3 AGING MANAGEMENT REVIEW RESULTS

3.0 Common Aging Management Programs

The applicant provided a proposed supplement to the Updated Final Safety Analysis Report (UFSAR Supplement) in Appendix A to the LRA, in accordance with 10 CFR 54.21(d). The purpose of the proposed UFSAR Supplement is to provide an appropriate description of the programs and activities for managing the effects of aging and the evaluation of time-limited aging analyses (TLAAs), so that any future changes to the programs or activities that may affect their effectiveness will be controlled under 10 CFR 50.59. A condition will be included in the renewed license requiring the applicant to include the UFSAR Supplement in the next UFSAR update, required by 10 CFR 50.71(e).

The applicant committed to performing future inspections before the extended period of operation. These commitments are identified in the UFSAR Supplement, submitted pursuant to 10 CFR 54.21(d), as part of the proposed aging management programs. Upon satisfactory completion of these activities prior to entering the extended period of operation (i.e., no later than August 8, 2013 for Unit 2 and ~~June 15, 2016~~ July 2, 2014 for Unit 3), the staff can conclude that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB, as requested by 10 CFR 54.29. A condition will be included in the renewed license requiring completion of these inspection activities before the beginning of the period of the extended operation.

3.0.1 Introduction

This section of the SER contains the staff's evaluation of 22 AMPs that are in Appendix B of the LRA and are referenced as a part of the AMR for two or more of the systems and/or structures. It should be noted that the staff's conclusions on the evaluations of these 21 common AMPs may be predicated on the assumption that they are implemented in conjunction with other AMPs (if more than one AMP is credited by the applicant) as discussed in subsequent sections of this SER for managing the effects of aging of SCs that are subject to an AMR.

In addition in one case the applicant has indicated that the aging management program relied on is consistent with the Generic Aging Lessons Learned (GALL) report, NUREG-1801. The GALL report contains the staff's generic evaluation of the existing plant programs and documents the technical basis for determining where existing programs are adequate without modification and where existing programs should be augmented for the extended period of operation. The GALL report should be treated in the same manner as an approved topical report that is generically applicable. An applicant may reference the GALL report in a license renewal application to demonstrate that the programs at the applicant's facility correspond to those reviewed and approved in the GALL report and that no further staff review is required. If an applicant takes credit for the program in GALL, it is incumbent on the applicant to ensure that the plant program contains all the elements of the referenced GALL program. In addition, the conditions at the plant must be bounded by the conditions for which the GALL program was evaluated. The above verifications must be documented on-site in an auditable form.

3.0.2 Program and Activity Attributes

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 NUREG-1800, "Standard Review Plan for License Renewal," which was issued in July 2001. This SER describes the extent to which the 10 elements, as described in Appendix A of NUREG-1800 (Branch Technical Position, A.1 Aging Management Review Generic), are applicable to a particular program or activity, and evaluates each program and activity against those elements. On the basis of NRC experience with maintenance programs and activities, the staff concluded that conformance with the 10 elements of an AMP, or a combination of AMPs, provides reasonable assurance that an AMP (or combination of programs and activities) is effective at managing an applicable aging effect. The following 10 elements of an effective AMP will be considered in evaluating each AMP used by the applicant to manage the applicable aging effects identified within this SER:

1. scope of 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
10. operating experience

The applicant did not initially describe how the elements involving corrective actions, confirmation process, and administrative controls for license renewal are implemented in Appendix B of the LRA. The staff's evaluation of the applicant's corrective action program, confirmation process and administrative controls was generic and is evaluated separately in Section 3.0.4 of this SER.

3.0.3 Common Aging Management Programs and Activities

3.0.3.1 Flow-Accelerated Corrosion Program

The applicant described the flow-accelerated corrosion (FAC) aging management program (AMP) in Section B.1.1 of Appendix B of the LRA. The AMP is an existing aging management program. The program provides procedures to predict, detect, and monitor wall thinning in piping and fittings due to flow-accelerated corrosion. The applicant stated that the FAC program is based on the EPRI guidelines in NSAC-202L-R2, April 1999, "Recommendations for an Effective Flow-Accelerated Corrosion Program." In addition, a Peach Bottom Atomic Power Station (PBAPS) specification ensures that the FAC program will be implemented as required by NRC Generic Letter 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning."

Preventive or Mitigative Actions: The applicant described the FAC program as a condition monitoring program that identifies loss of material aging effects prior to loss of intended function. The applicant stated that no preventive or mitigative attributes are associated with the FAC program. The staff found this program attribute acceptable because condition monitoring should identify degradation before there is a loss of intended function.

Parameters Monitored or Inspected: The applicant stated that piping and fitting wall thickness reduction could challenge the maintenance of the pressure boundary intended function. Therefore, the applicant performs inspections to monitor the wall thickness of piping and fittings susceptible to FAC-induced loss of material as provided in the FAC program procedures. The procedures of the parameters monitored and inspected are provided below in the discussion of the detection of aging effects and monitoring and trending attributes. The staff found this program attribute adequate because the parameter monitored, wall thickness, should detect the presence and extent of the aging effect. In addition, operating experience EPRI and NRC guidelines support the monitoring of wall thickness to mitigate FAC related ~~and~~ degradations.

Detection of Aging Effects: Periodic ultrasonic inspections are conducted of components susceptible to FAC to validate analytical evaluations. The extent and schedule of inspections ensure that loss of material (wall thinning) of piping and fittings is detected prior to loss of intended function of the piping. The staff requested additional information as to the applicant's approach in identifying the susceptible components and locations to manage FAC. The applicant responded, in a letter to the NRC, dated May 14, 2002, that the susceptible piping systems are divided into two categories: Category 1, which consists of piping systems, or portions of systems, that are susceptible to FAC and have a completed FAC Wear Rate Analysis in CHECWORKS (a computer code developed by EPRI), and Category 2, which consists of piping systems, or portions of systems, that are susceptible to FAC but do not have a completed FAC Wear Rate Analysis in CHECWORKS.

For Category 1 systems, susceptible locations and components are based on CHECWORKS Wear Rate ranking results for each piping system. To the extent practical, varying geometry types (elbows, reducers, tees, etc.) are selected. For Category 2 systems, locations are conservatively selected using a combination of engineering judgment, industry experience, and plant experience. Special consideration is given to such locations as nozzles and tees that are downstream of orifices or have complex geometry.

The applicant stated that components that are susceptible to FAC within the scope of its programs are documented in industry and regulatory reports, such as NRC Information notices, significant operating experience reports (SOERs), and EPRI reports. Plant operating experience is provided through results of previous ultrasonic testing examinations of the subject piping inspections.

The staff found this program attribute acceptable because the applicant's program as described in its LRA should identify the susceptible components and locations to manage FAC and the program activities may be relied upon to provide reasonable assurance that aging effects will be detected before there is a loss of intended function.

Monitoring and Trending: The FAC AMP supplies analytical evaluations using parameters such as pipe material, geometry, hydrodynamic conditions, temperature, pH, and oxygen content to predict wall thickness reduction due to FAC. Inspections of the piping verify the evaluations.

changes to the existing FAC program are required in regard to wall thinning due to erosion/corrosion.

The staff found that the aging management activities described above are based on plant and industry experience. Because the applicant was incorporating operating experience into their program, the staff concluded that the applicant had provided evidence that the effects of aging will be managed so that the structure and component intended functions will be maintained during the extend period of operation.

3.0.3.1.3 UFSAR Supplement

The staff reviewed Section A.1.1 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management associated with flow-accelerated corrosion is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.1.4 Conclusions

The staff concludes that the applicant has demonstrated that the aging effects associated with flow-accelerated corrosion will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement contains an adequate summary description of the program activities associated with flow accelerated corrosion for managing the effects of aging as required by 10 CFR 54.21(d).

3.0.3.2 Reactor Coolant System Chemistry Program

3.0.3.2.1 Technical Information in the Application

The applicant described its Reactor Coolant System (RCS) chemistry program AMP in Section A.1.2 of Appendix A and Section B.1.2 of Appendix B of the LRA. The RCS chemistry activities manage loss of material and cracking in reactor, RPV instrumentation, reactor recirculation, standby liquid control, feedwater, HPCI, RCIC, core spray, RHR, PCIS (RWCU), and main steam systems by monitoring and controlling detrimental contaminants.

The objective of the RCS chemistry program is to optimize the water chemistry so that aging effects, loss of material, and cracking will be minimized.

In Section 3.1 of the LRA, the applicant identified the following mechanical systems that contain the components that are affected by the RCS chemistry program:

- reactor pressure vessel and internals
- reactor pressure vessel instrumentation system
- reactor recirculation system

The details of these systems are described in Section 2.3.1 of the LRA and Sections 3.3, 4.2, 4.3, 7.8, and 7.9 of the ~~Plant~~ Peach Bottom UFSAR.

have a continuous dissolved oxygen monitor on the condensate, feedwater, and reactor water systems. Since under normal operations control rod drive water comes from the condensate system, an additional dissolved oxygen monitor is not provided on the control rod drive water system.

In RAI 3.1-13, the staff also requested information about whether normal or HWC with NMAC is applied at the Peach Bottom plants and about the parameters monitored to assess the effectiveness of this water chemistry. In response, the applicant stated that PBAPS is a HWC plant with NMCA applied. Peach Bottom Unit 2 applied NMCA during Refueling Outage 12 in October 1998 and on Unit 3 during Refueling Outage 12 in October 1999. After the startup following the refueling outage, when chemistry stabilized, HWC was placed in operation under NMCA on both units. Both plants have been operating on HWC since May 1997. The applicant provided tables of parameters and frequencies for monitoring the effectiveness of the NMCA/HWC water chemistry and EPRI BWR Water Chemistry Guidelines limits, including administrative limits which are in accordance with the 2000 revision of the EPRI BWR Water Chemistry Guidelines.

The applicant also stated that PBAPS complies with the recommendations of BWRVIP-62, "BWR Vessel and Internals Project, Technical Basis for Inspection Relief for BWR Internal Components with Hydrogen Injection," by monitoring ECP and the hydrogen-to-oxygen molar ratio to assess the effectiveness of HWC with NMAC applied. As described in BWRVIP-62, PBAPS may not replace its ECP probes when they fail but instead it must use secondary measurements (reactor water dissolved oxygen and HWC hydrogen flow/feedwater flow). Q

The staff finds acceptable the applicant's response about the use of continuous monitoring of dissolved oxygen and the use of hydrogen water chemistry with NMAC at PBAPS, as well as the parameters monitored to assess the effectiveness of this water chemistry because they are in accordance with industry guidelines and provide an effective method of monitoring the water chemistry .

Detection of Aging Effects: The applicant stated that the subject program mitigates the onset and propagation of loss of material and cracking and no credit is taken for detection of aging effects in the affected components. The staff concurs with the applicant's statement.

Monitoring and Trending: The subject program does not monitor or trend age-related component degradation. However, the EPRI BWR Water Chemistry Guidelines (EPRI TR-103515) include guidelines for data collection and trending methodologies for evaluation of reactor water chemistry control parameters. The conductivity is monitored continuously and the chloride and sulfate concentrations are monitored daily. The dissolved oxygen concentration is also monitored continuously. In response to the staff RAI 3.1-13, the applicant submitted information about monitoring of these parameters; the information is presented in this section of the SER in the evaluation of parameters monitored or inspected. The staff finds this response acceptable because the frequency allows timely detection of off-chemistry conditions. In addition, the staff requested that the applicant provide periodic inspections to confirm the effectiveness of the RCS Chemistry program for carbon steel components. This is part of Open Item ~~3.0.3.6.2-1~~ 3.1.3.2.1-1 (see Section ~~3.0.3.6~~ 3.1.3.2.1 and 3.1.4.2.1 of this SER).

three times per week.

Acceptance Criteria: The applicant states that the acceptance criteria for the reactor water chemistry control parameters are based on the EPRI BWR Water Chemistry Guidelines. These guidelines specify the minimum reactor water control parameters (conductivity < 0.30 mS/cm, chlorides < 5 parts per billion (ppb) and sulfates < 5 ppb) during normal power operation. When a parameter has exceeded the guidelines, specify the adequate action level that the plant operator enter. These guidelines also provide the minimum dissolved oxygen concentration (<200 ppb in reactor feedwater/condensate and control rod drive water) for action level during normal power operation. These criteria are acceptable because they are in accordance with industry guidelines that have been proven successful.

Operating Experience: The major aging-related degradation found at Plant Peach Bottom is cracking of stainless steel recirculation and residual heat removal (RHR) system piping caused by IGSCC. Loss of material was found in the high-pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) system, carbon steel steam line drains. Portions of the "304 stainless" steel recirculation system and RHR piping were replaced with more IGSCC-resistant, low-carbon, "316 stainless" steel piping. The HPCI and RCIC steam drain lines were also replaced.

In RAI 3.1-13(b), the staff requested information about the effectiveness of the EPRI BWR Water Chemistry Guidelines (TR-103515). In response, the applicant stated that the RCS water chemistry is maintained in accordance with the recommendations of EPRI TR-103515 that have been developed based on industry experience. These recommendations have been shown to be effective and are adjusted as new information becomes available. Since the pipe replacement and improvements to chemistry activities, the overall effectiveness of RCS chemistry activities is supported by the excellent operating experience of reactor coolant and main steam systems at PBAPS. For example, no IGSCC cracking has been identified in the recirculation system piping since it was replaced in 1985 and 1988. PBAPS implemented the EPRI chemistry guidelines in 1986 and has continued to revise plant procedures as the guidelines are updated. PBAPS uses the BWRVIP program to monitor the condition of reactor vessel internals. An annual summary report is sent to the NRC from the BWRVIP with results of BWR plant inspections.

The staff finds that the plant-specific and industry-wide operating experience confirm the effectiveness of the RCS chemistry program.

3.0.3.2.3 UFSAR Supplement

The staff reviewed Section A.1.2 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.2.4 Conclusions

The staff concludes that the applicant has demonstrated that the aging effects associated with reactor coolant system chemistry will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.3 Closed Cooling Water Chemistry

The applicant described the closed cooling water chemistry AMP in Section B.1.3 of Appendix B of the LRA. This is an existing aging management program. The program provides procedures to monitor periodically and maintain the closed cooling water quality in accordance with the guidelines of EPRI TR-107396, "Closed Cooling Water Chemistry Guidelines." The staff reviewed the applicant's description of the AMP in the LRA to determine whether the applicant has demonstrated that the closed cooling water chemistry AMP will adequately manage the applicable effects for components in the primary containment isolation (PCI) and the emergency diesel generator (EDG) systems during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.0.3.3.1 Technical Information in the Application

In Section B.1.3 of the LRA the applicant stated that the closed cooling water chemistry AMP manages loss of material in carbon steel, aluminum, brass, bronze, and cast iron components and cracking of stainless steel components exposed to closed cooling water in the PCI and the EDG systems. In addition, the closed cooling water chemistry AMP also manage heat transfer reduction for the EDG heat exchanger components. These components in the PCI and EDG systems, their intended functions, the associated environment, the materials of construction, and the aging effect are described in Sections 3.2 and 3.3 of the LRA.

The program provides procedures to monitor periodically and maintain the closed cooling water quality in accordance with the guidelines of EPRI TR-107396, "Closed Cooling Water Chemistry Guidelines." The quality of the closed cooling water is maintained by monitoring and controlling detrimental contaminants and maintaining corrosion inhibitors.

3.0.3.3.2 Staff Evaluation

The staff reviewed the applicant's description of the AMP in the LRA to determine whether the applicant has demonstrated that the closed cooling water chemistry AMP will adequately manage the applicable effects for components in the primary containment isolation (PCI) and the emergency diesel generator (EDG) systems during the period of extended operation as required by 10 CFR 54.21(a)(3).

The staff's evaluation of the closed cooling water chemistry 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 three elements is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

Program Scope: The CCW chemistry AMP manages loss of material and cracking in systems and portions of systems within the emergency diesel generator and primary containment isolation systems subject to a closed cooling water environment by monitoring and controlling detrimental contaminants and maintaining corrosion inhibitors to minimize corrosion. CCW maintaining the intended functions of the systems, structures, and components that may be affected by closed cooling water chemistry, and can reasonably be expected to do so for the period of extended operation.

3.0.3.3.3 UFSAR Supplement

The staff reviewed Section A.1.3 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.3.4 Conclusions

The staff concludes that with the exception of **Confirmatory Item 3.0.3.3.2-1**, that the applicant has demonstrated that the aging effects associated with closed cooling water chemistry will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.4 Demineralized Water and Condensate Storage Tank Chemistry Activities

Based on discussions with the staff during the RAI reviews, Exelon decided to modify the LRA Appendix B.1.4 Condensate Storage Tank Chemistry Activities to include the demineralized water system supply to the standby liquid control system storage tank. The modified AMP includes water chemistry controls applied to the demineralized water system.

In a letter dated May 14, 2002, the applicant described the demineralized water and condensate storage tank (CST) chemistry activities AMP in the revised Section B.1.4 of Appendix B of the LRA. These chemistry activities provide for monitoring and controlling of the CST and demineralized water chemistry using PBAPS procedures and processes based on EPRI TR-103515, "BWR Water Chemistry Guidelines." The staff reviewed the applicant's description of the modified AMP to determine whether the applicant has demonstrated that the demineralized water and CST chemistry activities AMP will adequately manage the applicable effects of aging caused by components exposed to demineralized water or CST water during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.0.3.4.1 Technical Information in the Application

The applicant credits the demineralized water and CST chemistry activities to manage loss of material of carbon steel and stainless steel components and cracking of stainless steel components exposed to CST water or demineralized water in the HPCI, core spray, RCIC, CRD, standby liquid control, demineralized water, and condensate storage system. In addition, the applicant also uses this AMP to manage loss of material, cracking, and heat transfer reduction of carbon steel and stainless steel components of the HPCI gland seal condenser and the RCIC and HPCI turbine lubricating oil cooler together with the PBAPS heat exchanger staff requested the applicant to clarify whether there is a one-time inspection included in this AMP. The applicant was requested to include a one-time inspection or explain the basis for not including a one-time inspection.

In a letter dated May 14, 2002, the applicant stated that PBAPS has operating experience that verifies the effectiveness of these chemistry activities. Piping inspections are routinely performed in the Inservice Inspection (ISI) and FAC programs and have been satisfactory. Much of this piping exposed to CST water or demineralized water is ASME Section XI Class 2 piping, which requires periodic inspections of welds and pressure tests to verify integrity. In addition, the FAC program provides for inspections at several susceptible locations to verify required wall thickness. The applicant stated that the demineralized water and CST chemistry activities are sufficient to adequately manage aging effects of the systems and components exposed to CST water or demineralized water. The routine inspections performed for piping in the condensate storage water environment verify the effectiveness of the program. The staff found the applicant's response acceptable because it is doing periodic inspection of the piping. The staff also agreed that this AMP does not have aging detection capability and that the AMP is designed to maintain a~~nd~~ demineralized water and CST water chemistry environment that will minimize aging effects such as loss of material and cracking.

Monitoring and Trending: The applicant stated that periodic sampling measurements are taken and analyzed, and the data are trended. The minimum frequency of sampling is once per week based on EPRI TR-103515. The staff found the weekly sampling adequate in providing data for trending and that the AMP would provide early indication of chemistry deviations, allowing for timely corrective action. However, as discussed as part of **Open Item 3.0.3.6.2-1**, the staff requested that the applicant verify the effectiveness of the chemistry program through an inspection activity.

