaces and surface coatings inside the selected tanks will be inspected. In addition, the external surfaces of tanks will be inspected as part of the tank inspection activities. This includes the external surfaces of tanks that are not easily accessible. Because visual inspection can be used to identify loss of material of the internal and external surfaces of tanks, inspection of the above ground and underground tanks that are within the scope of license renewal is acceptable to the staff.

Detection of aging effects: The applicant states that the internal and/or external surface conditions will be evaluated by visual examination to identify loss of material. In addition, volumetric examinations will be performed to determine the extent of wall thinning on tanks that are founded on soil or buried. The use of visual inspection of the internal and external surfaces of tanks is consistent with industry practices and is considered by the staff to be a reasonable means to detect loss of material before the loss of intended function.

Monitoring and trending: The applicant states that the inspection of tank surfaces will be accomplished using the applicant's work control process, which is presented in Section B2.2.19 of each LRA, to perform one-time inspections. The applicant committed to conducting the one-time inspections between year 30 and the end of the current operating license term and will document the results for evaluation and retention. If degradation is identified, it will be evaluated and corrected in accordance with the applicant's corrective action program. The extent of wall thinning will be characterized by nondestructive examination (NDE) and will be recorded on NDE reports and kept in the applicant's station records. In RAI B2.1.3-2, the staff requested clarification of the monitoring activities used by the tank inspection activities. In response, the applicant stated that future tank inspection activities, beyond the one-time inspections, will be based on an engineering evaluation of the results of the one-time inspections. In addition, these engineering evaluations of the one-time tank inspections will take place prior to beginning the period of extended operation. The monitoring activities used by the applicant are consistent with current industry practices, and, therefore, are acceptable to the staff.

Acceptance criteria: The applicant states that the acceptance criterion for visual tank inspections is the absence of anomalous indications of degradation. The acceptance criteria for volumetric inspections are based on minimum wall thickness requirements. Evaluations of indication of degradation found during the visual and volumetric examinations of the tanks will determine whether corrective action is required. The staff considers these acceptance criteria to be a reasonable benchmark for initiating corrective action.

Operating experience: The applicant states that indications of degradation that have been found during previous tank inspections have been evaluated to determine the acceptability of the observed condition or to develop a corrective action plan. In addition, operating experience from prior tank inspections and the corrective action activities that have been performed by the applicant, although limited in scope, indicates that there has been no significant loss of material from the base metal. In RAI B2.1.3-1, the staff requested further information regarding past tank inspections at North Anna and Surry. In response the applicant stated that periodic tank inspection is a new activity for North Anna and Surry and that only limited internal and external tank surfaces of selected tanks have been examined. The external surfaces of most above-ground tanks that are not readily accessible have not been previously inspected. Buried tanks have also not yet been inspected by the applicant. Internal visual inspection of condensate storage tanks, fire protection tanks (SPS 1/2 only), and underground fuel oil storage tanks have been performed by the applicant and "some deterioration of protective coatings has been found and corrected" by the applicant's corrective action program. The staff finds the description of the operating experience reasonable, and the tank inspection activities to be included as part of this aging management activity acceptable.

3.3.4.3.3 Conclusions

The staff has reviewed the information provided in Section B2.1.3 of each LRA and the summary description of the tank inspection activities in Section A2.1.3 of the UFSAR supplement. In addition, the staff considered the applicant's response to the staff's RAIs provided in a letter to the NRC dated November 30, 2001. On the basis of this review and the above evaluation, the staff finds the applicant has demonstrated that the effect of aging associated with the tanks, which are within the scope of this evaluation, will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.3.4.3.4 FSAR Supplement

The staff reviewed Section A2.1.3 of the UFSAR supplement and found that the description of the tank inspection activities is consistent with Section B2.1.3 of each LRA.

3.4 Reactor Coolant Systems

The North Anna and Surry include the following mechanical components within the reactor coolant systems that require an AMR:

- Westinghouse (W) designed primary coolant Class 1 piping and associated connections to other support systems (including the reactor coolant pumps and their motor oil collection system, and the neutron shield tank)
- reactor vessels (including the control rod drive mechanism housing, and the vessel head vent piping and fittings)
- reactor vessel internals
- pressurizers (including safety relief valves, and pressure relief tank)
- steam generators

Each reactor coolant system (RCS) consists of three primary piping loops (A, B, and C) interconnected at each reactor vessel. Each primary piping loop contains one reactor coolant pump, one steam generator, valves, and interconnecting piping. The pressurizer, connected to Loop C hot leg, provides a means for controlling the RCS pressure. The RCS also contains piping and components that allow venting of the reactor vessel and the pressurizer.

The neutron shield tank (NST) is located inside the primary shield wall around the reactor vessel. The tank provides support for the reactor vessel and limits heat transfer to the primary shield wall. The tank is cooled by the neutron shield tank cooling system.

Results from AMR of these components are described in Section 3.1, "Aging Management of Reactor Coolant System," of both North Anna and Surry LRAs. During the review of these AMR results, the staff requested additional information to obtain clarification on certain AMR results from the applicant. In response to staff's RAIs, the applicant provided additional information in several documented letters and telecommunication summaries as follows:

- summary of October 9, 11, and 15, 2001, telecommunication with Virginia Electric and Power Company
- summary of August 8, 9, 13, 27, and 28, 2001, telecommunication with Virginia Electric and Power Company
- applicant's letter dated October 22, 2001, Serial No. 01-685
- applicant's letter dated October 22, 2001, Serial No. 01-686
- applicant's letter dated November 30, 2001, Serial No. 01-647

The applicant's AMRs for the RCS components (i.e., Class 1 piping and associated components, reactor vessel internals, and pressurizers) are described in a series of Westinghouse Owners Group (WOG) topical reports. These reports are:

WCAP-14575-A	Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components

WCAP-14577, Rev. 1-A	License Renewal Evaluation: Aging Management for Reactor Internals
WCAP-14574-A	License Renewal Evaluation: Aging Management Evaluation for Pressurizers

The staff previously approved these Westinghouse topical reports, having determined that they presented adequate information to meet the requirements of 10 CFR 54.21(a)(3) for managing the aging effects on the RCS components.

An applicant may incorporate NRC-approved WOG topical reports by reference if the conditions of approval in the final safety evaluation report (FSER) of the specific report are met. In Section C4.0 of the LRAs, the applicant discussed the process used to evaluate the plant-specific RCS components against these topical reports. The applicant stated that the information in these topical reports was reviewed for applicability to the station and the AMR report was used to document the comparisons between the equipment, materials, fabrication techniques, installed configuration, modes of operation and environments evaluated in the topical report and those that exist for the plant. In the LRA Sections 3.1.1, 3.1.3, and 3.1.4, the applicant confirmed that it used the AMRs performed on the reactor coolant Class 1 piping and associated pressure boundary components, reactor vessel internals, and pressurizers, respectively. The applicant stated that the RCS components described in these topical reports bound the RCS components, with some clarifications, for both North Anna and Surry. Also, the applicant stated that Tables 3.1.1-W1, 3.1.3-W1, and 3.1.4-W1 in each LRA provide the reconciliation of the FSER applicant action items for these RCS components.

3.4.1 Reactor Coolant Piping and Associated Components

The RCS contains reactor coolant (RC) piping and associated connections to other systems. The RC piping subject to an AMR includes portions of the Class 1 RCS pressure boundary that are connected to the following components: the reactor vessel, the steam generators (primary side), the pressurizer, and the reactor coolant pump (RCP). Portions of other systems that are attached to the RC piping and that contain Class 1 components, include the chemical and volume control system (CVCS), high head/low head safety injection (HH/LHSI) systems, residual heat removal (RHR) system, reactor vessel level inventory system (RVLIS), and accumulator lines. Several components including nozzles and thermal sleeves, branch line restrictors, valves including power operated relief valves (PORV), and RCP thermal barriers and seals, are also included within the scope of the RC piping. In addition, vents, drains, and instrument lines attached to the RC piping contain Class 1 components. The RC piping also includes piping (e.g., fittings, branch connections, safe ends, and thermal sleeves), valve bodies (pressure-retaining parts of RCS isolation/boundary valves), bolted closures, and bolted connections.