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Acceptance Criteria: The specific limits of demineralized water and CST water chemistry are conductivity ($\leq$ 1 μS/cm), chloride ($\leq$ 10 ppb), and sulfate ($\leq$ 10 ppb). The minimum sampling frequency is once a week. These parameters and their maximum levels, and minimum frequency of measurement are based on the values specified in EPRI TR-103515. The staff found these values acceptable because they are consistent with the EPRI guideline which has been developed based on operating experience and has been effective over time with widespread use.

Operating Experience: The applicant stated that components within the scope of license renewal have not experienced any loss of function such as failure of pressure boundary due to exposure to demineralized water or CST water. The aging management review of operating experience did not identify any age-related degradation that required corrective action in a demineralized water or CST environment. The staff found that the applicant demonstrated that the demineralized water and CST water chemistry activities program has been effective in managing the aging effects associated with the systems and components exposed to demineralized water or CST water.

3.0.3.4.3 UFSAR Supplement

The staff reviewed Section A.1.4 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.4.4 Conclusions

The staff concludes that the applicant has demonstrated that the aging effects associated with demineralized water and condensate storage tank chemistry will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.5 Torus Water Chemistry Activities

The applicant described the torus water chemistry activities AMP in Section B.1.5 of Appendix B of the LRA. The staff reviewed the applicant's description of the AMP in the LRA to determine whether the applicant has demonstrated that the torus water chemistry activities AMP will adequately manage the applicable effects of aging caused by components exposed to torus water during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.0.3.5.1 Technical Information in the Application

In Section B.1.5 of the LRA, the applicant identified the torus water chemistry activities AMP as an existing aging management program. The applicant credits the torus water chemistry activities AMP with managing loss of material of carbon steel and stainless steel components and cracking of stainless steel components exposed to torus water in the high-pressure coolant injection (HPCI), core spray, reactor core isolation cooling (RCIC), residual heat removal (RHR), and main steam systems. In addition, the applicant credits the AMP to manage heat transfer reduction of carbon steel and stainless steel RHR heat exchanger components and cracking of stainless steel component supports submerged in torus water.

The torus-grade water quality is monitored periodically and maintained in accordance with station procedures that include recommendations from EPRI TR-103515, "BWR Water Chemistry Guidelines." Purity of the torus water is maintained by pumping the torus water through filters and demineralizers.

Some systems, located in the torus, pass through the surfaces of the torus water and are exposed to a water-gas interface. For some lines, the water-gas interface occurs at both inside and outside diameters of the pipe. The torus water chemistry activities AMP and the torus piping inspection AMP (a new one-time inspection AMP, as described in Section B.3.1 of the LRA), together, manage loss of material at water-gas interface of carbon steel torus piping.

The HPCI has a primary water source from the condensate storage tank, which has demineralized water, with a backup supply of torus water available from the suppression pool. The RCIC system could have a water source from either the condensate storage tank or the pressure suppression pool. Therefore, these components could be exposed to either torus water or demineralized water or both.

these parameters acceptable because operating experience and the EPRI guidelines support the monitoring and control of these parameters to mitigate corrosion-related degradations and to ensure contaminants are not present in the torus water.

Detection of Aging Effects: The applicant stated that the torus water chemistry activities AMP mitigates the onset and propagation of loss of material and heat transfer reduction; however, detection of aging effects is not credited. The staff believes that there should be a one-time inspection to verify the effectiveness of the torus water chemistry control. Therefore, in RAI B1.5-2, the staff requested the applicant to clarify whether there is a one-time inspection included in this AMP. The applicant was requested to include a one-time inspection or explain the basis for not including a one-time inspection.

In a letter dated May 14, 2002, the applicant stated that the PBAPS has operating experience that verifies the effectiveness of the torus water chemistry activities. Piping inspections are routinely performed on these systems in the ISI and FAC programs and have been satisfactory. Most of the piping exposed to torus water is ASME Section XI Class 2 piping, which requires periodic inspections of welds and pressure tests to verify integrity. In addition, the FAC program provides for inspections of several susceptible locations of these systems to verify required wall thickness. The applicant found that the torus water chemistry activities are sufficient to adequately manage aging and that the routine inspections performed on the piping in the torus-grade water environment verify the effectiveness of the program. The staff found the applicant's response unacceptable as discussed as part of Open Item 3.0.3.6.2-1 and agreed that this AMP does not have aging detection capability and that its function is to maintain a torus water chemistry environment that will minimize aging effects such as loss of material and cracking.

Monitoring and Trending: For the torus water chemistry activities AMP, the applicant indicated that periodic sampling measurements are taken and analyzed, and the data are trended. The frequency of sampling is based on EPRI TR-103515, which recommends sampling at least once every quarter. EPRI TR-103515 recommends increased frequencies if chemical ingress is detected or suspected. The staff found the frequency of sampling to be adequate in providing data for trending because it is based on an industry standard for early detection of chemistry deviations, allowing for timely corrective action. However, as discussed, as part of **Open Item 3.0.3.6.2-1**, the staff requested that the applicant verify the effectiveness of the chemistry program through an inspection activity.

Acceptance Criteria: The applicant stated that the specific limits of the torus water chemistry activities AMP are conductivity (< 5 µmho/cm), chlorides (≤ 200 ppb), sulfates (≤ 200 ppb), total organic carbon (≤ 1000 ppb) and turbidity (2-25 ntu). The minimum sampling frequency is quarterly. These parameters and their maximum levels and frequency of measurement are based on the values specified in EPRI TR-103515 for torus/pressure suppression pool. The staff found the applicant's acceptance criteria acceptable because they are consistent with the EPRI guideline which was developed based on operating experience and has been effective over time with widespread use.

The staff also noted that the system description of the HPCI in the UFSAR of the LRA indicates that the HPCI has a primary water source from the condensate storage tank, which has demineralized water with a backup supply of torus water available from the suppression pool. The UFSAR also indicates that RCIC could have a water source from either the condensate water tank or the pressure suppression pool. Therefore, the components of HPCI or RCIC may be exposed to either torus water or demineralized water, or both.

The staff noted that the chemistry parameters and sampling frequency are quite different in the torus water chemistry AMP and the CST water chemistry AMP. The specific limits of the demineralized water chemistry are conductivity (≤ 1.0 μmho/cm), chlorides (≤ ~~2~~0 ppb), sulfates (≤ ~~2~~0 ppb)~~, total organic carbon (< 200 ppb)~~. Daily measurements of conductivity, chlorides, and sulfates are recommended for demineralized water in EPRI TR-103515. Therefore, in RAI B1.5-5, the staff requested the applicant to clarify which of these two AMPs is credited for these systems and provide the supporting justification.

In a letter dated May 14, 2002, the applicant stated that the HPCI and RCIC systems are normally lined up to have their water supply from the CST. In this configuration, most of the piping and components are in the CST water environment. The torus suction component groups and the piping that is inside the torus are always in the torus water environment. This is reflected in Table 3.2.1 of the LRA for HPCI and Table 3.2.4 of the LRA for RCIC.

The aging management review credited the torus water chemistry and CST water chemistry AMPs for the portions of the HPCI and RCIC system component groups that are in the respective environment. The only time that the torus water enters the piping that is normally exposed to the CST water is during a quarterly surveillance test which swaps the suction flow path to the torus for a brief time. After this flow path is proven, the piping is then flushed with CST water to reestablish the normal CST water environment. Also, there is an operating procedure that directs the piping to be flushed with CST water after any operation of the system that used the torus as the water source. The staff found the applicant's response comprehensive and satisfactory. The staff agreed that the aging management review credited the torus water chemistry and CST water chemistry AMPs for the portions of the HPCI and RCIC system component groups that are in the respective environment. The staff found the acceptance criteria acceptable because they are consistent with the EPRI guideline, which has been developed based on operating experience and has proven effective over time with widespread use.

Operating Experience: The torus water chemistry activities AMP is an existing program. The applicant stated that components within the scope of license renewal have not experienced any loss of function such as failure of pressure boundary or structural support due to exposure to torus water. In ~~Appendix A o~~f the ~~LRA~~ UFSAR, the applicant stated that large-capacity passive pump suction strainers have been installed on each RHR suction line and other lines in the suppression pool, via plant modification, in response to NRC I.E. Bulletin 96-03, "Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling Water Reactors."

Because the amount of debris in straainers affects to the quality of the torus water, the staff requested the applicant to address the operating experience of the strainers as well as debris in the torus water in RAI B.1.5-7. In a letter dated May 14, 2002, the applicant stated that the operating experience of the strainers has been excellent. The differential pressure across the strainers is measured quarterly during the operability surveillance test. The data have been satisfactory since the strainers were installed. The inspection for debris in the Unit 3 torus in September 2001 found no measurable buildup of silt or sludge. Based on the applicant's response, the staff found that the torus water chemistry activities have been effective in

(LRA Section B.1.4), Closed Cooling Water Chemistry (LRA Section B.1.3), or Torus Water Chemistry Activities (LRA Section B.1.5), as applicable. Small bore piping has experienced cracking as a result of stress corrosion and thermal cycling resulting from turbulent penetration and thermal stratification. However, as discussed in Section 3.1.3.2.1 of this SER these aging effects were determined to be not applicable for Peach Bottom small-bore Class 1 piping. Therefore, the ISI program is adequate for Peach Bottom small-bore Class one piping.

In response to RAIs B.1.8-1 and B.1.8-2, the applicant stated that the ISI program is not credited with managing the aging effects of ASME Code class piping in several plant systems, including HPCI, core spray, PCIS, RCIC, and RHR. Instead, the applicant stated the aging was adequately managed by Reactor Coolant System Chemistry (B.1.2), Condensate Storage Tank Chemistry Activities (B.1.4), Closed Cooling Water Chemistry (B.1.3), or Torus Water Chemistry Activities (B.1.5), as applicable. These programs provides chemistry controls only and do not include provisions for any inspections to verify the effectiveness of the programs. Water chemistry programs are designed to mitigate aging effects and not designed to confirm that the aging effect has not occurred. Confirmation of the effectiveness of chemistry programs is needed because they may not be effective in managing aging effect particularly in low or stagnant flow areas and lead to unacceptable degradation. Therefore, it is the staff's position that the applicant should perform inspections, through either the ISI program or one-time inspections, which are credited for license renewal, to verify the effectiveness of the chemistry program credited for managing the effects of aging. **This Is Open Item 3.0.3.6.2-1.**

Preventive Actions: The applicant described this AMP as a condition inspection AMP. The applicant did not provide any preventive or mitigation actions for this activity, nor did the staff identify a need for such.

Parameters Monitored or Inspected: The applicant described the parameters to be monitored or inspected per ASME requirements. They are as follows:

A. Raw water and torus water

1. VT-3 visual inspection for corrosion for submerged support members
2. Identification of leakage during flow test and pressure test for monitoring loss of material and cracking for various service water system components exposed to raw water

B. Outdoor

ECW system piping and equipment support members

VT-3 visual inspection for corrosion of ~~components~~ in outdoor environment.

C. Steam

1. Identification of leakage during pressure test for monitoring loss of material and cracking for ASME Class 1 components in the main steam, reactor vessel instrumentation, HPCI, and RCIC systems
2. Visual inspection of valves in the main steam and HPCI systems for corrosion and pressure retaining wall thickness reduction when they are disassembled for maintenance

5. Visual inspection of susceptible ASME Class 1 valves in the feedwater, RCIC, and HPCI systems for loss of material when they are disassembled for maintenance

6. Visual inspection of susceptible ASME Class 1 reactor water cleanup system valves and reactor recirculation system pump casings for loss of fracture toughness when they are disassembled for maintenance

D. Reactor Coolant

1. Monitoring of leakage during pressure test for management of loss of material and cracking for ASME Class 1 components in the reactor recirculation, reactor vessel instrumentation, SBLC, feedwater, RHR, RCIC, core spray, HPCI, and PCIS (reactor water cleanup) systems
2. Visual inspection of ASME Class 1 valves and pumps in the reactor recirculation, RHR, core spray, and PCIS (reactor water cleanup) systems for corrosion when they are disassembled for maintenance
3. Surface and volumetric examinations of reactor pressure vessel studs for cracking
4. Crack monitoring of susceptible ASME Class 1 components in the reactor recirculation, RHR, core spray, and PCIS systems by surface and volumetric examinations of pressure retaining welds and heat-affected zones in piping

E. Borated Water

Monitoring of leakage during pressure test for management of loss of material and cracking for the SBLC system components from suction side of SBLC pumps to RPV injection.

F. Wetted Gas

Monitoring of leakage during pressure test for management of loss of material and cracking for the RCIC and HPCI system components exposed to wetted gas.

The staff finds the parameters monitored to be acceptable because they are linked to the degradation of the system and component intended functions and would adequately detect the presence and extent of the aging effects.

Detection of Aging Effects: The applicant stated that the test techniques, extent, and schedule of the ISI AMP are based on the requirements of ASME Section XI. These are designed to maintain component structural integrity and ensure that aging effects will be detected and repaired before the loss of the intended function of the component. The staff agrees that the applicant's AMP has an adequate inspection schedule, inspection techniques, and inspection scope, and thus the aging effects will be detected before there is loss of component intended function.

Monitoring and Trending: The applicant stated that documentation for comparison with previous and subsequent inspections is maintained in accordance with ASME Section XI, IWA-6000. The staff finds the approach acceptable because comparison with previous and subsequent inspections would provide data for trending and provide predictability of the extent of degradation so timely corrective or mitigative actions are possible.

Acceptance Criteria: The applicant evaluates degradation detected during tests or inspections in accordance with ASME Section XI IWB-3000, IWC-3000, or IWD-3000 for Class 1, 2, and 3 components, respectively. Degradations detected in support members are evaluated in accordance with ASME Code Case N-491-1. The staff finds that these criteria are acceptable because they are based on the ASME Code.

Operating Experience: The applicant stated that PBAPS has implemented extensive inspection programs through the ISI program to identify IGSCC. The LRA, however, does not describe the operating experience and the effectiveness of the inspection program in the identification of IGSCC. In RAI B.1.8-4, the staff requested information on the operating experience and the effectiveness of the inspection program in the identification of IGSCC. In a letter dated April 29, 2002, the applicant stated that prior to 1988, cracking attributed to IGSCC was found in stainless steel recirculation and RHR system piping. Portions of the "304 stainless" steel recirculation system, RWCU, and RHR piping were replaced with more IGSCC resistant, low carbon "316 stainless" steel. Subsequent to 1988, IGSCC has been identified in the RWCU system, core spray downcomer piping, core shroud, and jet pump riser piping. The identified cracking was dispositioned as meeting the applicable acceptance criteria either by repair or by analysis. The applicant stated that the ISI program, including the augmented inspections to address GL 88-01, has been effective in identifying IGSCC prior to loss of system intended functions. The staff finds that the plant operating experience has demonstrated the effectiveness of the AMP, and that the applicant has incorporated lessons learned from operating experience into the development of this program.

3.0.3.6.3 UFSAR Supplement

The staff reviewed Section A.1.8 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.6.4 Conclusions

The staff concludes that, with the exception of Open Item 3.0.3.6.2-1, the applicant has demonstrated that the aging effects associated with the ISI program will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.7 Primary Containment Inservice Inspection Program

The applicant described the primary containment ISI program in Section B.1.9 of Appendix B to the LRA. The applicant credits the program to manage loss of material in the primary containment for Class MC pressure-retaining components, their integral attachments, and Class MC component supports, and loss of sealing for the drywell internal moisture barrier at the juncture of the containment wall and the concrete floor. The staff has reviewed this section of the application to determine whether the applicant has demonstrated that the effects of aging will be adequately managed by the ~~ISI~~ program during the extended period of operation as required by 10 CFR 54.21(a)(3). primary containment

3.0.3.7.1 Technical Information in the Application

In its description of the program, the applicant indicated that the containment ISI program provides for inspections that manage loss of material in the primary containment for Class MC pressure-retaining components, their integral attachments, and Class MC component supports; and loss of sealing for the drywell internal moisture barrier at the juncture of the containment wall and the concrete floor. The applicant further indicated that the program complies with subsection IWE of ASME Section XI, 1992 Edition including 1992 Addenda, in accordance with the provisions of 10 CFR 50.55a, and is implemented through a PBAPS specification. The applicant stated that Class MC support inspection meets the support examination criteria established by Code Case N-491-1.

The applicant also addresses the 10 elements of a typical AMP, as relevant to the Primary Containment ISI program. These elements are discussed in Section B.1.9~~X~~ of the LRA.

The applicant concludes that on the basis of compliance with industry standards and operating experience, the primary containment ISI program will continue to adequately manage the identified aging effects such that the primary containment intended functions will be maintained consistent with the CLB for the period of extended operation.

3.0.3.7.2 Staff Evaluation

The staff evaluation of the primary containment ISI program focused on how the ISI activities manage aging effects through the effective incorporation of the following 10 elements: scope of program, 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 indicated that the corrective actions, confirmation process, and administrative controls part of the site-controlled quality assurance program. The staff's evaluation of these three elements is provided separately in Section 3.0.4 of this SER. The remaining seven elements are evaluated below.

Program Scope: The primary containment ISI program manages loss of material in pressure boundary components and supports of the drywell, pressure suppression chamber, and vent system. The components monitored in the drywell are the shell, head, control rod drive removal hatch, equipment hatch, personnel airlock, access manhole, inspection ports, and penetration sleeves. The components monitored in the pressure suppression chamber are the shell, ring girders, access hatches and penetrations. The components monitored in the vent system are the vent lines, vent header with downcomers, downcomer bracing, and vent system supports. The primary containment ISI program also manages loss of sealing for the moisture barrier inside the drywell at the juncture of the containment wall and the concrete floor.

The structural components included in the scope cover the essential pressure-retaining components of the containment structure. However, the LRA was not clear as to whether the program includes the examination and testing of the pressure retaining bolts associated with the primary containment components (e.g., equipment hatch, drywell head). In RAI B.1.9-1 the staff requested clarification concerning the examination and the testing of bolts. In response, the applicant stated that the visual examination of pressure retaining bolts is in accordance with IWE-3510.3, and testing of the bolts ~~will be part of~~ is in accordance with Appendix J, Type B tests.

The staff considers the scope of the program adequate and acceptable, as the applicant will perform visual examination of the pressure retaining bolts in accordance with the requirements of IWE-3510.3 and confirm the bolts pressure retaining capacity during Type B testing as required by Appendix J on the basis of conformance with the ASME standard.

or failure of the moisture barrier inside the drywell due to the loss of sealing has occurred at PBAPS. The development process for the ASME Code that forms the basis for the primary containment ISI program includes review and approval by industry experts, thereby assuring that industry data has been considered.

To get a better understanding of the applicant's procedures and criteria, in RAI B.1.9-5 and B.1.9-6 the staff requested additional information regarding the PBAPS operating experience related to the degradation of the tori. In letter dated April 29, 2002, the applicant provided the following summary.

> PBAPS examination program for wetted and submerged surfaces on the interior of the suppression chamber (torus) in both units was established in 1991. Underwater visual examinations were performed on the interior torus surfaces, and pit depth measurements were taken on one square foot evaluation areas that were selected in each of the 16 bays, based on having the greatest concentration of deep pits. In conjunction with underwater examinations, ultrasonic thickness measurements were taken on the defined evaluation areas from the outside of the torus at the pitted areas. Examination results showed that the maximum measured pit depth approached a depth of 10% of the shell's wall thickness. The average measured pit depth in unit 2 torus was 25 mils, while the average measured pit depth in unit 3 was 31 mils.
>
> The degradations were dispositioned by a combination of corrective actions and engineering evaluation. The evaluation concluded that the structural integrity of the torus in both units was maintained, and continued operation was justified. The evaluation also established inspection methodology and acceptance criteria for future examinations. These requirements are incorporated in the "augmented" inspection of the torus under the Primary Containment ISI Program.
>
> Water chemistry is determined to be the primary cause of the degradation as evidenced by the reduced rate of corrosion since 1991 when improved water chemistry controls were established. However other factors such as possible loss of protective coatings, lamination or potential flaws in the rolled steel plate, and micro-organisms present in the accumulated sludge may have contributed to the degree of the degradation.
>
> As for location of the degradations, our inspections found the pits to be randomly distributed along the submerged surface of the torus. The worst pits were found is areas where protective coating was lost due to damage during construction or misapplication. These degradations were found near the bottom of the torus at approximately 30-degree angle from the vertical. The area near the strainers was not significantly different from the rest of the torus.

Under operating experience, the LRA states that the rate of ~~depression~~ pressure suppression chamber degradation reduced significantly, following recoating of the torus and improving torus chemistry. In RAI B.1.9-6, the staff requested information about the projected torus wall thickness at the end of the period of extended operation, and whether it was sufficient to the support the CLB. By letter dated April 29, 2002, the applicant provided the response.

3.0.3.7.3 UFSAR Supplement

The staff reviewed Section A.1.9 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.7.4 Conclusions

The staff concludes that the applicant has demonstrated that the aging effects associated with primary containment ISI program will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.8 Primary Containment Leakage Rate Testing Program

The applicant described the primary containment leakage rate testing program in Section B.1.10 of Appendix B to the LRA. The applicant credits the program to manage the loss of material of pressure retaining boundaries of piping and components in a wetted gas environment for the containment atmosphere control and dilution, RHR, and primary containment isolation systems. The applicant also credits the program to manage change in the material properties and cracking of gaskets and O-rings of the primary containment pressure boundary access penetration points. The staff has reviewed the section of the application to determine whether the applicant has demonstrated that the effects of aging will be adequately managed by the ~~ISI~~ program during the extended period of operation as required by 10 CFR 54.21(a)(3). primary containment leakage rate testing

3.0.3.8.1 Technical Information in the Application

In the introductory paragraph, the applicant states: "The PBAPS Primary Containment Leakage Rate Testing Program complies with the requirements of 10 CFR Part 50 Appendix J, Option B. Containment leak rate tests are performed to assure that leakage through the primary containment and systems and components penetrating primary containment does not exceed allowable leakage rates specified in the PBAPS Technical Specifications. An integrated leak rate test (ILRT) is performed during a period of reactor shutdown at a frequency of at least once every 10 years. Local leak rate tests (LLRT) are performed on isolation valves and containment pressure boundary access penetrations at frequencies that comply with the requirements of 10 CFR Part 50 Appendix J, Option B."

The applicant also addresses the 10 elements of a typical AMP, as relevant to the Primary Containment Leakage Rate Testing Program. These elements are discussed below.

Based on the content of the program description, the applicant concluded that there is reasonable assurance that the primary containment leakage rate testing program activities will continue to adequately manage loss of material, change in materials, and cracking of the

The staff finds the adequate applicant's approach to monitoring and trending aging in components within the scope of the BWRVIP reports because it is consistent with the staff approved BWRVIP programs.

Acceptance Criteria: BWRVIP I&E reports provide the basis for Plant Peach Bottom reactor pressure and vessel internals inspection requirements, acceptance criteria, and proper corrective actions. The applicant has incorporated these applicable I&E reports into the Plant Peach Bottom LRA by specific reference. BWRVIP I&E reports applicable to PBAPS RPV and vessel internals components are as follows:

Component	Reference	SER Date	Accession # for SER
Reactor pressure vessel components, nozzle safe ends	BWRVIP-74	10/18/01	ML012920549
Vessel shells	BWRVIP-05	03/07/00	ML003690281
Shroud support and attachments	BWRVIP-38	03/01/01	ML010600211
Shroud	BWRVIP-76	To be completed by 12/31/02	N/A
~~Nozzle safe ends~~	~~BWRVIP-75~~ 4	~~09/15/00~~	~~ML003751105~~
Core support plate	BWRVIP-25	12/07/00	ML003775989
Core ΔP/SLC line and nozzle	BWRVIP-27	12/20/99	ML993630179
Core spray, jet pump riser brace, and other attachments	BWRVIP-48	01/17/01	ML010180493
Core spray lines and spargers	BWRVIP-18	12/07/00	ML003775973
Top guide	BWRVIP-26	12/07/00	ML003776810
Jet pump assemblies	BWRVIP-41	06/15/01	ML011310322
CRDH stub tubes and guide tubes, ICM housing guide tubes and penetrations	BWRVIP-47	12/07/00	ML003775765
Instrument penetrations	BWRVIP-49A	03/31/02	ML021510061
Integrated Surveillance Program Plan	BWRVIP-78	To be completed 2003	N/A
Intergrated Surveillance Program: Implementation Plan	BWRVIP-86	To be completed 2003	N/A

The acceptance criteria for cracking in the feedwater nozzle are presented in the industry report GE-NE-523-A71-0594-A, Revision 1, "Alternate BWR Feedwater Nozzle Inspection Requirements," May 2000. The staff finds that the acceptance criteria, as presented in the referenced BWRVIP reports and in GE-NE-523-A71-0594-A, Revision 1, are acceptable. While the review of BWRVIP-76 and -78 have not been completed PBAPS has indicated by letter dated May 6, 2002, that they will incorporate the approved BWRVIP programs into the aging management activities.

In addition, for open issues between the BWRVIP and NRC, Exelon will work as part of the BWRVIP to resolve these issues generically while the staff's review of BWRVIP-78 and BWRVIP-86 is continuing. And while the proposed ISP addressed by BWRVIP-78 and BWRVIP-86 only applies to the period of the current operating license, the BWRVIP has committed to provide supplemental information to extend the ISP through the period of extended operation, based on the same technical criteria as found in BWRVIP-78 and BWRVIP-86 for the BWR fleet. The staff expects this supplemental information to be submitted in 2002 and 2003.

Although the BWRVIP-78 and -86 reports apply only to the current term, the staff finds that the provisions in these reports, if implemented during the extended period of operation, constitute sufficient actions to manage the aging effects associated with the reactor vessel during the renewal term.

On the basis of these commitments, the staff concludes that the applicant has identified in sufficient detail the actions that will be taken to provide reasonable assurance that aging effects associated with embrittlement of the reactor vessel will be adequately managed for the period of extended operation. The renewed license will be conditioned to require that prior to operation in the renewal term, the applicant will notify the NRC of its decision to implement the ISP or a plant-specific program, and provide the adequate revisions to the UFSAR Supplement summary descriptions of the vessel surveillance material testing program.

Operating Experience: The applicant has made a general statement that the degradations found at Peach Bottom are similar to those reported in the industry and most of them are attributed to cracking. The applicant further states that the program is based on BWRVIP guidelines, which relied on extensive review of applicable industry operating experiences and examination results to develop adequate inspection and evaluation guidelines. The BWRVIP program is an industry-wide effort based on over 20 years of service and inspection experience and is focused on detecting evidence of component degradation well before significant degradation occurs. The BWRVIP inspection and evaluation reports for reactor pressure vessel and internals components were submitted to the NRC for review and approval. These inspection and evaluations reports address both the current and license renewal periods. The applicant further stated that the BWRVIP program was reviewed for its applicability to PBAPS design, construction, and operating experience. Therefore, it was concluded that the BWRVIP inspection and evaluation reports bound PBAPS design and operation.

3.0.3.9.3 UFSAR Supplement

The staff reviewed Section A.2.7 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

The applicant describes the reactor pressure vessel and internals ISI program as an enhanced aging management program in Section A.2.7 of the LRA. The program provides for condition monitoring of the reactor pressure vessel and internals. The program complies with the requirements of an NRC-approved Edition of the ASME Section XI Code, or its approved alternative. The program has been augmented to include various additional requirements, including those from the BWRVIP guidelines, BWROG alternative to NUREG-0619 inspection of feedwater nozzle for GL 81-11 thermal cycle cracking, and GE SIL 462 for examination of the access hole cover. In RAI 3.1-18, the staff requested the applicant to confirm whether all the BWRVIP reports, including all appendices and revisions that are referenced in Sections B.2.7 and B.1.12, will be included in the UFSAR Supplement (Appendix A of the LRA). In response, the applicant stated that Exelon confirms that the BWRVIP reports that are referenced in Appendix B.2.7 will be included in the UFSAR Supplement (Appendix A of the LRA). The staff finds the applicant response to the part of RAI 3.1-18 related to the UFSAR Supplement (Appendix A of the LRA) is acceptable because it adequately described the reactor pressure vessel and internals ISI program.

3.0.3.9.4 Conclusions

The staff concludes that the applicant has demonstrated that the aging effects associated with reactor pressure vessel and internals ISI program will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.10 Inservice Testing Program

The applicant described the Inservice Testing (IST) program in Section B.1.11 of Appendix B to the LRA. The applicant credits the testing under the PBAPS IST program with managing the effects of aging of flow blockages in the emergency service water system (ESW) and emergency cooling water system (ECW) components exposed to raw water. In addition, the program manages heat transfer reduction of the RHR heat exchangers through flow testing of the torus water path. The staff has reviewed Section B.1.11 of the LRA to determine whether the applicant has demonstrated that the effects of aging will be adequately managed by the IST program during the extended period of operation as required by 10 CFR 54.21(a)(3).

3.0.3.10.1 Technical Information in the Application

The IST program that is being credited for license renewal is a portion of the PBAPS IST program. The PBAPS IST program is implemented by a PBAPS specification and provides for inservice testing of Class 1, 2, and 3 pumps and valves in compliance with the ASME O&M Code, 1990 Edition, and 10 CFR 50.55a. The staff reviewed and approved the IST program.

As identified in Chapter 3, Tables 3.2-5, 3.3.6, and 3.3.14, of the LRA, the IST program is credited for managing flow blockages in the ESW and ECW components exposed to raw water and for managing heat transfer reduction for the torus water path through the RHR heat exchangers. ~~The applicant's description of the program addressing the seven program elements is discussed in Section 3.0.3.8.2 of this SER.~~ In Section B.1.11 of the LRA, the applicant concluded that based on the application of industry standards and the PBAPS operating experience, there is reasonable assurance that the IST program will continue to provide a method for early detection of flow blockage and heat transfer reduction of the RHR heat exchangers through flow testing of the torus water path so that intended functions of the components will be maintained consistent with the CLB through the period of extended operation.

3.0.3.10.2 Staff Evaluation

The staff evaluation of the IST program focused on how the activities managed aging effects through the effective incorporation of the following 10 elements: scope of program, 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 indicated that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program pursuant to 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel

Operating Experience: The applicant stated that the IST program complies with the ASME O&M Code. The IST program is reviewed and approved by staff every 10 years. The ASME O&M Code incorporates industry practice and experience. The applicant indicated that system modifications have been made to repair and replace piping and components due to leakage and degrading performance. In addition, corrosion, silting, and clams have been discovered and evaluated through plant work order inspections. RHR heat exchanger leaks, degradation of baffle plate welds, and tube plugging events have been noted. Corrective actions were implemented prior to loss of function.

The staff finds that operating experience demonstrates that the ~~containment~~ IST program has been successful in identifying aging effects. The program has been successful in identifying blockage and heat transfer reduction so that intended functions of the components will be maintained consistent with the CLB through the period of extended operation as required by 10 CFR 54.21(a)(3).

3.0.3.10.3 UFSAR Supplement

The staff reviewed Section A.1.11 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.10.4 Conclusions

The staff concludes that the applicant has demonstrated that the aging effects associated with inservice testing (IST) program will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.11 Maintenance Rule Structural Monitoring Program

The maintenance rule structural monitoring program is described in Section B.1.16 of Appendix B to the LRA. This aging management program is that portion of the applicant's maintenance rule structural monitoring program that is being credited for license renewal. The maintenance rule structural monitoring program provides for condition monitoring of structures and components within the scope of license renewal that are not covered by other inspection programs. The staff reviewed the LRA to determine whether the applicant has demonstrated that the maintenance rule structural monitoring program will adequately manage the aging effects for the components that credit this program throughout the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.11.1 Summary of Technical Information in the Application

Section B.1.16 of the LRA states that the maintenance rule structural monitoring program provides for condition monitoring of reinforced concrete components in the emergency cooling tower exposed to raw water, structural steel components outside primary containment exposed

To be consistent with the commitment made in response to RAIs 3.5-1 and 3.5-2, the applicant needs to clarify that the scope of the maintenance rule structural monitoring program will be revised to include the above concrete and structural steel components, which now credit this program. These additional commitments will require changes to the UFSAR Supplement (Appendix A of the LRA) for the maintenance rule structural monitoring program to add the additional components to the list in the supplement. **This is Confirmatory Item 3.0.3.11.2-1.**

With the addition of the above concrete and structural steel components, response to staff RAIs, the staff finds that the scope of the maintenance rule structural monitoring program is acceptable since it includes a walkdown inspection and aging effects assessment of all structures and components that credit this aging management activity.

Preventive Actions: The applicant identified the condition monitoring as the only inspection activity of the maintenance rule structural monitoring program, and states that no preventive actions are applicable to this aging management program. The staff concurs with this position.

Parameters Monitored or Inspected: Section B.1.16 of the application states that the maintenance rule structural monitoring program provides for a visual inspection of

- emergency cooling tower and reservoir reinforced concrete walls in contact with raw water for evidence of a change in material properties due to leaching of calcium hydroxide
- structural steel components for loss of material
- emergency cooling water outdoor piping support anchors for corrosion
- penetration seals and expansion joint seals for gaps, voids, tears, and general degradation associated with cracking, delamination and separation, and change in material properties

As stated above under Scope of Program, in response to RAI 3.5-1 the applicant committed to manage loss of material, cracking, and change in material properties for all accessible concrete and masonry block structures. To be consistent with this commitment made in response to RAI 3.5-1, the applicant needs to clarify that the parameters inspected for the maintenance rule structural monitoring program will be revised to include inspection of the concrete components, which credit this program, for cracking, loss of material, and change in material properties. **This is part of Open Item 3.0.3.11.2-1.** The additional part of this open item related to the acceptance criteria is discussed below.

For ~~below-grade~~ inaccessible concrete components, the staff has determined that aging management is unnecessary if applicants are able to show that the ~~below-grade~~ soil/water environment is nonaggressive. In RAI B.1.16-1(a), the staff requested that the applicant provide further information regarding the chemistry of the groundwater samples taken at Peach Bottom. In part (b) of RAI B.1.16-1, the staff requested that the applicant describe the provision of the maintenance rule structural monitoring program for inspecting normally inaccessible structures and components. In part (c) of RAI B.1.16-1, the staff requested that the applicant ~~provide the frequency for future groundwater sampling in order to demonstrate that the condition of the below-grade environment for concrete components~~ to describe the provisions of the Maintenance Rule Structural Monitoring Program that ensure that the soil/water environment remains nonaggressive ~~during the period of extended operation~~ (e.g., periodic sampling of groundwater). In response to RAI B.16-1, the applicant stated:

have (1) a bachelor's degree in civil, structural, or mechanical engineering with 2 years of relevant experience or (2) 5 years of civil/structural experience. The staff considers the above qualifications to be adequate for the performance of the walkdowns and evaluation of the findings associated with the maintenance rule structural monitoring program. Therefore, the applicant's response to RAI B.1.16-2 is considered to be adequate.

Operating Experience: The applicant stated that some specific previous maintenance rule structural monitoring aging management experiences include:

1. Effective management of change in material properties due to contact of the emergency cooling tower and reservoir reinforced concrete walls with raw water by the detection and monitoring of calcium hydroxide.
2. Degraded conditions for some penetration and expansion joint seals. Most of the degradation was not attributed to aging effects.

For each of the above findings, the applicant stated that corrective actions were taken before loss of intended function. Based on the previous and ongoing success of the maintenance rule structural monitoring program in detecting aging of components prior to loss of intended function as well as evaluations of inspection findings, the staff finds that the use of this program during the period of extended operation will provide reasonable assurance that the aging effects for the components that credit this program will be managed such that they continue to perform their intended functions, consistent with the CLB, throughout the period of extended operation.

3.0.3.11.3 UFSAR Supplement

The staff reviewed Section A.1.15 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.11.4 Conclusions

The staff concludes that, with the exception of **Open Item 3.0.3.11.2-1**, the applicant has demonstrated that the aging effects associated with maintenance rule structural monitoring program will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement (Appendix of the LRA), with the exception of **Confirmatory Item 3.0.3.11.2-1**, contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.12 Ventilation System Inspection and Testing Activities

2.3
The applicant's Ventilation System Inspection and Testing Activities program is described in Section B.~~1.14~~ of the LRA. This program is credited with managing the potential aging effects of change in material properties in ventilation system components. The staff has reviewed Section B.~~1.14~~ of the LRA of the to determine whether the applicant has demonstrated that the
2.3

effects of aging will be adequately managed by the Ventilation System Inspection and Testing Activities ~~crane inspection activities~~ during the extended period of operation as required by 10 CFR 54.21(a)(3).

3.0.3.12.1 Technical Information in the Application

Section B.2.3 of the LRA states that PBAPS Ventilation System Inspection and Testing Activities consist of inspections and tests that are relied upon to manage change in material properties in ventilation system components. The Ventilation System Inspection and Testing Activities are implemented through periodic surveillance tests and preventive maintenance work orders that provide for assurance of functionality of the ventilation systems by confirmation of integrity of selected components. The aging management review determined that scope of the components covered by these activities will be enhanced to provide added assurance of aging management.

The applicant concluded that the Ventilation System Inspection and Testing Activities assure that change in material properties is managed for fan flex connections and filter plenum access door seals. Based on the periodic inspection and testing and PBAPS operating experience, there is reasonable assurance that the Ventilation System Inspection and Testing Activities will continue to adequately manage the identified aging effects of the components so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

3.0.3.12.2 Staff Evaluation

The staff's evaluation of the Ventilation System Inspection and Testing Activities focused on how the inspection and testing activities manage the aging effects and ensure the intended function of the affected systems through the effective incorporation of the following 10 elements: scope of program, 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 indicated that the corrective actions, confirmation process, and administrative are part of the site-controlled quality assurance program. The staff's evaluation of these three elements is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

Program Scope: The applicant stated that the PBAPS Ventilation System Inspection and Testing Activities include surveillance tests that provide for inspection and leakage testing of the filter plenum access door seals in the standby gas treatment system and the control room ventilation system. These activities also include inspections of fan flex connections for the standby gas treatment system, the control room ventilation system, the battery room and emergency switchgear ventilation system exhaust fans, and the emergency service water booster pump room ventilation supply fans. Ventilation System Inspection and Testing Activities will be enhanced to include inspections of fan flex connections in the diesel generator building ventilation system, the pump structure ventilation system, and the battery room and emergency switchgear ventilation system supply fans. The staff finds that the scope of the program to be acceptable.

Preventive Actions: The applicant stated that Ventilation System Inspection and Testing Activities include the inspections and testing necessary to identify component aging degradation effects prior to loss of intended function. No preventive or mitigative attributes are

Detection of Aging Effects: Outdoor, buried, and submerged components are visually inspected to identify loss of material and cracking aging effects. Outdoor valves are inspected during performance of component maintenance. These inspections provide for detection of external loss of material aging effects. Outdoor insulation jacketing is periodically inspected as part of heat trace testing. The extent and schedule of the outdoor insulation inspections assure detection of loss of material before any jacketing leaks develop.