The RC piping includes the RCP motor oil collection system components for North Anna. These components are included in the fire protection (FP) system for Surry.

3.4.1.1 Summary of Technical Information in the Application

The applicant described its AMR for the RC piping and associated components in LRA Section 3.1.1, "Reactor Coolant System," as supplemented by RAI responses. The staff reviewed this section of the LRAs and the RAI responses to determine whether the applicant has demonstrated that the effects of aging on the Class 1 RC piping and associated components within the RCS will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The applicant confirmed that the RC piping and associated components for North Anna and Surry plants are bounded, with several clarifications, by the description of Class 1 piping contained in WCAP-14575-A, "Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components." The staff issued the FSER for WCAP-14575-A by letter dated November 8, 2000. The applicant's clarifications associated with this report include the following:

- The topical report assumes that the primary system chemistry control program does not manage loss of material or cracking from stress corrosion. However, the chemistry control program for primary systems at both plants manages these aging effects.

- The topical report considers wear due to relative motion or sliding as an aging effect that requires an AMR of limited number of RCS components. The applicant's aging management reviews indicated that wear in RC piping components at both plants will not result in such an aging effect requiring management.

- The topical report does not require aging management of flow restricting orifices. The LRA requires aging management of flow restricting orifices.

- The topical report specifically addressed Class 1 piping and associated pressure boundary components that support the operation of the RCS. However, the applicant claims that the AMR results presented in both LRAs consider Class 1, 2, and 3 components within the scope of the RC piping and associated components.

- The topical report states that Westinghouse had a policy of prohibiting the use of sensitized austenitic stainless steel and controlled the fabrication and installation process. Therefore, the topical report does not address stress corrosion cracking (SCC) of sensitized pipe. However, the pressurizer spray lines at Surry are sensitized and the aging effect associated with the spray lines are addressed in the AMR for the RCS.

The RC piping, pipe fittings, and associated components that are subject to an AMR have been designed to meet the requirements of USAS B31.1 Code (Surry) and USAS B31.7 Code (North Anna) for Pressure Piping or ASME Boiler and Pressure Vessel Code, Section III. The predominant material of construction for these components is stainless steel, including cast austenitic stainless steel (CASS), with carbon steel, low-alloy steel, and copper alloys used to a lesser extent. With the exception of the pressurizer spray line at Surry, there is no sensitized stainless steel in the RCS. Design considerations in the selection of materials for RC components, including small bore pipe, reduce the potential for SCC.

The RC system components that are within the scope of license renewal are internally exposed to different types of treated water (i.e., borated water, primary grade water, component cooling (CC) water, and distilled de-aerated water) and lubricating oil (motor coolers). The system is predominantly internally exposed to borated water at approximately 315.6 °C (600 of) and 15.41 MPa (2,235 psig). These components are located in the containment and the auxiliary building and are externally exposed to an air environment. External surfaces near pipe fitting connections (e.g., flange) may also be exposed to borated water leakage conditions.

The component cooling water system provides cooling water for the RCP motor's lower and upper bearing oil coolers, and the RCP motor's stator coolers. The lower bearing cooler is a coiled tube design. The tube outside is exposed to oil inside the oil reservoir and air outside of the reservoir, and the tube inside is exposed to treated water (component cooling). The upper bearing cooler is a tube and shell design. The tube side is exposed to treated water and the shell side to the lube oil. The stator cooler is a fin and tube design with treated water inside the tube and air on the outside of the tube.

The reactor vessel's level instrumentation system (RVLIS) is a stagnant system with bellows used to separate the primary reactor coolant from the treated water (i.e., distilled de-aerated water).

3.4.1.1.1 Aging Effects

In accordance with Table 3.1.1-1 of the LRAs, the applicant identified the following two intended functions for the RC piping and associated components, based on the requirements of 10 CFR 54.4(a):

- maintain the integrity of the reactor coolant pressure boundary
- limit flow due to a downstream break to a value less than the normal RCS makeup capability

This is consistent with the staff's FSER on the topical report, WCAP-14575-A.

The aging effects applicable to the RC piping and associated components requiring aging management are:

- cracking of stainless steel components (including CASS) in treated water or steam environments in case of components interfacing with the pressurizer steam space)
- cracking and loss of material from sensitized stainless steel components at Surry in a treated water environment
- cracking of copper alloy components in the air environment
- loss of material from carbon steel, low-alloy steel, and copper alloy components in treated water, air, lubricating oil, or steam environments
- loss of material from carbon steel, low-alloy steel, and copper alloy components in a borated water leakage environment
- reduction in fracture toughness of CASS pumps and valves in a high-temperature treated water or steam environment
- loss of pre-load of ASME Class 1 bolting in an air environment

3.4.1.1.2 Aging Management Programs

In the LRA Section 3.1.1, the applicant identifies the following AMPs for the RC piping and associated components:

- chemistry control program for primary systems
- boric acid corrosion surveillance
- general condition monitoring activities
- work control process
- augmented inspection activities
- ISI program - component and component support inspections

The applicant concludes that these programs would manage the effects of aging in such a way that the intended functions of the RC piping and associated components would be maintained consistent with the CLB under all design loading conditions for the period of extended operation.

In addition, the TLAAs associated with RC piping and associated components include:

- thermal fatigue of RC piping
- leak-before-break (LBB)
- RCP fatigue (Code Case N-481)

3.4.1.2 Staff Evaluation

The staff reviewed the information included in LRA Section 3.1.1, "Reactor Coolant System," (including Tables 3.1.1-1 and 3.1.1-W1), the staff's FSER on topical report WCAP-14575-A, and pertinent sections of LRA Appendices A and B, for both North Anna and Surry plants. The review was performed to verify that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation for the RC piping and associated components.

The applicant addressed all renewal application action items that are included in the FSER for WCAP-14575-A in each LRA Table 3.1.1-W1 for the North Anna and Surry stations. There are 10 action items in the staff's FSER on WCAP-14575-A.

<u>Action Items from Previous Staff FSER for WCAP-14575-A</u>

From its review of this information, the staff finds that the applicant's response to the 10 "Renewal Applicant Action Items" resolve the applicant action items in the FSER for WCAP-14575-A. The action items, applicant's responses, and staff's evaluations are provided in the following paragraphs.

- 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 identify how such commitments will be controlled. Any deviations from the aging management programs with 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 discussed in Section 3.0 and associated tables, the ASME Class 1 piping and associated pressure boundary components are bounded by the topical report with regard to design criteria and features, materials of construction, fabrication techniques, installed configuration, mode of operation and environments/exposures. The programs necessary to manage the effects of aging are identified in Section 3.0. A detailed discussion of the aging management activities is provided in Appendix B. In Section 3.4.1.1 of this SER, the applicant clarifies several positions discussed in the topical report. Based on these considerations, the staff finds the applicant has verified that its plants are bounded by the topical report. Because the report allows for plant differences Therefore, the staff found the applicant's clarifications acceptable

- Item 2: Summary description of the programs and evaluation of Time-Limited Aging Analyses 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 results of the effects of aging and the Time-Limited Aging Analyses evaluation results for ASME Class 1 piping, valves, and reactor coolant pumps are provided in the UFSAR supplement in Appendix A. The staff finds this response to be acceptable.

- Item 3: The renewal applicant should complete the updated review of generic communications and capture any additional items not identified by the original review.