The excavating procedure will be enhanced to require visual inspection of buried commodities whenever they are uncovered during excavation. The inspection of the external coating, or the base metal if the commodity is uncoated, will detect any external degradation due to aging.

The above ground tank inspection procedure will be enhanced to include periodic visual inspection of the above-ground external surfaces of the CSTs. Inspections during component maintenance of submerged pumps and additional periodic inspections of the ECW pump will detect external casing degradation prior to loss of the pressure boundary function. The staff requested that the applicant address the frequency of inspections of the ECW pump. During a teleconference on August ~~8~~ 9, 2002, the applicant indicated that the ECW pumps are inspected every 10 years. **This is part of Confirmatory Item 3.0.3.13.2-1**. The additional part of this item is related to frequency of RWST inspections and is discussed below.

The inspection of the RWST will be enhanced to periodically perform volumetric inspection of the bottom of the RWST for loss of material as a representative inspection to determine the condition of the underside of the CSTs. The staff requested that the applicant address the frequency of inspections of the RWSTs. During a teleconference on August ~~8~~ 9, 2002, the applicant indicated that the RWSTS are inspected every 4 years. **This is the other part of Confirmatory Item 3.0.3.13.2-1.**

The staff found that these frequencies of inspections, in combination with other monitoring methods in the PBAPS aging management activities, are adequate to detect the aging degradation in a timely manner prior to loss of intended function.

Monitoring and Trending: Inspections of submerged pumps and outdoor valves are conducted as part of the maintenance process. In addition, the ECW pump will be periodically inspected as part of preventive maintenance. Buried commodities will be visually inspected whenever they are uncovered during excavation activities. The inspections of the RWST will be used to determine the condition of the underside of the CST. Degradation identified during the inspections is evaluated in accordance with procedure requirements. Annual inspections of the outdoor piping insulation jacketing and the above-ground exterior surfaces of the CSTs provide detection of corrosion degradation or damage to the jacketing or to the tanks. The staff found the applicant's monitoring approach acceptable because the subject program would provide timely detection of aging degradation and sufficient data for trending.

Acceptance Criteria: Identified loss of material or cracking will be evaluated to provide reasonable assurance that system and component functions are maintained. Indications of component degradation detected during the inspection processes will be evaluated by the engineering organization and the adequate corrective actions will be initiated. Degradation of the refueling water storage tank noted during its examination will result in the CSTs being evaluated for degradation. The staff found the acceptance criteria specified by the applicant to be adequate to ensure the intended functions of the systems, structures, and components.

Operating Experience: Significant external surface degradation of outdoor, buried, or submerged components has not been identified to date at PBAPS except for the ECW pump. The performance lives of the HPSW, ESW, and fire protection pumps are limited by wear of the pump internals. Inspections of the casings during maintenance have not detected significant corrosion degradation and the pumps are recoated following reassembly. The ECW pump is operated less frequently. Therefore, its performance life is dependent on external surface degradation. Enhanced periodic inspections of the pump casing and casing bolts will detect future pump casing corrosion degradation. The staff finds the applicant's operating experience to date supports the conclusion that these activities are effective at maintaining the intended function of the systems, structures, and components that may be served by the outdoor, buried, and submerged component inspection activities, and can reasonably be expected to do so for the period of extended operation.

3.0.3.13.3 UFSAR Supplement

The staff reviewed Section A.2.5 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.13.4 Conclusions

The staff concludes that, with the exception of Confirmatory Item 3.0.3.13.2-1, the applicant has demonstrated that the aging effects associated with outdoor, buried, and submerged component inspection activities will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement (Appendix A of the LRA) contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.14 Door Inspection Activities

The applicant described the Door Inspection Activities program in Section B.2.6 of the LRA. The applicant credits this program with managing the potential aging effects of loss of material due to corrosion and change of material properties of gaskets of doors in the scope of license renewal. The staff has reviewed this section of the application to determine whether the applicant has demonstrated that the effects of aging will be adequately managed by the Door Inspection Activities program during the extended period of operation as required by 10 CFR 54.21(a)(3).

3.0.3.14.1 Technical Information in the Application

Section B.2.6 of the LRA characterizes these activities as managing the aging effects for hazard barriers doors that are exposed to the outdoor environment. The applicant's aging management review determined that these activities needed to be enhanced to include (1) additional doors and (2) inspection for loss of material in hazard barrier doors in an outdoor environment. The applicant stated that the door inspection activities provide for managing the aging effects for gaskets associated with water-tight hazard barrier doors in both outdoor and sheltered environments. The inspection activities consist of condition monitoring of the gaskets associated with water-tight hazard barrier doors on a periodic basis in accordance with PBAPS procedures.

In the evaluation and technical basis discussion of Section B.2.6, the applicant addresses the 10 elements related to the inspection activities. They are discussed in Section 3.0.3.14.2 of this SER.

In summary, the applicant stated: "Based on the PBAPS operating experience there is reasonable assurance that the door inspection activities will continue to adequately manage the aging effects on hazard barrier doors in an outdoor environment and on gaskets associated with water-tight hazard barrier doors in outdoor and in sheltered environments so that the intended functions will be maintained consistent with the CLB for the period of extended operation."

3.0.3.14.2 Staff Evaluation

The staff evaluation of the Door Inspection Activities program focused on how the activities managed aging effects through the effective incorporation of the following 10 elements: scope of program, 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 indicated that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these three elements is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

Though the applicant does not provide cross-references to the aging management review with which these activities are associated, the staff's review of the LRA indicates that these activities are associated with Section 3.5.14 of the LRA.

Program Scope: The door inspection activities provide for inspections and evaluations of hazard barrier doors exposed to the outdoor environment and of gaskets for water-tight hazard barrier doors exposed to the outdoor and sheltered environments. The PBAPS procedures governing the inspections will be enhanced to identify additional doors and to include more inspection parameters linked to loss of material in hazard barrier doors in an outdoor environment.

The applicant excluded the inspection for loss of material for structural components of the doors in the sheltered environment. As the doors are located in various structures and appurtenances, and the ambient environment in the sheltered areas may not be always benign, the LRA does not provide a clear basis for excluding loss of material for structural components in the sheltered environment. The staff requested further information concerning this issue in RAI B.2.6-1. The applicant responded in letter dated April 29, 2002, that it had revised the door inspection activity to include monitoring of hazard barrier doors in a sheltered environment for loss of material due to corrosion. The staff finds the response adequate and the program scope acceptable.

Preventive Actions: The hazard barrier doors inspection activities are condition monitoring activities that utilize inspections to identify aging effects prior to loss of intended function. There are no preventive or mitigating attributes associated with this activity. The staff agrees with the applicant's statement regarding the preventive actions.

Parameters Monitored or Inspected: Hazard barrier doors exposed to the outdoor environment are and will be inspected for evidence of loss of material due to corrosion. Gaskets associated with water-tight hazard barrier doors in an outdoor environment are inspected to detect change in material properties. Gaskets for water-tight hazard barrier doors in a sheltered environment are inspected for evidence of change in material properties and cracking.

The program will monitor the loss of material of carbon water-tight steel doors and degradation and change in properties of ~~seals and~~ gaskets associated with the doors. However, it does not address the operating attributes of the doors, such as hinges and latches, and the operating mechanism of the door. The staff requested information regarding these components in RAI B.2.6-2. The applicant responded in a letter dated April 29, 2002, that door hinges, latches, and operating mechanisms are active components and are not subject to aging management review. The staff agrees that hinges and latches are excluded from management reviews in accordance with 10 CFR 54.21(a)(1). The staff finds the parameters monitored or inspected element acceptable.

Detection of Aging Effects: Inspections for loss of material of water-tight hazard barrier doors and inspections of associated gaskets for change in material properties and cracking are performed and results are documented. Inspections for loss of material of other hazard barrier doors exposed to the outside environment will be performed and the results documented.

The detection of change in material properties cannot be assessed by visual inspection. The staff requested information regarding the method of detecting this aging effect on seals and gaskets in RAI B.2.6-3. The applicant responded in a letter dated April 29, 2002, and provided the following answer:

> Door inspection activities require visual examination of watertight door gaskets for cracks, rips, tears, and other degradations that may cause loss of seal. Although these inspection criteria may not be a direct measurement of the gasket change in material properties, it is a good indicator of the gasket's physical condition and its ability to provide an adequate seal. Gaskets are repaired or replaced if upon examination their condition indicates loss of seal potential.

The staff considered the response acceptable because a visual inspection will provide an indication of the gasket's physical condition. The staff considers the program element detection of aging effects acceptable.

Monitoring and Trending: The door inspection activities periodically monitor water-tight hazard barrier doors for loss of material due to corrosion and their gaskets for change in material properties and cracking. In addition, door inspection activities will periodically monitor other hazard barrier doors for loss of material due to corrosion.

The effectiveness of the program in detecting the aging effects depends upon the frequency of inspections. RAI B.2.6-4 requested this information. The applicant provided the following response in letter dated April 29, 2002:

> Door inspection activities are performed on a frequency of 4 years or less. The frequency is consistent with the frequency of PBAPS Maintenance Rule Structural Monitoring Program (B.1.16) and industry practices for implementing the requirements of 10 CFR 50.65 for structures. The frequency is selected to ensure, with reasonable assurance, that aging degradation of hazard barrier doors will be detected before there is a loss of intended functions."

condition of hazard barrier doors will be monitored on a frequency consistent with the

The staff finds the response adequate because the PBAPS Maintenance Rule Structural Monitoring Program ~~will monitor the condition of hazard barrier doors~~.

Acceptance Criteria: Acceptance criteria for hazard barrier doors and gaskets associated with water-tight hazard barrier doors are provided in PBAPS procedures. If an indication or evidence of a degraded condition is found, the information is forwarded to engineering for evaluation to determine if an unacceptable visual indication of loss of material, cracking, or change in material properties exists. The staff considers these generic acceptance criteria adequate for detecting the aging effects.

Operating Experience: A review of the operating experience for hazard barrier doors and gaskets associated with water-tight hazard barrier doors found no degraded conditions due to loss of material, change in material properties, or cracking that resulted in loss of intended function. Corrosion on hazard barrier doors was found in a few instances, mainly on those doors with one face exposed to an outdoor environment. This condition was typically due to drainage problems that allowed the water to run toward the door rather than away from it. Corrective actions were taken to eliminate the drainage problem and door degradation prior to loss of intended function. There were a few instances of water-tight door gasket replacements. The cause, in most cases, was manmade. Plant documentation cited a few instances of debris within the gasket folds preventing door closure. Debris was removed and gaskets inspected with no detrimental effects observed. The staff finds that the operating experience indicates that the applicant's door inspection and maintenance activities will provide reasonable assurance that the intended function of the doors will be maintained.

3.0.3.14.3 UFSAR Supplement

The staff reviewed Section A.2.6 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

The summary description of the door inspection program provided in Section A.2.6 of Appendix A to the LRA does not reflect the additional commitment made by the applicant to include monitoring of hazard barrier doors in a sheltered environment for loss of material due to corrosion. **This Is Confirmatory Item 3.0.3.14.3-1.**

3.0.3.14.4 Conclusions

The staff concludes that the applicant has demonstrated that the aging effects associated with door inspection activities will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that, with the exception of Confirmatory Item 3.0.3.14.3-1, the UFSAR Supplement (Appendix A of the LRA) contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.15 Generic Letter 89-13 Activities

The applicant described the Generic Letter (GL) 89-13 activities AMP in Section B.2.8 of Appendix B of the LRA. The staff reviewed the applicant's description of the AMP in the LRA to determine whether the applicant has demonstrated that the GL 89-13 activities AMP will adequately manage the applicable effects of aging of systems and components exposed to raw water during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.0.3.15.1 Technical Information in the Application

In Section B.2.8 of the LRA, the applicant identified the GL 89-13 activities AMP as an enhanced AMP that will be used by the applicant to manage loss of material and cracking of piping, piping specialities (flow element, strainer screens, and orifice), pump casings, and valve bodies in the high-pressure service water (HPSW), emergency service water (ESW), and emergency cooling water (ECW) systems together with the ISI activities AMP (as discussed in Section B.1.8 of the LRA). The AMP by itself will be used to manage flow blockage and heat transfer reduction of the systems and components mentioned above. The AMP by itself will also be used to manage the aging effects of the RHR heat exchangers, HPSW; and core spray (CS) pump motor oil coolers; high-pressure cooling isolation (HPCI), reactor core cooling isolation (RCIC), and RHR pump room cooling coils; and emergency diesel generator (EDG) jacket, air, and lube oil coolers exposed to raw water.

The Generic Letter (GL) 89-13 activities AMP consists of system and component testing and biocide treatments in accordance with the guidelines of NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment." This AMP will be enhanced to require visual inspections to detect specific signs of degradation, including corrosion, cracking, excessive wear, and Asiatic clams and ultrasonic testing (UT) to detect wall thinning at susceptible piping locations.

3.0.3.15.2 Staff Evaluation

The staff's evaluation of the Generic Letter (GL) 89-13 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

Detection of Aging Effects: The applicant stated that aging effects of loss of material and cracking are detected through component visual inspection. Wall thinning due to loss of material in piping is detected through UT. Aging effects of flow blockage and heat transfer reduction are detected using a combination of system and component performance testing and component visual inspection during disassembly. The staff found the inspection techniques to be adequate for detection of aging effects of loss of material, cracking, flow blockage, and heat transfer reduction prior to loss of component intended function.

Monitoring and Trending: The applicant stated that system and component performance testing, piping UT, and periodic component visual inspections provide for timely detection of aging effects of loss of material, cracking, flow blockage, and heat transfer reduction. Pumps and valves are visually inspected for loss of material, cracking, and flow blockage during component maintenance. Performance and flow tests of heat exchangers are conducted from once every 6 weeks to once every 48 months. Biocide treatment of the ESW and HPSW systems is done once every 6 months. The staff found the applicant's approach to monitoring activities to be acceptable because it is based on methods that are sufficient to predict the extent of degradation so that timely corrective or mitigative actions are possible.

Acceptance Criteria: The applicant stated that engineering evaluations of identified aging degradation, including loss of material, cracking, and flow blockage, are performed to confirm the component's ability to perform its intended function. Semiannual biocide injection into the ESW and HPSW systems is performed per chemistry guidelines regarding concentration and treatment durations. Flow rates and heat removal rates measured from the heat exchanger test are compared with the system requirements specified in the plant procedures. The staff found the acceptance criteria acceptable because they are contained in the chemistry guidelines and plant procedures and are directly relevant to the conditions of the systems and components.

Operating Experience: The applicant stated that prior to the implementation of GL 89-13, corrosion-induced leakage and reduced system performance had occurred primarily in the ESW system. The GL 89-13 inspection activities AMP has detected the presence of corrosion, silting, and clams. Corrective actions were implemented by the applicant. The staff found that the operating experience has been satisfactorily incorporated into the development of this AMP. The GL 89-13 inspection activities AMP has been effective in managing the aging effects and is adequate to detect the aging degradation in timely manner prior to loss of component intended function.

3.0.3.15.3 UFSAR Supplement

The staff reviewed Section A.2.8 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.15.4 Conclusions

The staff concludes that the applicant has demonstrated that the aging effects associated with Generic Letter 89-13 inspection activities will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR

54.21(a)(3). The staff also concludes that the UFSAR Supplement (Appendix A of the LRA) contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.16 Fire Protection Activities

3.0.3.16.1 Technical Information in the Application

The applicant described the Fire Protection Activities program in Section B.2.9 of Appendix B to the LRA. The applicant credits the testing under this program with managing the effects of aging of the fire protection system. The staff has reviewed Section B.~~X.X~~ 2.9 of the LRA to determine whether the applicant has demonstrated that the effects of aging will be adequately managed by the ~~IST~~ Fire Protection Activities program during the extended period of operation as required by 10 CFR 54.21(a)(3).

The purpose of the Fire Protection Activities program is to manage loss of material and fouling of specific components exposed to raw water within the scope of license renewal in the fire protection systems. These activities manage loss of material in sprinklers, which can affect the pressure boundary and spray functions of the sprinklers. These activities also manage fouling of sprinklers, valves at hydrants, and valves at hose racks; fouling can affect the component function. These activities constitute a condition monitoring program that is credited with managing the subject aging effect for brass and bronze materials exposed to a raw water environment.

Fouling is considered an aging effect requiring management for the fire protection systems because of operating experience at Peach Bottom. For the purpose of license renewal, fouling is applicable to the distribution components (sprinklers, hose station valves, and hydrant valves) of the fire protection systems. As indicated by the description of this program, managing fouling of the distribution components ensures that the system is capable of performing its function of supplying fire suppression water through the distribution components. In addition, a one-time test will be conducted to detect loss of material due to selective leaching.

The fire protection ~~activities~~ systems are designed to protect plant equipment in the event of a fire, to ensure safe plant shutdown, and to minimize the risk of a radioactive release to the environment. The fire protection system relies on fire water supply, including sprinklers, ~~Halon suppression~~, fire dampers, RCA oil collection, alternate shutdown, safe shutdown, and fire detection and protection. Individual components relied upon for alternate shutdown and safe shutdown were screened with their respective systems. The screening for fire detection and protection electrical and instrumentation and controls is discussed in Section 2.5 of the LRA.

Fire protection components that are subject to an aging management review include the ~~raw water tanks,~~ pumps and valves (pressure boundary only), ~~tanks, heat exchangers,~~ hose stations, ~~flame arrestors,~~ sprinklers, strainers, orifices, piping, tubing, and fittings. The intended functions for fire protection components that are subject to an aging management review are pressure boundary integrity, ~~heat transfer,~~ filtration, throttling, fire spread prevention, and spray. A complete list of the fire protection components that require aging management review appears in Table 3.3.7 of the application. Fire extinguishers, fire hoses, and air packs are not subject to an aging management review because they are replaced based on condition in accordance with National Fire Protection Association (NFPA) standards and plant surveillance procedures for fire protection equipment.

3.0.3.16.2 Staff Evaluation

The staff's evaluation of the fire protection inspection activities program focused on how the program manages the aging effect through the effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The applicant indicated that the corrective actions, confirmation process, and administrative controls are part of the site-controlled quality assurance program. The staff's evaluation of these three elements is provided separately in Section 3.0.4 of this SER. The remaining seven elements are evaluated below.

Program Scope: The components within the scope of the Fire Protection Activities program are the sprinklers and fire hydrant valves and hose rack valves of the ~~interior fire protection system and the exterior~~ fire protection system. These components include the diesel-driven fire pump fuel oil system pumps, valves, piping and tubing, buried fire main piping and valves, outdoor fire hydrants, hose connections and hose station block valves, and fire barrier penetration seals, fire barrier doors, and fire wraps exposed to sheltered and outdoor environments.

The scope of fire protection activities will be enhanced to—

- Require additional inspection requirements for deluge valves in the power block sprinkler systems.
- Perform functional tests of sprinkler heads that have been in service for 50 years.
- Inspect diesel-driven fire pump exhaust systems.
- Inspect diesel-driven fire pump fuel oil system flexible hoses.
- Inspect fire doors for loss of material.
- Perform a one-time test of a cast iron fire protection component.

The staff finds acceptable the scope of the components and systems within fire protection activities, including the enhancements.

Preventive Actions: The fire protection activities provide system monitoring, performance testing, and inspections to identify aging effects prior to loss of intended function. There are no preventive or mitigating actions associated with these activities, and the staff did not identify the need for any.