  Response: A review of the generic communications related to the reactor coolant system has been completed. The aging management review of the reactor coolant system captures industry issues with no additional aging effects identified. The staff issued an RAI to further understand the review process used in evaluating the generic communications associated with RCS components. In response to RAI Item 3.1.1.2-1, the applicant stated that the following criteria were used to identify aging issues in generic communications relevant to the RCS components: (a) the issue is aging related (i.e., not a design deficiency or operational event), (b) the issue is applicable to in-scope RCS components, and (c) the issue involves a material/environment combination or aging mechanism/effect that was not already considered in the AMR for the RCS. The staff found the applicant's response to be acceptable.

- Item 4: Applications must provide a description of all insulation used on austenitic stainless steel Nuclear Steam Supply System piping to ensure the piping is not susceptible to stress-corrosion cracking from halogens.

  Response: Halogens are controlled by insulation specifications to minimize the potential for SCC. The insulation materials for the RC system meet the recommendations of Regulatory Guide 1.36, "Nonmetallic Thermal Insulation for Austenitic Stainless Steel." This ensures no adverse material interaction with the external surface of the RC system components. The staff finds this response to be acceptable.

- Item 5: 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 reactor coolant pumps address the 10 elements identified. These programs are identified in Table 3.1.1-1, Reactor Coolant System, and described in Appendix B, Aging Management Activities. The staff finds this response to be acceptable. The staff's evaluation of the aging management programs is discussed in Section 3.3.1 and 3.3.4 of this SER.

- Item 6: The license renewal applicant should perform additional inspection of small-bore RC system piping, that is, less than 4-inch-size piping, for license renewal to provide assurance that potential cracking of small-bore piping is adequately managed during the period of extended operation.

  Response: In general, SCC (including primary water SCC) in the RC system is managed by proper material selection for the system environment, and by controlling the chemical properties of the environment. This latter activity is identified as the chemistry control for primary systems program, which is supplemented by the work control process.

  The applicant is implementing a risk-informed inservice inspection (RI-ISI) program at Surry and North Anna as part of the ASME Section XI ISI Program. Volumetric examinations of small-bore piping would be added to the scope of ISI based upon risk significance and probability of failure. At this time, no small-bore butt or socket welds have been designated as high safety significance and no volumetric inspections of Class 1 small-bore pipe are planned.

  However, volumetric examinations are being performed on Surry 1 on a sample population of welds in several 3-inch lines in safety injection and chemical and volume control systems. These are Class 2 lines, but are used as leading indicators for small-bore piping conditions in Class 1 systems. The staff issued an RAI to further understand how these Class 2 lines bound the Class 1 lines within the scope of the license renewal. In response to the RAI Item 3.1.1.2-2, the applicant further reviewed the inspections being performed as part of the risk-informed inservice inspection programs and has determined that volumetric examinations of Class 2 small bore piping welds have limited value in managing aging for in-scope Class 1 small bore piping.

  The applicant actively participates in the EPRI sponsored Materials Reliability Project (MRP) Industry Task Group (ITG) on thermal fatigue. In addition, as indicated in Appendix B4.0, Licensee Follow-up Actions, of the LRAs, the applicant has committed to following all on-going industry activities related to failure mechanisms for small-bore piping and will evaluate changes to inspection activities based on industry recommendations. Changes will be made to the activities contained in the ISI program - component and component support inspections, as appropriate, based on industry recommendations. Based on the above considerations, the staff found the applicant's approach for aging management of small bore piping to be acceptable because ISI programs and changes to ISI programs are subject to the NRC review and approval prior to implementation.

- Item 7: 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 level exceeding the screening criterion may not have adequate fracture toughness and do require additional evaluation or examination. The license renewal applicant should address thermal-aging issues in accordance with the staff's comments in Section 3.3.3 of this evaluation.

  Response: Reduction in fracture toughness is identified as an aging effect related to thermal aging. ASME Class 1 piping, valves and reactor coolant pumps have been evaluated for reduction in fracture toughness and the results are presented in Section 3.1.1, Reactor Coolant System. The staff finds this to be acceptable.

- Item 8: The license renewal applicant should perform additional fatigue evaluation 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 established an Aging Management Activity (AMA), performed a plant-specific fatigue evaluation, or a USAS B31.7 (North Anna) or a USAS B31.1 (Surry) evaluation for the applicable components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575.

  The B31.1 piping and plant-specific metal fatigue evaluation results are provided in Section 4.0, Time-Limited Aging Analyses, of the LRAs.

  A combination of the aging management review results for the Pressurizer (Section 3.1.4), Reactor Pressure Vessel (Section 3.1.2), Steam Generator (Section 3.1.5), Reactor Coolant System (3.1.1), the Primary Process Systems (Section 3.3.1) and the Engineered Safety Features (Section 3.2) addresses the various aging management activities (AMAs) related to the components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575.

  In response to staff's RAI 4.3-4, the applicant stated that the components labeled I-M and I-RA in WCAP-14575, Tables 3-2 through 3-16 are all piping components such as elbows, nozzles, straight pipes etc., which are Class 1 piping and associated pressure boundary components. These components are analyzed in accordance with the requirements of ANSI B31.7 for North Anna and ANSI B31.1 for Surry, satisfying appropriate Code limits. The staff found the applicant's fatigue evaluation of the subject components to be acceptable because the fatigue limits meet the applicable construction codes.

- Item 9: The staff recommendation for the closure of GSI-190, "Fatigue Evaluation of Metal Components for 60-Year Plant Life" is contained in a December 26, 1999, memorandum from Ashok Thadani to William Travers. The license renewal applicant should address the effects of the coolant environment on component fatigue life as aging management programs 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: Section 4.3.4 of the LRAs, "Environmentally Assisted Fatigue," presents the results of the plant-specific evaluation of ASME Class 1 components with regard to environmental effects on fatigue. The surge line nozzle connection at the reactor coolant system's hot leg pipe is the leading indicator for reactor water environmental effects. As indicated in Table 3.1.1-1, Reactor Coolant System, an augmented inspection activity has been specifically developed to inspect for cracking of the pressurizer surge line weld at the RC system hot leg pipe connection. The development of these augmented inspection activities is identified as a licensee followup action, as described in Section B4.0 of the LRA's.

In response to staff's RAIs 4.3-5 through 7, the applicant stated that based on the plant-specific environmental fatigue evaluation the pressurizer sub-components have acceptable CUF values, with the exception of the surge nozzle, spray nozzle, lower head heater well, upper head shell, and instrument nozzle. The applicant will inspect the pressurizer surge line weld at the hot leg pipe connection as an augmented inspection program item, so that flaw initiation and growth can be detected and/or monitored. The results of these inspections and the results of planned research by the EPRI Materials Reliability Program (MRP) will be utilized to assess the appropriate approach for addressing environmentally-assisted fatigue of the surge lines. Should the applicant decide to manage environmentally-assisted fatigue by an AMP during the period of extended operation, inspection details will be provided to the staff for review. The staff finds this response to be acceptable.

- Item 10: The license renewal applicant 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, a new 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.

  Response: If ASME Class 1 cast austenitic stainless steel components are repaired or replaced, the applicant design control procedures would evaluate the existing LBB analysis based on replacement material properties. The staff finds this response to be acceptable.

3.4.1.2.1 Aging Effects

The material of construction for the RC piping and associated components subject to an AMR is stainless steel, including cast austenitic stainless steel (CASS) for pipe fittings, pump casings, and valve bodies. Carbon steel and low alloy steel are used for bolting, RCP motor's upper bearing coolers. The copper alloys are used in the RCP motor bearing and stator coolers. Most RC piping and associated components are exposed to primary treated water and air.

Some specific components are exposed to lubricating oil, steam, or borated water. In accordance to Table 3.1.1-1 of the LRAs, the aging effects requiring aging management for RC piping and associated components are:

- cracking
- loss of material
- reduction in fracture toughness
- loss of pre-load

The fatigue-sensitive piping and pipe fittings, valve bodies larger than 4-inch nominal pipe size, and the RCP pressure boundary closure components are susceptible to fatigue-related cracking. Since austenitic stainless steel is not susceptible to corrosion and stress corrosion in pressurized water reactor primary coolant, cracking due to corrosion/stress corrosion is not a concern for primary loop components excluding dissimilar metal. The applicant states that the insulation materials for the RC system meets the recommendations of Regulatory Guide 1.36 and therefore, no adverse material interaction with the external surface of the RC system components will cause stress corrosion cracking from halogens. The pressurizer spray lines at Surry are sensitized and therefore, these lines are susceptible to intergranular stress corrosion cracking (IGSCC).

Loss of material due to erosion in RC piping and associated components is not considered significant because of the design and operational characteristics of the system. However, loss of material due to erosion/corrosion, specifically due to boric acid exposure to external surfaces near leaky bolted connection, is an aging effect requiring aging management.

Irradiation embrittlement is not a concern for the RC piping and associated components because the expected neutron fluence is much less than the threshold level at which changes in properties of the material would occur. However, thermal aging of CASS components are susceptible to reduction in fracture toughness. The reduction in fracture toughness causes a reduction in the critical flaw size for the component. In accordance with Table 3.1.1-1 of the LRAs, the applicant states that loss of fracture toughness due to thermal embrittlement of the CASS pipe and elbows is not an aging effect requiring management because the results of the Leak-Before-Break (LBB) TLAA in Section 4.7.3 of the LRAs demonstrated that there was a large margin between detectable flaw size and flaw instability.

Loss of preload due to stress relaxation is an aging effect applicable to RCP and valve bolted closures. The applicant states that wear in RC piping and associated components at both stations will not result in such an aging effect requiring management. However, the topical report considers wear due to relative motion or sliding as an applicable aging effect for bolted connections. The staff issued an RAI to obtain clarification from the applicant. In response to RAI Item 3.1.1.2.1-1, the applicant stated that although North Anna and Surry have no operating history of "wear" in the areas of concern, the loss of material in the in-scope RC piping and associated components is considered as an applicable aging effect.

Based on these considerations, the staff finds the aging effects identified by the applicant for the RC piping and associated components to be consistent with the topical report.

3.4.1.2.2 Aging Management Programs

The staff evaluation of the applicant's AMPs focused on the program elements rather than details of specific plant procedures. The staff's approach to evaluating each program and activity used to manage the applicable aging effects is described in Section 3.3 of this SER.

The AMPs that apply to the Class 1 RC piping and associated components include the following:

- chemistry control program for primary systems
- boric acid corrosion surveillance
- general condition monitoring activities
- work control process
- augmented inspection activities
- ISI program - component and component support inspections

The staff's review of these AMPs that apply to the RC piping and associated components may be found in Section 3.3 of this SER. In addition, the TLAAs associated with RC piping and associated components include the following:

- thermal fatigue of RC piping
- leak-before-break
- RCP fatigue crack growth (Code Case N-481)

The staff's review of TLAAs that apply to the RC piping and associated components may be found in Section 4.0 of this SER.

In Table 3.1.1-1 of the LRA, the applicant listed all RC piping and associated components within the scope of license renewal with their intended functions, material groups, and both internal and external environments. Also, the table identified their aging effects requiring management and the plant-specific AMPs required to manage these aging effects during the period of extended operation. The applicant states that the applicable aging effects on RC piping and associated components will be adequately managed by the plant-specific AMPs identified in this table during the period of extended operation.

The chemistry control program for primary systems provides water quality that is compatible with the materials of construction in the RC piping and associated components in order to minimize loss of material and cracking. This program is developed based on the plant technical specification requirements and on EPRI guidelines, which reflects industry experience.

The boric acid corrosion surveillance program was developed in response to Generic Letter 88-05. Inspections are performed to provide reasonable assurance that borated water leakage from the reactor coolant pressure boundary does not lead to undetected loss of material on the external surface of RC piping and associated components, specifically those made out of carbon steel or copper. The boric acid corrosion surveillance program is discussed in detail in Section 3.3.1.3 of this SER.

The inservice inspection (ISI) program - component and component support inspections manages aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indication of reduction in fracture toughness. The scope of the ISI program for Class 1 and Class 2 components complies with the provisions of ASME Section XI, Subsections IWB and IWC. Examination categories applicable to Class 1 and Class 2 RC piping and associated components are B-F for dissimilar metal welds, B-G-1 and B-G-2 for bolting, B-J for similar metal welds, B-L-1 and B-L-2 for pump casings, B-M-1 and B-M-2 for valve bodies, B-P for all pressure retaining components, and C-F-2 for welds in carbon steel or low alloy steel piping. Depending on the examination category, the methods of inspections may include visual, surface and/or volumetric examination of weld locations susceptible to aging degradation. In response to RAI Item 3.1.1.2.2-1, the in-scope Class 2 components operate in less than 140 of and hence, cracking in these components due to SCC is not an applicable aging effect.

Surry has implemented the risk-informed inservice inspection (RI-ISI) program for examination category B-J and B-F welds in piping. Unit 1 has included all Class 1, 2, 3 and non-class systems, while Unit 2 has included Class 1 systems only. North Anna will implement the RI-ISI program for the Class 1 systems only.

Surface examinations for Class 1 piping less than 4-inch nominal pipe size (NPS) are performed as part of the ASME Section XI ISI program. Volumetric examinations of these small-bore pipes would be added to the scope of RI-ISI based on risk significance and probability of failure. At this time, no small-bore piping butt welds or socket welds have been designated high safety significance, and no volumetric inspections of Class 1 piping are planned. However, in accordance with Table B4.0-1 on licensee follow-on actions, Surry 1 is planning to perform volumetric examinations on a sample population of welds in several 3-inch lines in the safety injection and chemical volume and control systems. These are Class 2 lines, but are used as leading indicators for small-bore piping conditions in Class 1 systems. The staff issued an RAI to further understand how these Class 2 lines bound the Class 1 lines within the scope of the license renewal. In response to the RAI Item 3.1.1.2-2, the applicant further reviewed the inspections being performed as part of the risk-informed inservice inspection programs and has determined that volumetric examinations of Class 2 small bore piping welds have limited value in managing aging for in-scope Class 1 small bore piping.

The applicant participates in the EPRI's Materials Reliability Project Industry Task Group on thermal fatigue which is currently developing guidance for the management of fatigue caused by cyclic thermal stratification and environmental effects. The applicant is committed to following industry activities related to failure mechanisms for small-bore piping and will evaluate changes to inspection activities based on industry recommendations.

General condition monitoring activities are performed for the assessment and management of aging for components that are located in normally accessible areas. This program manages the aging effects of loss of material, change in material properties, and cracking. These activities are performed in three different ways: inspections of radiologically controlled areas once a week, periodic inspection and walkdown inspections during normal and refueling outages, and periodic inspections of supports and doors. As a licensee followup action (Table B4.0-1), additional procedures will be developed to inspect component supports and doors.

The objective of augmented inspection activities is to perform examinations of selected components and supports in accordance with requirements identified in the plant technical specifications, UFSAR, licensee commitments, industry operating experience, and good practices for the plant. These activities are outside the scope of ASME Section XI requirements. The Class 1 and Class 2 sensitized stainless steel circumferential and longitudinal welds, branch connections, and socket welds are subject to both surface and volumetric examinations during each refueling outage for Surry where sensitized materials are used in the pressurizer spray lines.