Parameters Monitored or Inspected: The existing fire protection activities provide for visual inspections and/or monitoring of the fire protection piping, sprinklers, and valves:

- Visual inspections of the fire protection system piping, sprinklers, and valves To detect loss of material, cracking and flow blockage.
- Visual inspection of fire pumps for loss of material and flow blockage during corrective maintenance activities.
- Visual inspections of the diesel-driven fire pump fuel oil system pumps, valves, piping, and tubing to detect loss of material and cracking.

- Monitoring of fire protection system pressure to detect leakage of buried fire main piping and valves.
- Flow tests to detect fire protection system blockage and component degradation in buried fire main piping and valves, outdoor fire hydrants, hose connections, and hose station block valves.
- Visual inspections of fire barrier penetration seals, fire barrier doors, and fire wraps to detect changes in material properties, cracking, delamination, separation, and loss of material.

Fire protection activities will be enhanced to include:

- Power block deluge valve visual inspection requirements to include examinations for loss of material, cracking, and flow blockage.
- Functional testing for flow blockage of sprinkler heads that have been in service for 50 years.
- Visual inspections to detect loss of material of the diesel-driven fire pump exhaust system.
- Visual inspections to detect a change in material properties of the diesel-driven fire pump fuel oil system flexible hoses.
- Visual inspections of fire doors for loss of material.
- Testing of a cast iron fire protection component to detect loss of material due to selective leaching.

In RAI B 2.9-1, the staff asked the applicant to discuss its inspection plans for the sprinkler heads at Peach Bottom during the current licensing term as well as during the period of extended operation. In its response, the applicant stated that testing will comply with the frequency requirements of NFPA-25, Section 2-3.1. However, for Peach Bottom, the applicant will perform the test only twice. Peach Bottom received the construction permit on January 31, 1968; therefore, the earliest that the first sprinkler test is required is 2018, and the next sprinkler test is required in 2028. Unless another 20 year extension is proposed, there will not be a third test. The staff finds the applicant's response acceptable because the applicant will perform two sprinkler inspections which is consistent with the staff's interim staff guidance position (ISG), ISG-4 (Letter to Mr. Alan Nelson of NEI dated January 28, 2002).

The staff noted that the applicant is committing to inspect the diesel-driven fire pump flexible hoses, but has not provided the kind of details regarding the inspection activities that were provided for the EDG fuel oil system flexible hoses. Therefore, the staff cannot conclude that the inspection activities for the diesel-driven fire pump fuel oil system flexible hoses provide adequate aging management. The applicant needs to provide information for the fire oil pump fuel oil flexible hoses comparable to that provided for the EDG flexible hoses. **This is part of Open Item 3.0.3.16.2-1.** Additional parts of this open item are discussed below under detection of aging effects, monitoring and trending, and acceptance criteria.

The staff finds that the parameters monitored as discussed above will permit timely detection of the aging effects and are, therefore, acceptable, with the exception of the open item discussed above.

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applicant's response to RAI 3.3-8, as described below. The staff requires that portions of the fire protection suppression piping that are exposed to water be evaluated for wall thickness. By letter dated July 29,2002, the applicant revised the inspection program to include volumetric examination of the fire protection piping at vulnerable locations in order to evaluate wall thickness and detect loss of material. With this revision, the inspections of fire protection piping to detect wall thinning due to internal corrosion are consistent with the interim staff guidance position, ISG-4 (Letter to Mr. Alan Nelson of NEI dated January 28,2002). Therefore, the staff finds the inspections reasonable and acceptable.

In RAI B 2.9-4, the staff asked the applicant to discuss the inspection activities at Peach Bottom to provide the reasonable assurance that the intended function of below-grade fire protection piping will be maintained consistent with the CLB for the period of extended operation. In its response, the applicant stated that the existing fire protection system activities provide for monitoring of fire protection system pressure to detect pressure boundary leakage of buried fire main piping and flow tests to detect fire protection system blockage and component degradation in buried fire main piping. Additionally, LRA Appendix B.2.5 indicates that the excavating procedure will be enhanced to require visual inspection of buried commodities whenever they are uncovered during excavation. The scope of this aging management activity includes buried commodities in fire protection system. The applicant inspected two buried piping sections in 2001. For these sections, the internal and external coating was good. One section was tested for selective leaching. The results showed no evidence of selective leaching. These sections have been in operation for 25-30 years. Based on a review of the applicants inspection and test results, as well as operational experience, as discussed above, the staff finds that the existing fire protection system activities will manage degradation of the buried fire main piping.

The staff finds that the detection of aging effects as discussed above is acceptable with the exception of the visual inspection of the diesel-driven fire pump fuel oil system flexible hoses. **This is part of Open Item 3.0.3.16.2-1.**

Monitoring and Trending: Existing fire protection activities provide for the following monitoring and trending activities:

- Sprinkler systems are functionally tested for flow blockage on a periodic basis.
- Fire main flow testing, and hydrant flushes and inspections, are performed on a periodic basis.
- The diesel-driven fire pump fuel oil system is visually examined for loss of material and cracking on a periodic basis.
- Fire main pressure is continuously monitored for leakage.
- Specified sample quantities of fire barrier penetration seals are inspected every 24 months with the entire population being inspected every 16 years for change in material properties, cracking, delamination, and separation.
- Fire wraps on structural steel and on electrical raceways are periodically visually inspected for change in material properties and loss of material.

Enhancements to fire protection activities will provide for the following monitoring and trending activities:

- Sprinkler system deluge control valves will be visually inspected for loss of material, cracking, and flow blockage following sprinkler system testing.
- A representative sample of sprinkler heads that have been in service for 50 years will be functionally tested for flow blockage and verification of proper operation.
- The diesel-driven fire pump exhaust system will be visually inspected for loss of material on a periodic basis.
- Diesel-driven fire pump fuel oil system flexible hoses will be visually examined for a change in material properties on a periodic basis.
- Fire barrier doors will be visually inspected for loss of material on a periodic basis.
- If the one-time test yields unfavorable results, the scope will be expanded to other components, based upon engineering evaluations.

Fire protection testing and inspections are performed in accordance with controlled plant procedures. Any degradation identified during testing and component inspections is evaluated in accordance with procedural requirements. When applicable, trending of findings is performed to determine potential long-term impact.

In RAI 3.~~5~~3-8, the staff asked the applicant to identify how the internal condition of this piping will be verified to assure flow capability. By letter dated May 6, 2002, the applicant responded that fouling of the pipe internals is addressed in the LRA under the aging effect of flow blockage. Flow blockage of the wet pipe sprinkler system branch lines is managed by performance of periodic sprinkler system testing. The applicant stated the following:

> There are nineteen wet pipe sprinkler systems in the scope of license renewal at PBAPS. Alarm device tests are performed on all of these systems. The alarm device test can be performed by opening the alarm test valve or by opening the inspector's test valve, and then verifying proper actuation of the alarm pressure switch within the prescribed time. In addition, a main drain test is performed which verifies unobstructed flow to the wet pipe sprinkler system.
>
> For all the wet pipe sprinkler systems, an alarm test is performed by opening the alarm test valve and verifying proper alarm actuation. An additional alarm test is performed on five of the wet pipe sprinkler systems by opening the inspector's test valve that is located at the most distant point in the sprinkler system from the alarm valve, and again verifying proper alarm actuation within the prescribed time. The inspector's test valve is opened to allow water to exit the system, resulting in observable flow and a reduction in sprinkler header pressure. Unobstructed flow from the test valve demonstrates that sprinkler heads and piping are not clogged from corrosion product debris. This test on five of the nineteen wet pipe sprinkler systems is considered a good representation for all nineteen lines since the environment, material and pipe sizes are similar.

The sprinkler system testing performed at PBAPS is similar to the testing that has been reviewed and approved for other plants, such as Hatch. The staff finds the flow test acceptable because it will assure flow capability.
space

The staff finds that the applicant's methodology will provide effective monitoring and trending of the aging effects and is therefore acceptable with the exception of the frequency of the visual inspections of the diesel-driven fire pump fuel oil system flexible hoses. **This is part of Open Item 3.0.3.16.2-1.**

Acceptance Criteria: Tests and inspections for flow blockage, loss of material, cracking, change in material properties, and cracking, delamination, and separation aging effects are conducted in accordance with plant procedures. These procedures contain specific acceptance criteria to confirm the system's ability to maintain required system pressures and flow rates and specific acceptance criteria for components and fire barriers to confirm their functionality. The diesel-driven fire pump engine manufacturer's representative is present during engine inspections and provides standards to ensure that inspections are properly performed and that the material condition of the exhaust and fuel oil system components is acceptable.

Acceptance criteria for fire barrier doors require that there be no visual indication of corrosion. Acceptance criteria for fire barrier penetrations seals and fire wraps require that they exhibit no change in material properties, cracking, delamination, separation, and loss of material. The acceptance criteria take the component material specification into account.

In RAI 3.3-9, the staff asked the applicant to provide the acceptance criteria which would identify unacceptable changes in material properties and the bases for these criteria. In its response dated May 6, 2002, the applicant stated the following:

> Change in material properties aging effect is specified in Table 3.5-14 of the LRA for materials, which are used for the following component groups:
>
> - Fire Barrier Penetration Seals
> - Other Hazard Barrier Penetration Seals
> - Gaskets for watertight doors
> - FireWraps
> - Expansion Joint Seals
>
> 1. Fire Barrier Penetration Seals. Specified quantities of fire barrier penetration seals are visually inspected as indicated in LRA Section B.2.9, "Fire Protection Activities." Each penetration seal, selected for inspection, is compared to its original installation detail drawing. Inspection and acceptance criteria are indicated on the drawings and depend on seal materials and seal configuration. Specific visual inspection and acceptance criteria for silicone type seals are:
>
>   - Verify silicone seal is in place
>   - Verify there are no voids greater than a depth of 1/4" in the surface of the seal
>   - Verify that shrinkage of seal away from items which penetrate the seal (cables, conduits, pipe, tubing, etc.) is less than 1/8" and no deeper than 1/4"
>   - Verify that shrinkage of seal away from penetration surface (concrete or embedded sleeve) is less than 1/8" and no deeper than ¼"

Visual inspection and acceptance criteria for grout/cement type seals are:

- Verify grout seal is in place ✓
- Verify shrinkage of the grout away from the penetrating items is less than 1/8" and no deeper than ½" ✓
- Verify shrinkage of the grout away from the penetration surface is less than 1/8" and no deeper than ½"
- Verify there are no cracks wider that 1/8" in the surface of the seal
- If an existing void or crack is greater than ½" deep, verify that the depth of sound grout is a least 8"

Similar inspection and acceptance criteria are specified for other fire barrier penetration seal types to ensure their fire protection intended function is maintained. It is relevant to note that PBAPS operating experience has not identified age-related degradation of fire barrier penetration seals. Instead, the materials have proven to be age independent, consistent with NRC letter SECY-96-1 46, 'Technical Assessment of Fire Barrier Penetration Seals in Nuclear Power Plants" findings.

2. Other Hazard Barrier Penetration Seals: These seals are monitored as a part of the specific hazard barrier (i.e. flood, HELB,. etc.) performed in accordance with the PBAPS Maintenance Rule Structural Monitoring Program (B.1 .16). The seals are inspected for separation gaps, voids, tears or general degradation by qualified evaluator or inspector (See Response to RAI B.1 .16-2). Inspection results are classified as "acceptable", "acceptable with deficiencies", or "unacceptable" based on whether the hazard barrier can perform its intended function considering the condition of the seal. Conditions that are classified "acceptable with deficiencies" and "unacceptable" are evaluated, documented and subject to corrective action.

3. Gaskets for watertight doors: Door inspection activities (B.2.6) require visual examination of watertight door gaskets for cracks, rips, tears, and other degradations that may cause loss of seal. Although these inspection criteria may not be a direct measurement of the gasket change in material properties, it is a good indicator of the gasket's physical condition and its ability to provide an adequate seal. Gaskets are repaired or replaced if upon examination their condition indicates loss of seal potential.

4. Fire Wraps: Fire wrap material is used for encapsulation of electrical raceways, for coating of steel beams, and cable tray covers.

Fire protection activities (B.2.9) require visual inspection of encapsulated electrical raceways for defects that include water damage, shrinkage of material, holes, punctures, gaps, cracks, and physical damage to the encapsulation surface. Inspection results are classified as satisfactory (no defects) or unsatisfactory. When encapsulation is determined to be unsatisfactory, compensatory actions per the PBAPS Technical Requirements Manual are established pending completion of the corrective action. Similar inspection and stated that part of the evaluation may include NDE examinations, as warranted. The staff found the description of the detection of aging effects reasonable and therefore acceptable.

Monitoring and Trending: The applicant stated that the periodic component visual inspections and cleaning are conducted as part of HPCI and RCIC turbine inspections, and provide for timely detection of loss of material, cracking, and heat transfer reduction prior to loss of intended function. Section A.1.2.3.5 of NUREG-1800 states that it is necessary to confirm that the next scheduled inspection will occur before a loss of SC intended function. Therefore, the staff requested additional information from the applicant concerning the schedule for the periodic component visual inspections and cleaning as part of the HPCI and RCIC turbine inspections and the justification for the inspection interval.

The applicant responded, in a letter to the NRC dated May 14, 2002, that the HPCI and RCIC turbine maintenance is performed every 8 years and this frequency is based on plant-specific operating and maintenance experience with the HPCI and RCIC turbines. The component inspections are scheduled as part of the turbine maintenance. The staff found the applicant's approach to monitoring activities to be acceptable because it is based on methods that are sufficient to predict the extent of degradation so that timely corrective or mitigative actions are possible.

Acceptance Criteria: Engineering evaluations of identified aging degradation, including loss of material, cracking, flow blockage, and loss of heat transfer aging effects, are used to confirm the ability of the component to perform its intended functions. Visual inspections of each of the subject heat exchangers are conducted by the applicant to detect fouling. If any type of degradation is found, the applicant takes further action via its corrective action program. The staff requested clarification regarding inspection procedures used to determine acceptability of the heat exchanger tubes. During a teleconference on August 6, 2002, the applicant indicated that the subject heat exchangers are very small heat exchangers and that all tubes are ~~fully disassembled~~ throughly cleaned and visually inspected. In addition, the applicant sited various inspection procedures that are used. **This is the other part of Confirmatory Item 3.0.3.17.2-1.**

The staff requested additional information from the applicant concerning the acceptance criteria for fouling management and whether the acceptance criteria include effective cleaning of fouling by organisms and maintenance of the coating or lining. The applicant responded, in a letter to the NRC dated May 14, 2002, that during maintenance, the tubes are cleaned and verification of effectiveness is accomplished by the turbine operability surveillance test. The applicant stated that these components do not have a coating or lining. The staff found the acceptance criteria specified by the applicant to ensure the intended functions of the SSCs which are inspected as a result of the heat exchanger inspection activities is adequate.

Operating Experience: The applicant stated that the heat exchanger inspection activities implement inspection and cleaning of heat exchangers. The applicant concluded that the PBAPS operating experience review identified no loss of pressure boundary integrity or heat transfer capability for these components as a result of aging degradation. The staff concludes that the aging management activities described above are based on plant experience. The staff agreed that these activities are effective at maintaining the intended function of the

Periodic cleaning of oil tanks is performed as part of the emergency diesel generator inspection activities (as discussed in Section B.2.4 of the LRA). The emergency diesel generator fuel oil storage tanks are drained and cleaned every 10 years. Residual fuel oil and sludge is removed, and the tank is washed with a cleaning solution and finally wiped until clean and dry. Tank wall thickness measurements are also taken, with no loss of wall thickness identified to date. The emergency diesel generator day tanks are periodically drained and the interiors of the tanks are visually inspected.

The HPCI lubricating oil storage tank is periodically drained, cleaned, and inspected as part of the HPCI turbine maintenance. This activity is performed as part of the HPCI and RCIC turbine inspection activities (as discussed in Section B.2.10 of the LRA). The bottom of the diesel-driven fire pump fuel oil storage tank is sampled for water annually ~~every 92 days~~. This tank is located indoors in a sheltered environment, so there are no significant aging effects at the tank external surfaces. Frequent oil sampling precludes significant accumulation of water inside the tank. The oil sampling for the presence of water and contaminants is an adequate activity for managing loss of material of the carbon steel tank in a fuel oil environment.

The sampling activities of the diesel-driven fire pump fuel tanks are intended to detect accumulation of water and contaminants and thereby preclude corrosion within the tanks, similar to the emergency diesel generator fuel oil tanks sample activities. The four EDG fuel oil storage tanks, four EDG fuel oil day tanks, diesel fire pump fuel oil storage tank, and diesel fire pump fuel oil day tank are all constructed of carbon steel. The EDG fuel oil storage tanks are buried tanks, while the EDG fuel oil day tanks, diesel fire pump fuel oil storage tank, and diesel fire pump fuel oil day tank are located in a sheltered indoor environment. Since the buried environment is considered more aggressive than the sheltered environment, the EDG fuel oil storage tanks are considered to be the most bounding for these carbon steel fuel oil tanks. The applicant stated that if the EDG fuel oil storage tank inspections and wall measurements indicate significant deterioration and/or significant wall thinning, the condition will be documented in a condition report and the cause of the degradation will be determined. Generic implications for similar storage tanks would be considered and additional inspections performed as ~~adequate~~ appropriate.

On the basis of this review and the above additional information provided by the applicant, the staff found these activities adequate to mitigate aging degradation for components exposed to lubricating oil or fuel oil.

Parameters Monitored or Inspected: The applicant described lubricating oil sample analyses to be performed periodically in accordance with an approved PBAPS procedure. The applicant stated that samples are analyzed for attributes such as viscosity, moisture content, and pH. Samples of new fuel oil deliveries are analyzed for water and sediment. Emergency diesel generator and diesel-driven fire pump fuel oil storage tank samples are also periodically analyzed for the presence of water and the particulate content of the fuel. Enhancements to the diesel-driven fire pump fuel oil sampling techniques will be made to improve the methods for detection of water in the fuel. The applicant further stated that sampling activities for water that may be detected in the EDG and diesel-driven fire pump fuel oil systems would be enhanced to include an analysis for microbes. The staff found the description of the parameters monitored or inspected adequate to mitigate aging degradation for components exposed to lubricating oil or fuel oil because of the approved plant procedures and the additional enhancement activities.

Detection of Aging Effects: The applicant stated that testing of lubricating oil for water and contaminants provides a means for detecting loss of material and cracking in the HPCI, RCIC, and EDG systems, and monitors for water in-leakage in the HPCI and RCIC turbine lube oil coolers, HPSW and CS pump motor oil coolers, and the EDG lube oil cooler. The applicant further stated that testing of fuel oil for the presence of corrosion particles or water provides a means for detecting loss of material for fuel oil storage tanks and underground fuel oil piping.

The staff indicated that corrosion may occur at locations in which contaminants may accumulate, such as tank bottoms. Accordingly, the staff believes that the subject AMP needs to effectively ensure that significant degradation is not occurring and the component intended function would be maintained during the period of extended operation; thickness measurements of tank bottom would be an acceptable verification technique. Therefore, the staff requested additional information from the applicant to address the issue of verification and the applicability of one of the applicant's other AMPs (the emergency diesel generator inspection activities AMP as discussed in Section B.2.4 of the LRA) as the corresponding verification program.