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

The RCS primary loop piping and balance-of-plant piping at Surry, except the pressurizer surge lines, are analyzed to the requirements of ANSI B31.1. The RCS pressure boundary piping and loop stop valves for North Anna are analyzed to the requirements of ANSI B31.7 (i.e., equivalent to ASME Section III, Class1), while the balance-of-plant piping is analyzed to the requirements of ANSI B31.1 which is equivalent to the requirements of ANSI B31.7, Class 2 and Class 3 rules. The pressurizer surge lines have been analyzed to the requirements of ASME Section III for Class 1 components. Design requirements in ANSI B31.1 use a stress range reduction factor to provide conservatism in the piping design to account for fatigue due to thermal cycle operation. The hot and cold leg sample lines at Surry, as determined to be the limiting case, have been found to experience approximately 3,120 cycles, significantly fewer than 7,000 cycles up to which the stress range reduction factor is 1.0. These lines at North Anna are qualified for 22,000 cycles, including stress range reduction factors. The total cycles expected to be experienced by the sample lines will be less than 9,000 cycles for a 60-year period.

To account for the environmental effects, the applicant states that only the surge line piping requires further evaluation for the period of extended operation. However, in lieu of additional analyses to refine the cumulative usage factor for the pressurizer surge line, the applicant selected aging management to address the surge line fatigue during the period of extended operation. The surge line weld at the hot leg pipe connection is chosen to be included in an augmented inspection program, so that flaw initiation and growth can be detected and/or monitored. In addition, the applicant will evaluate the results of the Materials Reliability Program (MRP) by the EPRI to adjust the technique, frequency and number of locations to be inspected during the period of extended operation. This provides reasonable assurance that the cracking due to thermal fatigue for the RC piping will be managed such that components within the scope of license renewal will perform their intended functions during the period of extended operation.

The objective of the leak-before-break (LBB) analysis is to determine whether a postulated crack causing a leak, will grow to become unstable and lead to a full circumferential break when subjected to the worst possible combinations of plant loading. The detailed evaluation showed that the RC piping are not subject to such unstable conditions under the worst combination of plant loading. To maintain the LBB design basis for the plant, the LBB evaluation using design transient cycles has been performed for a 60-year plant life. The new analysis considered the effect of thermal aging of CASS and concluded that the design is bounded by the generic Westinghouse analyses. Since the design transients and cycles are applicable to 60 years of operation, the LBB analysis is considered valid for the period of extended operation.

ASME Code Case N-481 provides an alternative to the ASME Section XI inservice inspection requirement of the RCP casing welds. The code case allows the replacement of volumetric examination of RCP casing with a fracture mechanics-based integrity evaluation supplemented by specific visual examinations. Based on the Westinghouse analysis on the RCP casing integrity, the applicant states that the provisions of Code Case N-481 are satisfied for 60-year service.

During normal operation, the RCP flywheel possesses sufficient kinetic energy to potentially produce high-energy missiles in the unlikely event of failure. The aging effect of concern is fatigue crack initiation in the flywheel. An evaluation of a failure over the period of extended operation demonstrates that the flywheel has a high structural integrity with a very high flaw tolerance and negligible flaw crack growth over a 60-year service life.

3.4.1.3 Conclusions

The staff has reviewed the information included in Section 3.1.1 of the LRAs, as supplemented by the RAI responses, and other pertinent sections of the LRAs. On the basis of this review, the staff concludes that the applicant has demonstrated that the effects of aging associated with the Class 1 RC piping and associated components will be adequately managed so that there is reasonable assurance that these components will perform their intended functions consistent with the CLB throughout the period of extended operation.

3.4.2 Reactor Vessels

The four reactor vessels (RVs) at the two plants, North Anna and Surry, are characterized as standard Westinghouse 399 cm (157-inch) ID three-loop vessels. Each RV is a cylindrical shell with a welded, hemispherical lower head and a flanged hemispherical upper head. The North Anna reactor vessel shells are constructed of forged rings welded together circumferentially, whereas the Surry shells are of welded plate segments. The hot-leg and cold-leg reactor coolant piping for each of the three loops is welded to the primary nozzles that have stainless steel safe ends. The internal surfaces of the vessels are clad with stainless steel to protect the carbon steel vessel from corrosion by the borated reactor coolant. As stated in Section 3.1.2 of the LRAs, a few RV components made from carbon or low-alloy steel are clad with a weld overlay of stainless steel with the exception of selected locations that are clad with high-nickel alloys. The RV provides structural support for the reactor core and a pressure boundary for the reactor coolant in which the core is submerged. The core support ledge, located inside the vessel just below the vessel flange, supports the weight of the reactor vessel internals and the fuel core. The lower internals assembly hangs from the core support ledge and is provided with lateral support by core support lugs.

The RV is vertically mounted on welded support pads attached to the bottom of the primary nozzles, which are located below the vessel flange. The weight of the vessel is transmitted through the nozzle support pads to the neutron shield tank that surrounds the vessel. The reactor vessel closure head dome is penetrated by the control rod drive mechanism (CRDM) housing and a vent pipe. The lower head has penetrations (instrumentation tubes), for movable in-core nuclear flux thimble tubes, which extend into the reactor vessel interior and mate with the lower internal assembly.

The vessel flange and closure head flange are joined by fifty-eight 15.24 cm (6 inch) studs, nuts, and spherical washers. Two concentric, hollow, metallic O-rings between the closure head flange and the vessel flange form an inner and outer seal. A dynamic seal is formed when the closure head is bolted in place and by the internal pressure in the RV.

3.4.2.1 Summary of Technical Information in the Application

The applicant described its AMR of the RVs in LRA Section 3.1.2, "Reactor Vessel," as supplemented by RAI responses. The staff reviewed this section of the LRAs and the RAI responses to determine whether the applicant has demonstrated that the effects of aging on the RVs in the RCS will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Table 3.1.2-1 of the LRAs listed 23 subcomponents of the RV that are subject to aging management review. They include shell components, nozzles, vessel penetrations such as the CRDM housing and instrumentation tubes. OF these subcomponents, 20 perform a passive pressure boundary intended function, while the remaining three provide passive intended functions for structural and/or functional support for in-scope equipment. The table specifies the component material, its service environment, the aging effect requiring management, and the relevant aging management activity.

3.4.2.1.1 Aging Effects

Table 3.1.2-1 of the LRAs lists the service environments that may cause aging degradation. They include external RV environments (air and borated water from leaks) and an internal environment (treated water). For stainless steel and nickel-based alloys, air acting on external surfaces was not considered to cause any aging effect and no aging management activities were specified for this environment. On the other hand the RV shell was cited as a subcomponent that was susceptible to a reduction in fracture toughness as a result of radiation. External attack of RV subcomponents made from carbon and low-alloy steel may cause loss of material due to corrosion by borated water leakage.

For RV internal environments, Table 3.1.2-1 specifies that stainless steel and nickel-based alloys are susceptible to cracking and loss of material in treated water and treated water/steam environments. Cast austenitic stainless steel (CASS) is also stated to be susceptible to a reduction in fracture toughness during exposure to treated water.

In Section B1.2 of the LRA, the applicant states that industry operating experience was used to identify aging effects and mechanisms that could challenge the intended functions of systems and structures within the scope of license renewal. These included in-house review of deviation reports in electronic data bases at the North Anna and Surry stations. The data bases included the time period between 1990 and mid 1999 and included about 50,000 deviation reports. In addition, the applicant reviewed and dispositioned industry operating experiences reported in NRC Information Notices, INPO reports, and manufacturing bulletins in order to include corrective actions in the aging management activities (AMAs) of the plants. From these activities, the applicant has identified in Section 3.1.2 of the LRAs the following aging effects for RV subcomponents that require management:

- cracking of stainless steel (including CASS), carbon steel, low-alloy steel, and nickel-based alloy subcomponents in treated water or air environments
- loss of material from stainless steel (including CASS) and nickel-based alloy subcomponents in a treated water environment
- loss of material from carbon steel and low-alloy steel subcomponents in a borated water leakage environment
- loss of preload of ASME Class 1 closure studs in an air environment
- reduction of fracture toughness of CASS subcomponents in a high-temperature treated water environment
- reduction of fracture toughness of carbon steel and low-alloy steel subcomponents in an air environment

3.4.2.1.2 Aging Management Programs

In Section 3.1.2 of the LRA, the applicant listed the following AMPs that will manage the aging effects for the RV components:

- chemistry control program for primary systems
- boric acid surveillance
- ISI program - reactor vessel
- reactor vessel integrity management

Appendix B of the LRAs provides a description of how these AMPs will be used to adequately manage the aging effects associated with the RV components so that there is reasonable assurance that their intended functions will be maintained consistent with the CLB during the period of extended operation.

In addition to the AMPs, Section 3.1.2 of the LRA identifies six TLAAs associated with RV subcomponents. These include the following:

- fatigue
- tensioning and detensioning of studs
- pressurized thermal shock
- upper shelf energy
- pressure-temperature limits
- reactor vessel underclad cracking

A description of these TLAAs is given in Section 4.0 of the LRAs.

3.4.2.2 Staff Evaluation

The staff reviewed the information included in the LRA Section 3.1.2 (including Table 3.1.2-1), the RAI responses by the applicant, and pertinent sections of LRA Appendices A and B, regarding the applicant's demonstration that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation for the RVs.

The applicant has identified two intended functions applicable to the RVs. They include reactor coolant pressure boundary and structural support function for the reactor core. The staff finds that the applicant has appropriately identified these two intended functions for the RVs.

3.4.2.2.1 Aging Effects

Section 3.1.2 of the LRAs defines the environmental conditions that are responsible for aging effects. The LRA states that the internal surfaces of the RV are wetted by treated water (borated water) at an operating pressure of 15.41 MPa gage (2,235 psig). The maximum operating temperature for reactor coolant water at North Anna is 327.3 °C (621.2 of). For Surry, it is 318.7 °C (605.6 of). Table 3.0-2 of the LRAs states that RV subcomponents exposed to sheltered air experience operating temperature between 0-48.9 °C (32-120 of), and those exposed to containment air have operating temperatures between 47.8-51.7 °C (75-125 of). External surfaces may also be exposed to borated water leakage conditions. The LRAs also state that the RV subcomponents are also exposed to different levels of high-energy neutron irradiation, with the RV beltline region having the most limiting (highest) exposure.

In Section B1.2, of the LRAs, the applicant stated that industry operating experience was used to identify aging effects and mechanisms that could challenge the intended functions of systems and structures within the scope of license renewal. The applicant also used the plant-specific deviation reports, NRC information notices, industry reports and manufacturing bulletins to determine the aging effects applicable to RV components. From these activities, the applicant has identified in Section 3.1.2 of the LRAs the following aging effects applicable to RV subcomponents that require management:

- cracking
- loss of material ,
- loss of preload
- reduction in fracture toughness

With respect to cracking, the RV and its subcomponents may be subject to this aging effect from fatigue or primary water stress corrosion cracking (PWSCC). Fatigue may be caused by large cyclic changes in stress as a result of thermal transients during service. PWSCC in stainless steels may be initiated by off-normal chemistry of the primary coolant together with the presence of tensile stresses in the reactor vessel. Loss of material may occur in all types of material as a result of coolant action at elevated temperature. However, more severe loss of material occurs in carbon and low-alloy steel components if leaking primary coolant forms concentrated boric acid which can attack external surfaces which are exposed to air. Bolting is susceptible to loss of preload if they and/or washers undergo stress relaxation at elevated service temperatures. This, in turn, could lead to coolant leakage past seals between bolted surfaces. Long-term service at elevated temperature may cause loss in fracture toughness of CASS components, and neutron irradiation will also cause losses in fracture toughness of RV components. OF particular concern is the RV itself because of its role in maintaining reactor coolant levels around the core and core internals.

NRC Bulletin No. 88-09 and Information Notice No. 87-44 revealed that flow-induced vibration wear (i.e., thinning) of the thimble tubes resulted in degradation of the RCS pressure boundary and could lead to a potentially non-isolable leak of reactor coolant. The amount of vibration the thimble tubes experience is determined by plant-specific factors such as the gap distance from the lower core plate to the fuel assembly instrument tube, the amount of clearance between the thimble tube and the guide or instrument tube, the axial component of the local fluid velocity, the thickness of the thimble tube, and the moment of inertia of the thimble tube. The staff concluded in the bulletin that the only effective method for determining thimble tube integrity is through plant-specific inspections and periodic monitoring. The staff issued an RAI to obtain clarification from the applicant. In response to RAI Item 3.1.3.2-1, the applicant stated that the loss of material due to wear in thimble tubes is managed by the ISI program - reactor vessel.

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

3.4.2.2.2 Aging Management Programs

The staff evaluation of the applicant's AMPs focused on the program elements rather than details of specific plant procedures. The staff's approach to evaluating each program and activity used to manage the applicable aging effects is described in Section 3.3 of this SER.

In Table 3.1.2-1 of the LRAs, the applicant listed the AMPs that will manage the aging effects associated with the RV subcomponents. They include:

- chemistry control program for primary systems
- boric acid surveillance
- ISI program - reactor vessel
- reactor vessel integrity management

The chemistry control program for primary systems is a set of mitigative activities utilized to maintain water chemistry that is compatible with the materials used in the construction of the reactor vessel and its subcomponents. This program is applicable to subcomponents made from stainless steel, CASS, and nickel-based alloys that are subject to cracking and/or loss of material while exposed to treated water. This AMP is designed to minimize corrosive attack of RV subcomponents by reducing the concentrations of impurities in the primary coolant to within specified levels. This has the added effect on reducing the electrical conductivity of the coolant which also inhibits the electrochemical corrosion processes. The staff's evaluation of this AMP is discussed in Section 3.3.1.4 of this SER. Based on the operating experience, the applicant confirms that there has been no significant degradation in the ability of RV subcomponents to perform their intended functions due to chemistry concerns.

The boric acid corrosion surveillance program was developed in response to Generic Letter 88-05. The program is applicable to carbon and low-alloy steel subcomponents exposed to borated water leakage. The aging effect is loss of material. This program carries out non-destructive examination of the external surfaces of RV subcomponents to check for locations where primary coolant is leaking. Nuts, bolts, and washers are made from carbon or low-alloy steel are susceptible to this type of attack when the leaking coolant concentrates on their surfaces where air is also present. The external surface, visual inspections are performed inside the containment to determine the presence of borated water leakage, which could lead to surface degradation of RV components, specifically near the closure studs, nuts, washers, and the refueling seal ledge. Based on the operating experience, the applicant states that significant borated water leakage has not occurred in the RV components at both stations. However, inspection activities have located minor leakage in certain components and the applicant has repaired leaks that have occurred. The boric acid corrosion surveillance program is discussed in detail in Section 3.3.1.3 of this SER.

The reactor vessel ISI program is applicable to a large number of RV subcomponents made from carbon and low alloy steel, stainless steel, CASS, and nickel-based alloys that are exposed to treated water, air, and borated water. The aging effects for carbon and low-alloy steel subcomponents are cracking and loss of preload in an external air environment. For stainless steel, CASS, and nickel-based alloys, the aging effects are dominated by cracking, with an added aging effect for CASS which is a reduction in fracture toughness. In this program, ASME Section XI inspections are conducted to check for cracking or loss of material. Visual, surface, and volumetric examinations are included for the specific RV subcomponents. This program assures the pressure retaining capability of the RV welds; the studs, nuts, and washers that are used for vessel closure; the surface and attachments on the interior of the vessel; the housings and housing tubes for control rod drive mechanism on the upper head; the incore flux thimbles and guide tubes that penetrate the lower head; and the seal table and fittings. Among the vessel welds included in the scope of license renewal are the head-to-flange weld, the shell-to-flange weld, the nozzle welds, the circumferential and longitudinal (for Surry only) vessel welds, and integrally-welded attachments. The staff's evaluation of this AMP is discussed in Section 3.3.1.13 of this SER. This AMP identifies two additional inspections that are included in the augmented inspection activities in Section B2.2.1 of the LRAs. They are basically enhanced ASME Section XI inspections and include the incore flux thimble tubes in the RV bottom and the control rod drive housings on the upper head.