The applicant responded, in a letter to the NRC dated May 14, 2002, with the following information. The emergency diesel generator fuel oil storage and day tanks and the diesel-driven fire pump fuel oil storage and day tanks are periodically sampled to confirm that water and contaminants are not accumulating. This frequent sampling precludes long-term accumulation of contaminants at the bottom of these tanks. In addition to sampling, the emergency diesel generator fuel oil storage and day tanks are periodically inspected as part of the emergency diesel generator inspection activities AMP as discussed in Section B.2.4 of the LRA. This aging management activity is cross-referenced with the lubricating and fuel oil quality testing activities in Table 3.3-16 of the LRA. The EDG inspection activity includes wall thickness measurements for the emergency diesel generator fuel oil storage tanks. The applicant stated that this inspection activity confirms the effectiveness of periodic sampling to prevent significant corrosion of the tank bottom.

The staff also requested further information on whether the UT and visual inspection activities described in B.2.4 of the LRA are applied to components in systems other than the EDG. The applicant responded, in the same letter to the NRC dated May 14, 2002, stating that experience to date with the visual inspections of the emergency diesel generator fuel oil day tanks and storage tanks has not revealed significant deterioration. In addition, experience with wall thickness measurements of the emergency diesel generator fuel oil storage tanks has not revealed any significant wall thinning. The applicant further stated that since the EDG tank inspections have validated the effectiveness of the fuel oil sampling activities, it is not considered necessary to perform internal visual inspections of the diesel-driven fire pump fuel oil tanks.

The staff found this program attribute acceptable because the applicant has provided comprehensive information both in the LRA and in the response to the staff's RAIs on the applicant's approach to detecting applicable aging effects and the program activities may be relied upon to provide reasonable assurance that aging effects will be detected before there is loss of intended function.

Monitoring and Trending: The applicant stated that the lubricating oil and fuel oil analyses are regularly scheduled and the results are evaluated to aid in the identification of potential adverse conditions. Section A.1.2.3.5 of NUREG-1800 states that it is necessary to confirm that the next scheduled inspection will occur before a loss of SC intended function. Therefore, the staff requested additional information from the applicant to provide the schedule for the lubricating oil and fuel oil analyses. The applicant responded, in a letter to the NRC dated May 14, 2002, with the following schedule information:

The emergency diesel generator lubricating oil is sampled quarterly (every 92 days).

The emergency diesel generator fuel oil is sampled and analyzed upon delivery to the station, prior to being delivered to onsite storage tanks.

The emergency diesel generator main fuel oil storage tanks are sampled for water accumulation, with any accumulated water analyzed for microbes, every 31 days.

The emergency diesel generator main fuel oil storage tanks are sampled for particulate contamination every 31 days.

The emergency diesel generator fuel oil day tanks are sampled for water accumulation, with any accumulated water analyzed for microbes, every 31 days.

The diesel-driven fire pump fuel oil is sampled and analyzed upon delivery to the station, prior to being delivered to onsite storage tanks.

The diesel-driven fire pump fuel oil storage tank will be sampled for viscosity, sediment, and water accumulation, with any accumulated water analyzed for microbes, ~~every 92 days (quarterly).~~ annually.

HPCI lubricating oil is sampled during the quarterly HPCI pump test.

RCIC lubricating oil is sampled during the quarterly RCIC pump test.

The staff found the applicant's approach to monitoring activities to be acceptable because it is based on methods that are sufficient to predict the extent of degradation so that timely corrective or mitigative actions are possible.

Acceptance Criteria: The applicant stated that the lubricating and fuel oil quality testing activities are performed in accordance with approved PBAPS procedures which contain quantitative and qualitative acceptance criteria. Lubricating oil analysis acceptance criteria are based on deviations from the physical requirements identified in the oil type listing. The acceptability of lubricating oil test results is based upon comparison with new oil values, published data, or previous oil analysis results. Oil is acceptable if viscosity changes by no more than +15% to -10%, percent water is less than or equal to 0.10, and pH is within the required values for the type of oil being analyzed. EDG fuel oil analysis acceptance criteria are contained in the PBAPS Technical Specifications and are based on the requirements of ASTM D2276-78 and ASTM D975-81. A fuel oil testing procedure based on ASTM D975-81 requires that new fuel oil contain no visible water or sediment.

PBAPS Technical Specifications require periodic sampling of the EDG fuel oil for particulates and the presence of water. Tests for particulates use the methods specified in ASTM D2276-78 to provide assurance that the particulate limit of 10 mg/L is not exceeded. Plant diesel-driven fire pump fuel oil tanks. These EDG tank inspection activities confirm the effectiveness of the lubricating and fuel oil quality testing activities AMP.

The staff found that the aging management activities described above are based on plant experience. Because of the review of the information provided in the LRA and the evaluation of the additional information provided by the applicant above the staff agreed that these activities are effective in maintaining the intended function of the systems, structures, and components that may be served by the lubricating and fuel oil quality testing activities, and can reasonably be expected to do so for the period of extended operation.

3.0.3.18.3 UFSAR Supplement

The staff reviewed Section A.2.1 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.18.4 Conclusions

The staff concludes that the applicant has demonstrated that the aging effects associated with lubricating and fuel oil quality testing activities will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement (Appendix A of the LRA) contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.19 One-Time Piping Inspection Activities

In the evaluation of the aging management of the components in the standby liquid control system (SBLC), the staff had concerns about the adequacy of the SBLC system surveillance activities in Section B1.13 of Appendix B of the LRA used by the applicant to manage applicable aging effects of the solution tank. The applicant stated that the surveillance activities monitor the SBLC solution tank liquid level on a daily basis in accordance with a PBAPS procedure. The basis of the staff's concern was that aging management programs are generally of four types: prevention, mitigation, condition monitoring, or performance monitoring, as described in Section A.1.1, "Branch Technical Position of Aging Management Review," of NUREG-1800. An AMP that relies only on liquid-level monitoring (as do the SBLC system surveillance activities) may act as an indicator of throughwall cracks and/or openings that have already developed. It is not an effective indicator of aging degradation already in progress (no matter how extensive) but not actually throughwall. Borated water can induce corrosion and cracking at the tank bottom due to the presence of chlorides, sulfates, and contaminants. Control and monitoring of water chemistry provides an indicator of aging degradation prior to loss of component intended function. A one-time inspection provides a verification of the effectiveness of managing the aging degradation. Therefore, the staff requested additional information from the applicant on (1) why the SBLC system surveillance activities do not include preventive or mitigative actions such as controlling and monitoring the borated water chemistry; and (2) why there is not a verification program such as one-time inspection to ensure that aging degradation is mitigated.

The applicant responded, in a letter to the NRC dated May 14, 2002, that the borated water stored in the standby liquid control solution tank is prepared by mixing an enriched chemical material with demineralized water to form a sodium pentaborate solution. The sodium pentaborate solution provides a relatively mild environment whose pH is slightly basic. The enriched chemical material is purchased as safety-related material under an approved purchase specification. The purchase specification requirements include impurity limits for chlorides, sulfates, and other contaminants that are based on industry standards. Each batch of material is supplied with a certified chemical analysis that typically indicates impurity levels well below the established limits. The water source is demineralized water from the water treatment system, and is subject to water chemistry controls. Since impurities are controlled when preparing the tank solution, and there is no source for contaminants to subsequently enter the closed tank, the level of detrimental contaminants is adequately controlled and aging degradation is mitigated.

In addition, based on discussions with the NRC staff and representatives from Argonne National Laboratory during the RAI reviews and two teleconference calls, the applicant has decided to modify the aging management activities associated with the standby liquid control system. In the same letter to the NRC dated May 14, 2002, the applicant stated that the modified aging management approach for the standby liquid control system includes water chemistry controls applied to the demineralized water system and a one-time inspection of a representative section of standby liquid control system piping. The one-time inspection piping is a new activity. LRA Appendix B.1.13, "Standby Liquid Control System Surveillance Activities," will be deleted. The applicant further stated that this modified approach for aging management of the standby liquid control system is the same approach that is described in NUREG-1803, "Safety Evaluation Report Related to the License Renewal of Edwin I. Hatch Nuclear Plant, Units 1 and 2." The staff's evaluation of the water chemistry controls activities applied to the demineralized water system is discussed in Section 3.0.3.4 of this SER. The evaluation of the one-time piping inspection activities is provided below.

The applicant described the one-time piping inspection activities aging management program in Section B.3.~~X~~4 of Appendix B of the LRA. The one-time piping inspection activities AMP (in conjunction with the demineralized water and condensate storage tank chemistry AMP (Section B.1.4)) is used by PBAPS to manage loss of material and cracking in SBLC system components that contain or are exposed to demineralized water (including borated) or condensate storage water. The staff reviewed the applicant's description of the AMP in the LRA to determine whether the applicant has demonstrated that the one-time piping inspection activities AMP will adequately manage the effects of aging caused by components exposed to demineralized water (including borated water) or condensate storage water during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.0.3.19.1 Technical Information in the Application

The applicant described the one-time piping inspection activities aging management program in Section B.3.~~X~~4 of the LRA. The one-time piping inspection activities is a new activity that will be added to confirm the effectiveness of the water chemistry programs in managing the effects of aging in the standby liquid control system. This activity will consist of a one-time inspection of selected system piping to verify the integrity of the piping and confirm the absence of identified aging effects. The inspections will be condition monitoring examinations intended to verify that existing environmental conditions are not causing material degradation that could result in a loss of intended functions.

3.0.3.19.2 Staff Evaluation

The staff's evaluation of the one-time piping 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 three elements is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

Program Scope: The applicant described the scope of this activity as including piping inspections at a susceptible location in the following systems:

- standby liquid control system
- auxiliary steam system
- plant equipment and floor drain system
- service water system
- radiation monitoring
- RPV instrumentation system
- Reactor recirculation system
- fuel pool cooling system

The staff found the scope of the program to be acceptable because the applicant adequately addressed the components whose aging effects could be managed by the application of this activity.

Preventive or Mitigative Actions: The applicant stated that the piping inspection activities will be condition monitoring activities that identify loss of material or cracking aging effects as applicable for the material and environment. No preventive or mitigating attributes will be associated with the one-time piping inspection activities. The staff considers inspection activities a means of detecting, not preventing, aging and, therefore, agrees that there are no preventive actions associated with the one-time system piping inspection activities.

Parameters Monitored or Inspected: The applicant stated that the one-time piping inspection activities will provide for a one-time inspection to determine whether there has been loss of material or cracking in the subject piping, as applicable for the system material and environment. The inspection activities will confirm the pressure boundary integrity of the piping system. Inspections are performed in accordance with the requirements of the American Society of Mechanical Engineers (ASME) Code, by using volumetric nondestructive examination (NDE) methods. The staff found the applicant's approach following the ASME Code to be capable of adequately detecting the applicable aging effects using the one-time system piping inspection activities.

Detection of Aging Effects: The applicant stated that the one-time piping inspection activities will be undertaken to provide reasonable assurance that there is no loss of material or cracking, as adequate for the system material and environment, that would result in loss of pressure boundary intended function of the piping. Qualified personnel following procedures consistent with the ASME Code will perform the nondestructive examinations. The staff requested the applicant to provide information regarding when this one-time inspection would occur. By teleconference call, on August 8, 2002, the applicant indicated that this one-time inspection will occur before the end of plant life, between the years 30 to 40. **This is a Confirmatory Item 3.0.3.19.2-1.** The staff found the description of the detection of aging effects adequate. The staff found this program attribute acceptable because the applicants approach in detecting applicable aging effects is consistent with ASME Code and the program activities may be relied upon to provide reasonable assurance that aging effects will be detected before there is loss of intended function.

Monitoring and Trending: The applicant stated that the results of the one-time piping inspection activities will be evaluated. The scope and frequency of subsequent examinations will be based on the results of the initial inspections. The staff found the applicant's approach to monitoring activities to be acceptable because it is a new activity and because the results of the initial inspections will be used to determine the scope and frequency of subsequent examinations. Therefore this approach is based on methods that are sufficient to predict the extent of degradation so that timely corrective or mitigative actions are possible.

Acceptance Criteria: The applicant stated that the one-time piping inspection activities acceptance criteria will be used to ensure that there is no unacceptable loss of material or cracking, as applicable for the material and environment of the piping system. Indications of corrosion or cracking will be evaluated by further engineering analysis and, if warranted, additional inspections performed. The applicant further stated that the inspection acceptance criteria will provide assurance that the minimum wall thickness requirements for the piping continue to be met during the period of extended operation. The staff found the acceptance criteria specified by the applicant to be adequate to ensure the intended functions of the systems, structures, and components that may be served by the one-time piping inspection activities.

Operating Experience: The one-time piping inspection activities are new, and therefore there is no operating history associated with these activities. However, these inspection activities will use techniques with demonstrated capability to detect loss of material or cracking. This inspection will be performed utilizing approved procedures and qualified personnel. The staff finds the one-time inspection program acceptable because the results of the initial inspection will be used to determine the scope and frequency of subsequent examinations which are sufficient to predict degradation so that timely corrections actions are possible.

3.0.3.19.3 UFSAR Supplement

The staff reviewed Section A.3.~~3~~4 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.19.4 Conclusions

The staff concludes that the applicant has demonstrated that the aging effects associated with one-time piping inspection activities will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement (Appendix A of the LRA) contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.20 Reactor Materials Surveillance Program

3.0.3.20.1 Technical Information in the Application

The applicant described its reactor materials surveillance (RMS) program in Sections A.1.12 and B.1.12 of the LRA. The reactor materials surveillance program is an existing program at Peach Bottom. It is based on a detailed evaluation of the ~~Plant~~ Peach Bottom Unit 2 and Unit 3 RPV beltline materials. The LRA indicates that the BWRVIP is developing an Integrated Surveillance Program (ISP) for all domestic operating BWRs as allowed by 10 CFR Part 50 Appendix H. The ISP was submitted to the NRC by BWRVIP for review and approval. The NRC approved a 40 year program. Both of the ~~Plant~~ Peach Bottom RPVs are included in the program. The subject program will be incorporated into the ISP, as described in BWRVIP-78.

3.0.3.20.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in the relevant sections of the LRA regarding the applicant's demonstration of the reactor materials surveillance program to ensure that the applicable component aging effects will be managed so that system intended functions will be maintained consistent with the CLB for the period of extended operation.

The staff evaluation of Reactor Materials 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, confirmative 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 three elements is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

Section B.1.12 of the LRA describes the reactor materials surveillance program for ~~Plant~~ Peach Bottom. The reactor materials surveillance program employs the program documented in BWRVIP-78, "BWR Vessel and Internals Project, BWR Integrated Surveillance Program Plan." The staff has approved a BWR intergrated surveillance program for 40 years; but, has not approved a program for 60 years, the extended license renewal period. For open issues between the BWRVIP and NRC, Exelon will work as part of the BWRVIP to resolve these issues generically. When the issues are resolved, PBAPS will follow the BWRVIP recommendations resulting from that resolution. If PBAPS cannot follow the resolution, then PBAPS will notify the NRC in accordance with the BWRVIP commitment (i.e., within 45 days of the NRC approval of the issue). Since the applicant and the BWRVIP have procedures for resolving open items, the response by the applicant is acceptable to the staff. Because the report is not currently approved for the license renewal term the staff will condition the license and this is discussed in Section 3.0.3.9 of this SER.

Program Scope: The objective of the subject program is to monitor the effects of neutron embrittlement on the reactor vessel beltline materials (plates and welds). The staff finds that the scope of the subject AMP is adequate because it applies to vessel shell courses exposed to fluence greater than 10^{17} n/cm^2 (E>1Mev).

Preventive or Mitigative Actions: The subject program is a condition monitoring program. There are no preventive or mitigative attributes associated with the subject program.

Parameters Monitored or Inspected: The subject program monitors Charpy V-Notch 42-Joule (30 ft-lb) transition temperature, upper shelf energy, and neutron fluence consistent with the requirements of ASTM E 185 and 10 CFR Part 50, Appendix H. Since the program monitors the parameters required by the regulations, the parameters monitored by the program are acceptable.

Detection of Aging Effects: The subject program monitors the effects of neutron irradiation embrittlement by evaluating the loss of fracture toughness. This is acceptable to the staff because it allows for detection of the effects of neutron irradiation embrittlement before there is a loss of the component intended function.

Monitoring and Trending: To evaluate whether the reactor materials surveillance program provides sufficient data for monitoring the extent of neutron irradiation embrittlement during the license renewal period, the staff issued RAI 3.1-15 requesting the applicant to provide information about whether the existing Plant Peach Bottom reactor surveillance program will be revised to satisfy the following attributes:

- Capsules must be removed periodically to determine the rate of embrittlement and at least one capsule with neutron fluence not less than once or greater than twice the peak beltline neutron fluence must be removed before the expiration of the license renewal period.

- Capsules must contain material to monitor the impact of irradiation on the limiting beltline materials and must contain dosimetry to monitor neutron fluence.

- If capsules are not being removed from Plant Peach Bottom during the license renewal period, the applicant must supply operating restrictions (i.e., inlet temperature, neutron spectrum, and flux) to ensure that the RPV is operating within the environment of the surveillance capsules, and must supply ex-vessel dosimetry for monitoring neutron fluence.

In addition the applicant has indicated in the subject program that the provisions of the Integrated Surveillance Program (ISP) as described in BWRVIP-78 will be implemented. As part of RAI 3.1-15, the staff requested information about the schedule for implementing the ISP at Plant Peach Bottom and about how the proposed ISP would satisfy the ISP criteria in 10 CFR Part 50, Appendix H, and the attributes discussed above. In response to RAI 3.1-15, the applicant submitted the following information.

The BWRVIP has developed an ISP for 40 years and submitted it to NRC for review and approval. The ISP is documented in BWRVIP-78, "BWR Vessels and Internals Project: BWR Integrated Surveillance Program Plan," issued December 1999, and its companion document, BWRVIP-86, "BWR Vessels and Internals Project: BWR Integrated Surveillance Program Implementation Plan." BWRVIP-78 and BWRVIP-86 were found acceptable for the current term by the NRC as documented in an SER dated February 1, 2002, from Bill Bateman of the NRC to Carl Terry, BWRVIP Chairman. One of the provisions of the ISP is for surveillance capsule material withdrawal and testing during the license renewal period. A revision to these BWRVIP documents to include license renewal is in process and will be submitted to the NRC in the near future. As noted in Section 2.1 of BWRVIP-78, the ISP complies with the provisions of 10 CFR Part 50, Appendix H. The ISP currently provides for 13 capsules to be available for testing during the renewal period for the BWR fleet.

Exelon is aware of the provisions of Appendix H and understands that the RPV must be operated within parametric limits that assure vessel integrity with regard to embrittlement and fracture toughness. However, there is not yet a demonstrated need to provide operating restrictions. Should the ISP be approved by the NRC for 60 years, PBAPS will be bounded by the 13 representative capsules that are available for testing during the renewal period for the BWR fleet.

Exelon plans to implement the provisions of the ISP currently described in BWRVIP-78 and BWRVIP-86. Should the ISP not be approved by the NRC, or should it be modified such that PBAPS is not covered by the ISP, then Exelon will develop a RPV material surveillance program for the period of extended operation. This plant-specific program, if needed, will include the following actions:

- Capsules will be removed periodically to determine the rate of embrittlement and at least one capsule with neutron fluence not less than once or greater than twice the peak beltline neutron fluence will be removed before the expiration of the license renewal period.

- Capsules will contain material to monitor the impact of irradiation on the limiting beltline materials and must contain dosimetry to monitor neutron fluence.

- If capsules are not being removed from PBAPS during the license renewal period, the applicant will supply operating restrictions (i.e., inlet temperature, neutron spectrum, and flux) to ensure that the RPV is operating within the environment of the surveillance capsules, and must supply ex-vessel dosimetry for monitoring neutron fluence.

The staff finds that applicant's response to RAI 3.1-15 acceptable.

Acceptance Criteria: Regulatory Guide 1.99, Revision 2, and ASTM E185 supply the basis for ~~Plant~~ Peach Bottom reactor materials surveillance acceptance criteria. The applicant has incorporated these documents into the LRA by specific reference. Appendix H to 10 CFR Part 50 requires the reactor vessel materials surveillance program to comply with ASTM E185. The staff finds that the acceptance criteria based on Regulatory Guide 1.99, Revision 2, and ASTM E185 are acceptable because they are based on regulatory guidance and regulatory requirements.

Operating Experience: PBAPS Units 2 and 3 have tested surveillance capsules containing plate and weld material, and the results are consistent with Regulatory Guide 1.99, Revision 2, predictions. The staff concludes that the operating experience supports the licensee's program.

3.0.3.20.3 UFSAR Supplement

The applicant describes the reactor materials surveillance program as an existing program in Section A.1.12 of the LRA. The program uses periodic testing of metallurgical surveillance samples to monitor the loss of fracture toughness of the reactor pressure vessel beltline region materials consistent with the requirements of 10 CFR Part 50, Appendix H, and ASTM E185. The applicant does not include a summary of the BWR Integrated Surveillance Program, which it intends to use at Peach Bottom. In RAI 3.1-17, the staff requested the applicant to include information about the BWR Integrated Surveillance Program, which should include reference to BWRVIP reports. In response to this RAI, the applicant stated that Section A.1.12 description has been revised to include information about the BWR Integrated Surveillance Program, which is one alternative that may be used at PBAPS to comply with 10 CFR Part 50, Appendix H. **This is Confirmatory Item 3.0.3.20.3-1.**

The staff reviewed Section A.1.12 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

3.0.3.20.4 Conclusions

The staff concludes that the applicant has demonstrated that the aging effects associated with reactor materials surveillance program will be adequately managed so there is reasonable assurance that the intended functions of the systems and components will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement, with the exception of Confirmatory Item 3.0.3.20.3-1, (Appendix A of the LRA) contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.0.3.21 Torus Piping Inspection Activities

The applicant described the Torus Piping Inspection Activities program in Section B.3.1 of Appendix B of the LRA. The applicant credits this program with managing the aging effects of the carbon steel piping located at the water-air interface in the torus of the primary containment. The staff reviewed the applicant's description of the program to determine whether the applicant has demonstrated that the program will adequately manage the applicable effects of aging caused by the torus piping exposed to the torus water-air interface or wetted air environment during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.0.3.21.1 Technical Information in the Application

In Section B.3.1 of the LRA, the applicant identified the torus piping inspection activities as a new aging management program that will be used ~~in conjunction with the Torus Water~~ stet

Cracking

Core shroud cracking was first discovered in an overseas BWR in 1990. Subsequently, visual (VT) and ultrasonic (UT) examination techniques have detected cracking in core shrouds in a number of domestic and overseas BWRs. Crack indications have been found in heat-affected zones of both horizontal and vertical welds. The predominant form of cracking is circumferentially oriented indications located in the heat-affected zones of horizontal welds. Limited cracking has also been observed in vertical welds.

Most of the cracking has been identified as intergranular stress corrosion cracking (IGSCC). Irradiation-assisted stress corrosion cracking (IASCC) has also been observed in the core beltline region (weld H4). The shrouds are fabricated using either Type 304 or Type 304L austenitic stainless steel, and cracking has been detected in core shrouds fabricated from both materials.

Initially, BWR owners were notified of the cracking through GE SILs and RICSILs and NRC information notices 93-79, "Core Shroud Cracking at Beltline Regions Welds in BWRs," and 94-42, and supplement 1, "Cracking in the Lower Region of the Core Shroud in BWRs". As a result of an increased number of detected shroud cracks, the BWR Owners' Group (BWROG) in April 1994 published topical report GE-NE-523-148-1193, "BWR Core Shroud Evaluation." This report provided a conservative, generic screening methodology for evaluating core shroud flaw indications on a plant-specific basis.

In July 1994, the NRC issued Generic Letter (GL) 94-03, "Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors," which required all BWR licensees to inspect their core shrouds at the next scheduled refueling outage. A plant-specific safety evaluation was also required to support continued operation of the plant until the inspections could be performed.

In response to GL 94-03, flaw acceptance criteria for horizontal welds in unrepaired shrouds were submitted to NRC in reports "BWR Core Shroud Inspection and Flaw Evaluation Guidelines," September 2, 1994, and "BWR Core Shroud Inspection and Flaw Evaluation Guidelines," Rev. 1, March 1995. The results of the NRC review of these documents were presented in safety evaluation reports issued on December 28, 1994, and June 16, 1995, respectively. These guidelines grouped core shrouds into three categories (A, B, or C) based on the expected susceptibility to cracking.

~~The basis for defining the core shroud categories is summarized in Appendix B of the LRA.~~ Welds in Category A core shrouds (those judged unlikely to experience cracking) were exempted from inspection. For Category B shrouds (those judged mildly susceptible to cracking), a sample of horizontal welds (H3, H4, H5, and H7) were required to be inspected. For Category C shrouds (those judged to have potential for significant cracking), all horizontal welds (H1 through H7, inclusive) were required to be inspected. The inspection scope for each weld in Category B and C core shrouds was to cover sufficient weld length to ensure adequate structural integrity.

All vessel internals and attachment welds that are within the scope of license renewal and fabricated from austenitic stainless steel and nickel-based alloys are subject to stress corrosion cracking. The staff-approved BWRVIP reports (i.e., BWRVIP -18, -25, -26, -27, -38, -41, -47,

-48, and -49) support this identification of cracking as an aging effect for these vessel internals and attachment welds.

Cracking due to stress corrosion cracking is an aging effect for vessel closure studs. This identification of cracking as an aging effect is supported by the industry experience reported in Section XI.M3, "Reactor Head Closure Studs," of NUREG-1801, "Generic Aging Lessons Learned (GALL) Report."

Cracking due to cyclic loading is an aging effect for low-alloy steel feedwater nozzles. Generic Letter 81-11," Crack Growth Analysis to Demonstrate Conformance to the Intent of NUREG-0619, 'BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking,'" supports this identification of cracking as an aging effect. The control rod drive return line nozzles at to ~~Plant~~ Peach Bottom Units ~~1~~ 2 and ~~2~~ 3 are capped; therefore, these nozzles are not susceptible to cracking due to cyclic loading.

The low-alloy steel vessel shells are not subject to stress corrosion cracking. BWRVIP-05, "BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations," and BWRVIP-60, "Evaluation of Crack Growth in BWR Low-Alloy Steel RPV Internals," indicate that even if cracks emanate from the vessel cladding, they are not expected to propagate into the low-alloy steel of the reactor vessel. BWRVIP-05 and BWRVIP-60 have been reviewed and approved by the staff.

Loss of Material

Loss of material has been identified as an aging effect for the top head of the reactor pressure vessel. Loss of material as an aging effect has not been identified for any component of the reactor pressure vessel and vessel internals. Loss of material was evaluated in BWRVIP-74. The staff agrees with this identification, because loss of material was evaluated as part of the BWRVIP program and the only reactor pressure vessel and internals component that was subject to loss of material was the top head of the reactor pressure vessel.

Cumulative Fatigue Damage

Cumulative fatigue damage is an aging effect for the reactor pressure vessel feedwater nozzle, "other nozzles," and the support skirt. In response to RAI 3.1-2 inquiring about the definition of "other nozzles," the applicant submitted the following information. The term "other nozzles" includes both nozzles and safe ends with a design-basis-predicted 40-year CUF of 0.4 or greater.

Table 3.1-1 of the LRA does not identify cumulative fatigue damage as an aging effect for vessel flanges and stabilizer brackets. Table 3-1 of BWRVIP-74, "BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines," however, identifies cumulative fatigue damage as an aging effect for these two components. RAI 3.1-2 requested a justification for not identifying cumulative fatigue damage as an aging effect for these two components. In response, the applicant stated that the CUFs for these components are low and, therefore, Table 3.1-1 of the LRA does not identify cumulative fatigue damage as an aging effect for these components. For a 40-year life, the CUF for the Peach Bottom Units 2 and 3 stabilizer brackets is 0.17, and for vessel flanges, it is 0.0. The staff finds the applicant's response acceptable because the CUF projected for the license renewal period for these components is low.

BWRVIP-74, "BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines" determined that cumulative fatigue damage of the vessel shell and closure head is not an aging effect requiring management. This conclusion is justified because the applicable fatigue usage factors for the vessel shell, according to BWRVIP-74, are very low in comparison to other RPV locations.

<u>Loss of Fracture Toughness Due to Neutron and Thermal Embrittlement</u>

Low-alloy steel components in the reactor pressure vessel may be susceptible to loss of fracture toughness due to neutron embrittlement. Loss of fracture toughness due to neutron embrittlement is potentially significant for vessel materials in the beltline region. The beltline region of reactor vessel, according to Appendix G to 10 CFR Part 50, is the region of the reactor that directly surrounds the effective height of the active core and adjacent regions of the reactor vessel that are predicted to experience sufficient neutron radiation damage to be considered in the selection of the most limiting material with regard to radiation damage. Appendix H to 10 CFR Part 50 states that neutron irradiation embrittlement becomes significant at a neutron fluence greater than 10^{17} n/cm^2 (E>1Mev). BWRVIP-74, "BWR Vessel Internals Project—BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines," considers 10^{17} n/cm^2 (E>1Mev) as the threshold fluence for radiation embrittlement and identifies vessel shell materials (i.e., base metal, weld metal, and heat-affected zone) in the beltline region being susceptible to radiation embrittlement. In addition, Table 3-1 of BWRVIP-74 identifies water level instrument nozzles made of low-alloy steel as susceptible to radiation embrittlement. According to Table 2-1 of BWRVIP-49, "BWR Vessel and Internals Project—Instrument Penetration Inspection and Flaw Evaluation Guidelines," the water level instrument nozzles at Peach Bottom Units 2 and 3 are made of Type 304 stainless steel. Therefore, these nozzles are not susceptible to radiation embrittlement.

CASS components in the reactor pressure vessel and vessel internals may be susceptible to loss of fracture toughness due to the synergistic effects of thermal and neutron embrittlement. An evaluation of the loss of fracture toughness for CASS components is presented in a May 19, 2000, NRC letter. The staff evaluation in this letter indicates that the susceptibility to thermal aging embrittlement of CASS components is dependent upon the casting method, molybdenum content, and ferrite content. For low-molybdenum (0.5 wt.% max) steels, only static-cast steels with > 20% ferrite are potentially susceptible to thermal aging embrittlement. For high-molybdenum (2.0 to 3.0 wt.%) steels, static-cast steels with >14% ferrite are potentially susceptible to thermal aging embrittlement. In the susceptibility screening method, ferrite content is calculated by using the Hull's equivalent factors (described in NUREG/CR-4513, Rev. 1) or a method producing an equivalent level of accuracy (±6% deviation between measured and calculated values).

Table 2.3.1-1 of the LRA indicates that jet pump assemblies and fuel supports containing CASS components are within the scope of license renewal. The Plant Peach Bottom fuel supports bear the weight of the fuel assemblies and distribute core flow to the fuel assemblies. Table 3.1-1 of the LRA indicates that the CASS components in jet pump assemblies and CASS fuel supports have no aging effects requiring management because the ferrite content is less than 20 vol.%. However, if the molybdenum content of these components is not low (=0.5 wt.%) and the ferrite content is greater than 14 vol.%, these components are considered susceptible to thermal aging embrittlement.

3.1.3.1.1 Aging Effects

The applicant reviewed the industry experience (e.g., NRC information notices, generic letters, and bulletins) and the Peach Bottom operating experience (e.g., plant maintenance history, modifications, nonconformance reports, and licensee event reports) and identified the aging effects, component functions, environment, and materials for each component group in the reactor pressure vessel instrumentation system in Table 3.1-3 of the LRA.

The applicant identified the following aging effects for the reactor vessel instrumentation system:

- cracking for stainless steel components
- loss of material for carbon steel and stainless steel components

3.1.3.1.2 Aging Management Programs

The applicant identified the following two aging management programs for the reactor pressure vessel instrumentation system:

- Reactor Coolant System Chemistry Program
- ISI Program

The Reactor Coolant System Chemistry Program and the ISI Program are credited with managing the aging effects of several components in various different structures and systems and are, therefore, considered common aging management programs. The staff has evaluated these common AMPs and, found them to be acceptable for managing the aging effects identified for this system. The staff's evaluation of these AMPs is documented in Section 3.0 of this SER.

3.1.3.2 Staff Evaluation

The applicant describes its AMR for the reactor pressure vessel instrumentation system in Section 3.1 of the LRA. The staff reviewed this section to determine whether the applicant has identified all the applicable aging effects for components in these systems and demonstrated that the effects of aging on the components will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.1.3.2.1 Effects of Aging

The aging effects for the reactor pressure vessel instrumentation system are as follows:

- cracking of stainless steel components
- loss of material of carbon steel and stainless steel components

<u>Cracking</u>

The reactor pressure vessel instrumentation system stainless steel components exposed to the reactor coolant water or steam environment are susceptible to cracking. The affected components include pipe (including fitting), tubing, valve bodies, condensing chamber, and

3.1.4.1.1 Aging Effects

The applicant reviews the industry experience (e.g., NRC information notices, generic letters, and bulletins) and the ~~Plant~~/Peach Bottom operating experience (e.g., plant maintenance history, modifications, nonconformance reports, and licensee event reports) and identified the aging effects, component functions, environment, and materials for each component group in the reactor recirculation system in Table 3.1-4 of the LRA.

The applicant identified the following aging effects for the reactor recirculation system:

- cracking for stainless steel components
- loss of material for carbon steel and stainless steel components
- loss of fracture toughness due to thermal aging of cast stainless steel pump casings

3.1.4.1.2 Aging Management Programs

The applicant identified the following two aging management programs for the reactor recirculation system:

- RCS Chemistry Program, Section 3.0.3.2
- ISI Program, Section 3.0.3.6

3.1.4.2 Staff Evaluation

The applicant describes its AMR for the reactor recirculation system in Section 3.1 of the LRA. The staff reviewed this section to determine whether the applicant has identified all the applicable aging effects for components in these systems and demonstrated that the effects of aging on the components will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.1.4.2.1 Effects of Aging

The aging effects for the reactor recirculation system are as follows:

- cracking due to stress corrosion cracking for stainless steel components
- loss of material for carbon steel and stainless steel components
- cumulative fatigue damage (an additional aging effect discussed below and in TLAA Section 4.3)
- loss of fracture toughness due to thermal aging of cast austenitic stainless steel pump casings

<u>Cracking</u>

The applicant identified cracking as an applicable aging effect for the recirculation system austenitic stainless steel components (piping, tubing, valve bodies, flow elements, thermowells, and restricting orifice) but not cast stainless steel components exposed to reactor coolant water. According to NUREG-0313, Rev. 2, a CASS component is susceptible to stress corrosion cracking if the carbon content is greater than 0.035% or the ferrite content less than

The applicant does not identify loss of material due to corrosion as an aging effect for recirculation pump closure bolting and valve closure bolting in the reactor recirculation system. Lost of material is discussed in greater detail in Section 3.1.3.2.1 of the SER. **This is part of Open Item 3.1.3.2.1-1.**

The applicant does not identify loss of material due to wear as an aging effect for recirculation pump closure bolting and valve closure bolting in the reactor recirculation system. In response to RAI 3.1-1, the applicant stated that wear is caused by vibration and prying loads, both of which are event-related mechanisms. Therefore, loss of material due to wear should be excluded from an aging management review. The staff disagrees because vibrations and prying loads that can occur during normal operation and maintenance activities can cause loss of material due to wear. **This is part of Open Item 3.1.3.2.1-1.**

Loss of material due to galvanic corrosion can occur when two dissimilar metals (i.e., carbon steel and stainless steel) are in contact in the presence of oxygenated water. In RAI 3.1-8(b), the staff requested the applicant to identify whether the carbon steel piping of the reactor recirculation system is connected to stainless steel components, and if so, then state whether the aging effect of loss of material includes galvanic corrosion. Since the applicant has identified the RCS chemistry program to mitigate this aging effect, the staff further requested the applicant to describe an aging management program to confirm the effectiveness of the RCS chemistry program to prevent loss of material from galvanic corrosion. In response, the applicant states that the only carbon steel components in the reactor recirculation system are the piping and valves associated with the reactor vessel bottom head drain. The bottom head drain line is a 2-inch carbon steel line from the reactor bottom head to a connection with a 2-inch stainless line. The aging effect of loss of material includes potential damage due to galvanic corrosion. As indicated in Table 3.1-4, the RCS chemistry (LRA Appendix B.1.2) and ISI program (LRA Appendix B.1.8) aging management activities manage this aging effect. The RCS chemistry aging management activity monitors and controls conductivity, which acts to minimize the rate of galvanic corrosion. The ISI program aging management activity includes periodic hydrostatic pressure tests that confirm the integrity of the piping connections. A review of plant-specific operating experience does not indicate failure or leakage of this piping due to loss of material. The ISI pressure tests confirm the effectiveness of the RCS chemistry program to prevent loss of material from galvanic corrosion. However, the staff does not consider the hydrostatic pressure tests adequate because it will not detect the loss of material on the inside of the carbon steel pipe, therefore it will not confirm the effectiveness of the RCS chemistry program to prevent loss of material in these components. **This is part of Open Item 3.1.3.2.1-1.**

Cumulative Fatigue Damage

Piping; the recirculation pump casing, cover, seal flange and closure bolting; and valve bodies, bonnets, and closure bolting in the reactor recirculation system are susceptible to cumulative fatigue damage due to plant heatup, cooldown, and other operational transients. However, the applicant did not identify cumulative fatigue damage as an aging effect for any of the components in the reactor recirculation system. In RAI 3.1-12, the staff requested the applicant to present the technical basis for excluding cumulative fatigue damage as an aging effect for the reactor recirculation system components that are within the scope of license renewal. In response to RAI 3.1-12, the applicant stated that cumulative fatigue damage is addressed in

TLAA Section 4.3 of the LRA. Cumulative fatigue for reactor recirculation piping designed to ASME Section III Class 1 requirements is addressed in the TLAA Section 4.3.3.1. Although reactor recirculation system piping designed to the requirements of ANSI B31.1 does not require explicit fatigue analyses, PBAPS LRA Section 4.3.3.2 addresses piping and component fatigue and thermal cycles for piping designed to the requirements of ANSI B31.1. The staff's review of this TLAA is discussed in Section 4.3 of this SER.

Loss of Fracture Toughness

The applicant has identified the loss of fracture toughness due to thermal aging embrittlement as an applicable aging effect for the CASS pump casing of the recirculation pump. The staff agrees that CASS materials are susceptible to thermal aging embrittlement.

Loss of Preload

The applicant does not identify loss of preload as an aging effect for recirculation pump closure bolting and valve closure bolting in the reactor recirculation system. This issue is discussed in greater detail in Section 3.1.3.2.1 of this SER. **This is part of Open Item 3.1.3.2.1-1.**

3.1.4.2.2 Aging Management Programs

The aging management programs for the reactor recirculation system are identified in Section 3.1.4.1 of this SER. These programs are reviewed by the staff in the following sections of the SER.