Since the thimble tubes at Surry are double wall structures, wall thinning is not considered a potential aging effect and therefore, these tubes are examined every other refueling outage. On the other hand, North Anna incore flux thimble tubes are of single-wall construction and hence are examined each refueling outage. The applicant states that as part of this inspection, eddy current examinations of the incore flux thimble tubes are performed to check wall thickness.

In accordance with Generic Letter 97-01, the weld between the CRDM nozzle and the reactor vessel head, and the portion of the nozzle inside the reactor vessel head above the nozzle-to-vessel are susceptible to PWSCC. The staff concluded that if cracks occurred at the vessel head penetrations (VHPs), the cracks would be predominantly axial, the cracks would result in detectable leakage before catastrophic failure, and the leakage would be detected during visual examinations before significant damage to the RV closure head would occur. In addition, circumferential intergranular attack (IGA) associated with the weld between the inner surface of the RV closure head and the CRDM penetration in one of the CRDM penetrations was discovered in a foreign reactor. Westinghouse suggested that all plants control sulfur content in the primary water in order to mitigate this aging effect. During the spring 1996 refueling outage, North Anna inspected some high-stress areas on each outer ring of CRDM penetration of its Unit 1 reactor using eddy current testing and found no indications.

In accordance with the GL 97-01, as part of the augmented inspection activities in Section B2.2.1 of the LRAs, the applicant is committed to perform VT-2 visual inspection of the RV upper head region during every refueling outage for evidence of leakage at mechanical closures. In response to RAI Item 3.1.2.2.2-1 with regard to circumferential cracking of CRD tube, the applicant will incorporate appropriate AMP as the recommendations to this emerging issue are finalized as part of the CLB.

Recent discoveries of cracked and leaking Alloy 600 vessel head penetration (VHP) nozzles at four pressurized water reactors (PWRs) raised concerns about the structural integrity of the VHP nozzles. As a result, the staff issued Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles," which required all PWR addressees to provide a description of the extent of VHP nozzle leakage and cracking detected and, if cracking is identified, a description of inspections, repairs, and other corrective actions taken to satisfy applicable regulatory requirements. The applicant's responses to NRC bulletin 2001-01 are as follows.

North Anna 1: The VHP nozzle inspections were performed during the Fall 2001 refueling outage. No repairs were required.

North Anna 2: The VHP nozzle inspections were performed during the September 2002 refueling outage. The applicant performed a bare-metal inspection on the reactor vessel head and penetrations. The inspection showed indications of leakage from the head penetration nozzles. The applicant performed visual and eddy current inspections of 65 penetrations in the reactor vessel head. They have identified indications in the weld surface of 63 penetrations. Six of the penetrations showed leakage above the head. The applicant plans to replace the reactor vessel head.

Surry 1: The VHP nozzle inspections were performed during the October 2001 refueling outage. Six repairs were required.

Surry 2: The VHP nozzle inspections were performed during the November 2001 shutdown. No repairs were required.

The applicant's LRA annual update letter, dated July 22, 2002, stated that it plans replacing reactor vessel heads for all four Surry and North Anna units. The replacement of reactor vessel heads is currently scheduled to be completed in year 2005.

On August 9, 2002, the NRC staff issued Bulletin 2002-02, "Reactor Pressure Vessel Head and Vessel Head Penetration Nozzle Inspection Programs," which advised the pressurized water reactor owners that visual examination may need to be supplemented with additional inspection methods such as volumetric and surface examinations. The bulletin also advised the pressurized water reactor owners that the inspection methods and frequencies should be demonstrated to be reliable and effective.

The staff is currently reviewing the issues associated with NRC Bulletins 2001-01, 2002-01 and 2002-02. Any future regulatory actions that may be required as a result of those reviews will be addressed by the staff in a separate regulatory action.

In Table B4.0-1, "Licensee Follow-up Action," the applicant committed to follow industry efforts to stay aware of new recommendations (in addition to existing reliance on chemistry control and existing ASME Section XI inspections) regarding inspection of core support lugs. Industry recommendations will be considered by the applicant to determine the need for enhanced inspection. This commitment is reiterated in the Summary for the ISI program -reactor vessel AMP.

The reactor vessel integrity management program is applicable to the carbon and low-alloy steel RV shell, including the cladding. The aging effect is reduction of fracture toughness. This program includes the following activities:

- the irradiation capsule surveillance activity
- the reactor vessel fast neutron fluence calculations
- the analysis to determine the temperature for nil-ductility transition (RT_{NDT}) for the reactor vessel beltline materials
- the analysis to determine the Charpy upper shelf energy (C_VUSE) for the reactor vessel beltline materials
- the analysis to determine RCS pressure-temperature operating limits and low temperature overpressure system (LTOPS) setpoints
- pressurized thermal shock (PTS) screening calculations

The staff's evaluation of this AMP is discussed in Section 3.3.1.14 of this SER. The applicant actively participated in the WOG effort that developed a series of evaluations whose purpose was to demonstrate that the aging effects on RCS components are adequately managed for the period of extended operation.

On the basis of the evaluation of the AMPs identified above, the staff concludes that these AMPs are acceptable for managing the pertinent aging effects and providing assurance that the intended functions of the RV components will be maintained consistent with the CLB throughout the period of extended operation.

The TLAA categories relevant to the RV components are listed in Section 3.1.2 of the LRAs and the staff's assessment of these TLAAs are included in Section 4.0 of this SER. They are:

- Fatigue: This aging effect is a result of cyclic thermal or mechanical transients that result in possible fatigue damage because of the cyclic stresses that it causes. Table 4.1.1 of the LRAs states that the fatigue analyses involve ASME Section III, Class 1 analyses of all RV components. Based on this, for all components except studs (Surry and North Anna) and loop stop valves (North Anna only), the original analyses remain valid for the period of extended operation.

- Tensioning and detensioning of studs: This fatigue aging effect is caused by thermal transients which cause thermal expansion and contraction of bolts and bolted surfaces, leading to cyclic stresses during service. Table 4.1.1 of the LRAs states that the fatigue analyses involve ASME Section III, Class 1 analyses of all RV components. For studs (Surry and North Anna) and loop stop valves (North Anna only), the analyses have been projected to the end of the period of extended operation.

- Pressurized thermal shock: PTS may occur in a reactor vessel during a severe thermal transient, such as a loss-of-coolant accident or a steam line break. As stated in Section 4.2.2 of the LRA, these events may challenge the integrity of the RV under the following conditions: severe overcooling of the inside surface of the RV followed by high repressurization, significant degradation of the vessel fracture toughness, and the presence of a critical size defect in the vessel wall. The analysis associated with PTS has been projected to the end of the period of extended operation.

- Upper shelf energy: As stated in Section 4.2.1 of the LRA, RV integrity during the period of extended operation is associated with maintaining a minimum USE value as required by 10 CFR 50, Appendix G. Appendix G requires that a utility submit an analysis at least three years prior to the time that the USE of any RV material is predicted to fall below 50 ft-lb, as measured by Charpy V-notch specimen testing. From these data obtained from surveillance tests, the USE may be predicted through the period of extended operation. The analysis associated with USE has been projected to the end of the period of extended operation.

- Pressure-temperature limits: These are heatup and cooldown limit curves that are calculated, using the most limiting value of RT_{NDT}, to determine normal safe operating pressure-temperature limits for the reactor vessel. The embrittling effects of neutron irradiation are most severe at the RV beltline region, and surveillance specimen testing is used to estimate the increase in RT_{NDT} during reactor service. The analysis associated with P-T operating limits has been projected to the end of the period of extended operation.

- Reactor vessel underclad cracking: RV underclad cracking was stated in Section 4.3.2 of the LRAs as being first detected in 1971 in a European reactor vessel. It occurred along grain boundaries of the base metal heat-affected zone beneath the stainless steel clad. The analysis for underclad crack growth is performed using fracture mechanics methodologies to check crack growth over the period of extended performance for an assumed set of design transients. This analysis associated with RV underclad crack growth has been projected to the end of the period of extended operation.

3.4.2.3 Conclusions

The staff has reviewed the information on AMPs given in Section 3.1.2 "Reactor Vessel," as supplemented by the applicant's RAI responses. On the basis of this review, 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 functions will be maintained consistent with the CLB throughout the period of extended operation.

3.4.3 Reactor Vessel Internals

The reactor vessel (RV) internals consist of the lower core support structure (including the entire core barrel and thermal shield), upper core support structure, and the incore instrumentation support structures. The lower internals assembly, which may be removed following a complete core offload consists of the core barrel, core baffle, lower core plate and support columns, the thermal shield, intermediate diffuser plate, and bottom support plate. The upper internals assembly is removed during each refueling outage to obtain access to the reactor core, and consists of the top support plate, deep beam sections, upper core plate, support columns, and guide tube assemblies. The incore instrumentation support structures consist of an upper system to convey and support thermocouples penetrating the vessel head, and a lower system to convey and support flux thimbles penetrating the bottom vessel.

The RV internals support the core, maintain fuel alignment, limit fuel assembly movement, maintain alignment between fuel assemblies and control rod drive mechanisms, direct coolant flow past the fuel elements, direct coolant flow to the pressure vessel head, provide gamma and neutron shielding, and provide guides for the incore instrumentation.

As described by the applicant in the LRAs, the design and operating characteristics of the RV internals for the North Anna and Surry plants are similar with the following exceptions. The North Anna 1 RV internals have been modified to change the flow path of the reactor coolant from downflow between the core barrel and baffle plates to an upflow direction. This was accomplished by plugging the core barrel flow holes and creating new holes in the top former plate. The North Anna 2 RV internals were not modified. An intermediate perforated diffuser plate is added between the bottom support plate and the lower core plate in the Surry RV internals to enhance flow uniformity entering the core. The maximum operating temperature of the reactor coolant water at full power is 327.3 °C (621.2 of) for North Anna, and 318.6 °C (605.6 of) for Surry.

3.4.3.1 Summary of Technical Information in the Application

The applicant described its AMR of the RV internals in LRA Section 3.1.3, "Reactor Vessel Internals," as supplemented by RAI responses. The staff reviewed this section of the LRAs 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 applicant confirms that the RV internals for both stations are bounded, with several clarifications, by the description of the RV internals contained in WCAP -14577, Rev. 1-A, "License Renewal Evaluation: Aging Management for Reactor Internals." The staff issued the FSER for WCAP-14577, Rev. 1-A by letter dated February 10, 2001. These clarifications associated with RV internals include the following:

- The topical report assumes that the primary system water chemistry program is in place, and does not recognize this program in the management of loss of material or cracking from stress corrosion. For the aging management review of the RV internals, the chemistry control program for primary systems manages these aging effects.

- The topical report considers wear, which is defined as damage to a solid surface caused by removal or plastic deformation of material by way of mechanical contact characterized by a loss of material during relative motion or sliding, as an aging effect which requires management. In the AMR, the applicant concludes that wear will not result in an aging effect requiring management.

- The topical report includes an evaluation of the flux thimble tubes. The applicant evaluates the effect of aging for this component with the reactor vessel in Section 3.1.2.

- The topical report discusses IASCC and SCC aging mechanisms separately while the AMR of the RV internals combines the discussion of these mechanisms as part of the cracking aging effect.

- The topical report credits the loose parts monitoring program and the neutron noise monitoring program as AMR programs to manage cracking, the loss of material, and the loss of pre-load. The applicant does not credit these programs for managing the effects of aging for the RV internals. Rather the inspection requirements identified in the RV internals inspection are credited.

- The topical report identifies that primary water stress corrosion cracking (PWSCC) can occur in nickel-based alloys that are subjected to high stress. In the AMR of the RV internals, all nickel-based alloys are conservatively treated as being susceptible to PWSCC regardless of the stresses within the subcomponents.

3.4.3.1.1 Aging Effects

As stated in topical report WCAP-14577, Rev. 1-A, the reactor internals perform the following intended functions:

- provide the capability to shut down the reactor and maintain it in a safe shutdown condition
- prevent failure of all non-safety-related SSCs whose failure could prevent any of these functions
- ensure the integrity of the reactor coolant pressure boundary (bottom-mounted instrumentation flux thimbles only)

Specific functions for the individual subcomponents can be defined as:

- provide support and orientation of the reactor core
- provide support, orientation, guidance, and protection of the control rod assemblies
- provide a passageway for the distribution of the reactor coolant flow to the reactor core
- provide a passageway for support, guidance, and protection for incore instrumentation
- provide a secondary core support for limiting the core support downward displacement
- provide gamma and neutron shielding for the RPV

A review of Section 3.1.3 of the LRAs, confirms that the designs of the RV internals for the plants encompass these intended and specific functions.

The RV internals are in contact with borated water, and are exposed to a normal operating pressure of 15.41 MPa (2,235 psig). The operating environment is maintained in accordance with the chemistry control program for primary systems. The SPS and NAS reactor internals were designed to Westinghouse criteria, which were established prior to the issuance of the ASME Code Section III, subsection NG. The Westinghouse criteria contained no TLAAs and used pressure load calculations instead of fatigue calculations.

All RV internals are fabricated from stainless steel, except for the control rod guide tube split pins and the radial support clevis inserts, which are fabricated from a nickel-based alloy.

In the LRAs, Section 3.1.3, the applicant identifies the following applicable aging effects for the subcomponents subject to an AMR:

- cracking of stainless steel (including cast austenitic stainless steel) and nickel-based alloy subcomponents in a treated water environment
- loss of material from stainless steel (including cast austenitic stainless steel), and nickel-based alloy subcomponents in a treated water environment
- loss of pre-load of stainless steel bolting and core barrel holddown spring in a treated water environment
- reduction in fracture toughness of stainless steel (including cast austenitic stainless steel) subcomponents in a high-temperature treated water environment

The applicant also states that dimensional changes due to void swelling is a potential aging effect requiring management. A license renewal industry position on void swelling is being developed. The applicant will follow this issue and evaluate appropriate changes to the RV internals inspection program once an industry position has been established.

Section 2.6.7.2 of topical report WCAP-14577, Rev. 1-A states that the guide tube split pins have experienced SCC. The split pin degradation issue has been addressed on a plant-specific basis either by a complete support pin replacement, or through inspections that demonstrate no degradation. As stated in the LRAs, replacement split pins were installed at Surry 1, but examination of the original split pins revealed no degradation. North Anna 1 did experience a failure of an original split pin. Replacement split pins, with improved heat treatment characteristics, were installed for the North Anna. Based on the favorable split pin examinations at Surry 1 and the North Anna, along with the fact that split pin failures would have no adverse effect on the safety-related functions of the RV internals, the split pins have not been replaced at Surry 2.

3.4.3.1.2 Aging Management Programs

As stated in the LRAs, Section 3.1.3 and Table 3.1.3-1, the applicant identifies the following AMPs for the RV internals:

- reactor vessel internals inspection
- chemistry control program for primary systems

The applicant concluded that these programs would adequately manage the effects of aging so that there is reasonable assurance that the intended functions associated with the RV internals will be maintained consistent with the CLB under all design loading conditions throughout the period of extended operation.