- RCS Chemistry Program, Section 3.0.3.2
- ISI Program, Section 3.0.3.6

3.1.4.3 Conclusions

The staff has reviewed the reactor recirculation ~~pressure vessel instrumentation~~ system aging effects presented in Section 3.1 of the LRA and the AMPs presented in Sections B.1.2 and B.1.8 of Appendix B of the LRA. On the basis of the review, with the exception of Open Item 3.1.3.2.1-1, the staff concludes that the applicant has demonstrated that these AMPs adequately manage the effects of aging associated with reactor recirculation ~~RPV instrumentation~~ system components that are within the scope of license renewal so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2 Aging Management of Engineered Safety Features Systems

In Section 3.2 of the LRA the applicant describes its aging management reviews (AMRs) for the engineered safety features (ESF) systems. The staff reviewed Section 3.2 to determine whether the applicant has provided sufficient information to demonstrate 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, in accordance with 10 CFR

54.21(a)(3) for the ESF system structures and components (SCs) that are determined to be within the scope of license renewal and subject to AMRs.

The Peach Bottom ESF systems include the following systems:

- high-pressure coolant injection system (HPCI)
- core spray system (CS)
- primary containment isolation system (PCIS)
- reactor core isolation cooling system (RCIC)
- residual heat removal system (RHR)
- containment atmosphere control and dilution system (CACDS)
- standby gas treatment system (SGTS)
- secondary containment system (SCS)

The design descriptions and safety functions for these ESF systems are sufficiently described in Sections 2.3.2.1, 2.3.2.2, 2.3.2.3, 2.3.2.4, 2.3.2.5, 2.3.2.6, 2.3.2.7, and 2.3.2.8 of the application, respectively. The applicant provides its AMR results for these ESF systems in Sections 3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.7, and 3.2.8 and Tables 3.2-1, 3.2-2, 3.2-3, 3.2-4, 3.2-5, 3.2-6, 3.2-7, and 3.2-8 of the application, respectively. The staff's AMR evaluations of these ESF systems are given in Sections 3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.7 and 3.2.8 of this SER, respectively.

3.2.1 High-pressure Coolant Injection

3.2.1.1 Technical Information in the Application

The applicant describes its AMRs of the passive HPCI components within the scope of license renewal in Section 3.2.1 and Table 3.2-1 of the LRA. The staff reviewed these sections of the LRA to determine whether the applicant demonstrated that the effects of aging associated with the HPCI will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3). A complete list of the HPCI components requiring AMRs and the component intended functions is provided in Table 3.2-1 of the application.

3.2.1.1.1 Aging Effects

In Table 3.2-1 of the application, the applicant identifies the following components that are subject to AMRs: piping, piping specialties (i.e., thermowells, tubing, ~~pumps, valves~~, fittings, ~~tanks,~~ steam traps, rupture discs, spargers, restricting orifices, flow elements, and suction strainers), valve bodies, pump casings, filter bodies, turbine casing, flex hose, ~~and~~ heat exchangers (HX) and their subcomponents (i.e., HPCI gland seals, coolers, coils, tubes, tubesheets, frames, channels, and shells), and ~~tanks~~ vessels.

In this table, the applicant identifies that the specific components are fabricated from the following materials:

- carbon steel
- stainless steel
- cast iron
- galvanized carbon steel

tubes that are exposed to raw water. The cooling coil tubesheets and frames are fabricated from galvanized carbon steel, the cooling coil fins are fabricated from aluminum, and the cooling coil tubes are fabricated from copper. The fins, frames, and tubesheets are exposed to sheltered air conditions and the copper tubes are exposed to raw water internally and sheltered air externally. In Tables 3.2-2 and 3.2-5 of the application, the applicant provided its corresponding AMRs for the CS and RHR pump room cooling coil components and identified cracking, loss of material, flow blockage, and heat transfer reduction function as applicable effects for the surfaces of the RHR pump room cooling coil tubes that are exposed to raw water and heat transfer reduction function as an applicable aging effect for the RHR pump room coiling coil fins, tubes, tubesheets, and frames that are exposed to sheltered air. Table 3.2-1 of NUREG-1800 identifies biofouling and corrosion products (crud) as applicable to ESF heat exchanger tubes that are exposed to raw water sources. These mechanisms can lead to a loss of heat transfer function in these tubes. The applicant is required under the environmental qualification (EQ) requirements of 10 CFR 50.49 to assure the operability of safety-related electrical components by qualifying the components as capable of operating during the worst-case environmental conditions postulated to occur during a design basis accident. The applicant has performed an EQ analysis of both the HPCI and the RCIC pump rooms for the environmental conditions that are postulated to occur during a postulated design basis accident for the plants and has determined that the HPCI and RCIC pump room cooling coils are not required to maintain the operability of the HPCI and RCIC systems during these events. This provides an acceptable technical basis for concluding that reduction in heat transfer function is not an applicable effect for either the HPCI or the RCIC pump room cooling coil tubes that are exposed to raw water. The staff therefore concludes that the applicant's identification of aging effects for the HPCI and RCIC pump room cooling coil components under liquid conditions is acceptable.

Based on the technical considerations discussed in the previous paragraphs, the staff concludes that the applicant's identification of aging effects for the HPCI gland seal coolers, HPCI lube oil coolers, and HPCI and RCIC pump room coolers is acceptable.

HPCI also includes flex hoses made from neoprene or rubber. The applicant has identified loss of material properties as an applicable aging effect for HPCI flex hoses that are fabricated from neoprene or rubber and that are exposed to lubricating oil. Neoprene, an elastomer, is a form of rubber. Elastomers and rubber lose their elastic properties (thermally age or harden) over time. Radiation, ionic or organic impurities, and heat may accelerate the process. The staff therefore concurs that loss of material properties is an applicable effect for the HPCI ESF components made from neoprene and rubber and concludes that the applicant's identification of aging effects for the HPCI neoprene materials is acceptable.

Aging Effects for the Surfaces of HPCI Components Exposed to Gas Environments

In Table 3.2-1 of the LRA, the applicant lists the steam, wetted gas, ventilation air, and sheltered environments as the gas environments to which the HPCI components may be exposed. The applicant identified the following aging effects as applicable to the HPCI below the ambient temperature of the surrounding atmospheric environment. The applicant stated that this practice ensures that moisture is not in direct contact with exposed metal and therefore corrosion-induced aging effects (i.e., loss of material and cracking) are not relevant for metallic or rubber (including neoprene) components in sheltered air or ventilation air environments. The applicant's response to RAI 3.2-1 provides a sufficient basis for concluding that aging effects are not applicable for the surfaces of ESF components that are exposed to sheltered air or ventilation air environments. The staff therefore concludes that the applicant's identification of aging effects for HPCI and other ESF components under sheltered air or ventilation air conditions is acceptable.

The other gaseous environment applicable to the HPCI system is wetted gas. The applicant defines wetted gas environments as air, containment atmosphere, and diesel exhaust gas that may contain some moisture and/or corrosive impurities. Carbon steel components exposed to corrosive, liquid, or humid air environments may be susceptible to general corrosion. The applicant has therefore identified loss of material as an applicable aging effect for carbon or low-alloy steel HPCI and other ESF components that are exposed to wetted gas environments. In contrast, stainless steel components are designed to resist the effects of general corrosion. Loss of material is therefore not normally a concern for the surfaces of stainless steel ~~RCIC~~ HPCI components that are exposed to wetted gas. Stainless steel components, however, may be susceptible to stress corrosion cracking in steam or humid environments (including wetted gas). In RAI 3.2-2, the staff pointed out that the applicant did not always identify cracking as an applicable effect for stainless steel ESF components exposed to wetted gas conditions and asked the applicant to discuss its bases for excluding cracking as an applicable effect for these ESF components. In its response to RAI 3.2-2, the applicant stated that, for wetted gas environments, stress corrosion cracking was judged to be a concern for stainless steel only if there is a potential for concentration of contaminants, and that in the absence of a corrosive environment, stress corrosion cracking would not be an issue for the stainless steel ESF components exposed to wetted gas environments. In these cases, the applicant stated that its aging management reviews determined that the potential for concentration of contaminants was not significant. The applicant's response to RAI 3.2-2 provides a sufficient technical basis for concluding that cracking is not applicable for a number stainless steel HPCI and other ESF components that are identified in the ESF AMR tables (i.e., Tables 3.2-1 through 3.2-8 of the application) as being exposed to wetted gas environments, and specifically not applicable for those stainless steel HPCI and ESF components for which the applicant has omitted cracking as an applicable effect. Based on these considerations, the staff concludes that the applicant has either provided an acceptable technical basis for omitting an aging effect (i.e., cracking) as being applicable to the HPCI or other ESF components that are exposed to the wetted gas environment or conservatively identified those aging effects that are applicable to these components. The staff therefore finds that the applicant's identification of aging effects for HPCI and other ESF components that are exposed to the wetted gas environment is acceptable.

Based on these considerations, the staff finds the applicant's identification of aging effects for the HPCI and other ESF components that are exposed to steam, sheltered air, ventilation air, and wetted gas environments to be acceptable.

3.2.1.2.2 Aging Management Programs

The applicant identified the following AMPs and activities to manage the above aging effects for the HPCI components:

- The applicant has credited the demineralized water and condensate storage tank chemistry activities (LRA B.1.4) to manage loss of material, cracking, or reduction in heat transfer in stainless steel, carbon steel, and copper alloys in piping, valves, and heat exchangers. The staff evaluates these activities in Section 3.0.3.4 of this SER.

- The applicant has credited the reactor coolant system chemistry activities (LRA B.1.2) to manage loss of material and cracking in stainless steel, carbon steel, and copper alloys in piping, valves, and heat exchangers. The staff evaluates these activities in Section 3.0.3.2 of this SER.

- The applicant has credited the (ISI) program (LRA B.1.8) to manage loss of material and cracking in stainless steel, carbon steel, and copper in piping, valves, and heat exchangers. The staff evaluates these activities in Section 3.0.3.6 of this SER.

- The applicant has credited the torus water chemistry activities (LRA B.1.5) to manage loss of material and cracking in stainless steel and carbon steel in piping and valves. The staff evaluates these activities in Section 3.0.3.5 of this SER.

- The applicant has credited the torus piping inspection activities (LRA B.3.1) to manage loss of material in carbon steel in piping, pipe steam traps, and valves. The staff evaluates these activities in Section 3.0.3.21 of this SER.

- The applicant has credited the heat exchanger inspection activities (LRA B.2.12) to manage cracking, loss of material, and reduction in heat transfer in copper alloys and carbon steel in heat exchangers. The staff evaluates these activities in Section 3.0.3.17 of this SER.

- The applicant has credited the lubricating and fuel oil quality testing activities (LRA B.2.1) to manage loss of material, cracking, and heat transfer reduction in carbon steel, cast iron, copper alloys, stainless steel, brass alloys, and brass in valves, pump casings, heat exchangers, and lubricating oil tanks. The staff evaluates these activities in Section 3.0.3.18 of this SER.

- The applicant has credited the HPCI and RCIC turbine inspection activities (LRA B.2.10) to manage loss of material in carbon steel turbine casing and lubricating oil tanks. ~~and loss of properties in neoprene and rubber in flex hoses~~. The staff evaluates these activities in the following paragraphs.

<u>HPCI and RCIC Turbine Inspection Activities</u>

The applicant described the HPCI and RCIC turbine inspection activities in Section B.2.10 of the LRA. This program provides aging management of the HPCI and RCIC turbine casings exposed to a wetted gas environment. The applicant stated that the HPCI turbine inspection activities additionally provide for condition monitoring of components exposed to a lubricating oil environment. The staff reviewed Section B.2.10 of the LRA to determine whether the HPCI and RCIC turbine inspection activities AMP will adequately manage the effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

The applicant described the HPCI and RCIC turbine inspection activities that provide for aging management of the HPCI and RCIC turbine casings exposed to a wetted gas environment and of the HPCI turbine components exposed to a lubricating oil environment. The inspection activities consist of visual inspections of the turbine casings and the HPCI lubricating oil tank internals for evidence of loss of material. The applicant further stated that a PBAPS procedure would be enhanced to inspect the HPCI lubricating oil system flexible hoses for changes in material properties. The HPCI and the RCIC turbine inspection activities are performed periodically during turbine maintenance in accordance with plant procedures.

The applicant concluded that based on PBAPS operating experience, there is reasonable assurance that the HPCI and RCIC turbine inspection activities will adequately manage the identified aging effects for the components so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

The staff's evaluation of the HPCI and RCIC turbine 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 the quality assurance program is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

Program Scope: The applicant described the program scope of the HPCI and RCIC turbine inspection activities as focusing on managing loss of material and change in material properties by the performance of periodic inspections of the turbine casings and HPCI lubricating oil system tank internals and flexible hoses. In LRA Table 3.2-1(aging management results for HPCI ~~RCIC~~ system), the HPCI and RCIC turbine inspection activities AMP is listed as the aging management program for lubricating oil tanks with lubricating oil as the applicable environment. Wetted gas environment is also in the program scope of the AMP. Therefore, the staff requested the applicant to identify the reference to the AMP being applied to components in a wetted gas environment. By letter dated April 29, 2002, the applicant responded that LRA Table 3.2-1 identifies a number of carbon steel and stainless steel components in a wetted gas environment. For carbon steel components in a wetted gas environment, the applicable aging management activity is referenced in the table. The aging management review has determined that the stainless steel components in the HPCI system (LRA Table 3.2-1) that are exposed to an internal environment of wetted gas do not have any aging effects that require aging management. The applicant stated that therefore no aging management activity is identified for these components in Table 3.2-1. The staff found the scope of the program to be acceptable because the LRA and the additional information provided to the staff the have adequately addressed the components whose aging effects can be managed by the application of the HPCI and RCIC turbine inspection activities. The staff notes that during a conference call on August 21, 2002, the applicant stated the flexible hoses were stainless steel rather than an elastomer of neoprene and rubber. In a call and electronic mail on September 6, 2002, the

3.2.2.1.1 Aging Effects

In Table 3.2-2 of the application, the applicant identifies the following CS components that are subject to AMRs: pumps, valves, heat exchangers, piping, and piping specialities (restricting orifices, flow elements, thermowells, cyclone separators, and suction strainers).

In this table, the applicant identifies specific components fabricated from the following materials:

- stainless steel
- carbon steel
- cast iron
- galvanized carbon steel
- copper
- aluminum

The applicant identifies these components as subject to any of the following environments:

- condensate storage water
- reactor coolant
- torus-grade water
- raw water
- dry gas
- lubricating oil
- sheltered environment

The applicant describes the environmental conditions for these environments in Section 3.0 of the application.

The applicant identifies the following aging effects of applicable to the CS components:

- loss of material
- cracking
- heat transfer reduction capability
- flow blockages

3.2.2.1.2 Aging Management Programs

The applicant credits the following programs and activities for managing the aging effects attributed to these components:

- demineralized water and condensate storage tank chemistry activities
- reactor coolant system chemistry activities
- ISI Program
- torus water chemistry activities
- lubricating and fuel oil quality testing activities
- Generic Letter 89-13 activities
-

The CS components within the scope of license renewal include the CS pump motor oil coolers and the CS pump room cooling coils. The CS pump motor oil coolers include stainless steel coils that are exposed to raw water internally and lubricating oil externally and cast iron ~~frames~~ casings that are exposed to lubricating oil internally and sheltered air externally. The staff's evaluation of the surfaces of the cast iron casings ~~frames~~ that are exposed to sheltered air is given in this section under the heading "Aging Effects for the Surfaces of CS Components Exposed to Gas Environments." Microbiological organisms and crud (sediment or oxidation products) may build up in heat exchanger components that are exposed to raw water sources. These aging mechanisms may result in loss of material by corrosion, stress cracking, or fouling of heat exchanger components that serve a pressure boundary function, reducing the amount of available heat transfer surface area in heat exchanger components that serve a heat transfer function. Highly stressed carbon steel and stainless steel heat exchanger components that are exposed to lubricating oil may be susceptible to stress-induced cracking or stress corrosion cracking. The applicant has conservatively identified loss of material, cracking, reduction in heat transfer capability, and flow blockage as applicable aging effects for the internal surfaces of the CS pump motor oil cooler coils that are exposed to raw water and cracking and heat transfer reduction as applicable aging effects for the surfaces of the CS pump motor oil cooler casings ~~frames~~ and coils that are exposed to lubricating oil. On the basis of these technical considerations, the staff concludes that the applicant has conservatively identified those aging effects that are applicable to the CS heat exchanger components that are exposed to liquid environments. The staff therefore finds that the applicant's identification of aging effects for these components is acceptable.

The designs of the CS pump room cooling coils are similar to the designs of the HPCI, RCIC, and RHR pump room cooling coils. The CS pump room cooling coils recirculate raw water through the cooling coil tubes to remove excess heat from the sheltered air conditions in the CS pump rooms. The components in these cooling coils therefore serve a heat transfer function in addition the pressure boundary function of the cooling coil tubes. The cooling coil tubesheets and frames are fabricated from galvanized carbon steel, the cooling coil fins are fabricated from aluminum, and the cooling coil tubes are fabricated from copper. The fins, frames, and tubesheets are exposed only to sheltered air conditions and the copper tubes are exposed to raw water internally and sheltered air externally. The applicant has identified cracking, loss of material, heat transfer reduction, and flow blockage as applicable aging effects for the surfaces of the CS pump room cooling coil tubes that are exposed to raw water. This is in agreement with the applicant's aging effect analysis for the CS pump motor oil cooler components that are exposed to raw water sources. On the basis of this consideration, the staff concludes that the applicant has conservatively identified those aging effects that are applicable to the CS pump room cooling coil components that are exposed to raw water. The staff therefore finds that the applicant's identification of aging effects for the pump room cooling coil components that are exposed to raw water is acceptable. The staff's evaluation of aging effects for the surfaces of the CS pump room cooling coil components that are exposed to sheltered air is given in this section under the heading "Aging Effects for the Surfaces of CS Components Exposed to Gas Environments."

<u>Aging Effects for the Surfaces of CS Components Exposed to Gas Environments</u>

The CS system has components that are exposed to the following gas environments: steam, wetted gas, and sheltered air. The applicant identified the following aging effects as applicable in piping, valves, and heat exchangers. The staff evaluates these activities in Section 3.0.3.2 of this SER.

- The applicant has credited the (ISI) program (LRA B.1.8) to manage loss of material and cracking in stainless steel, carbon steel, and copper in piping, valves and heat exchangers. The staff evaluates these activities in Section 3.0.3.6 of this SER.
- The applicant has credited the torus water chemistry activities (LRA B.1.5) to manage loss of material and cracking in stainless steel and carbon steel in piping and valves. The staff evaluates these activities in Section 3.0.3.5 of this SER.

- The applicant has credited the lubricating and fuel oil quality testing activities (LRA B.2.1) to manage loss of material, cracking, and heat transfer reduction in carbon steel, cast iron, copper alloys, stainless steel, brass alloys, or brass in valves, pump casings, heat exchangers, and lubricating oil tanks. The staff evaluates these activities in Section 3.0.3.18 of this SER.

- The applicant has credited the Generic Letter 89-13 CS activities (LRA B.2.8) to manage flow blockage in the copper cooling coils in the ~~HPCI~~ pump rooms. The staff evaluates these activities in Section 3.0.3.15 of this SER.

The staff has evaluated these AMPs and found them to be acceptable for managing the aging effects identified for the CS system. On the basis of this review, the staff concludes that the applicant has provided adequate AMPs to manage the aging effects for these combinations of materials and environments and that these AMPs are consistent with published literature and industry experience.

3.2.2.2.3 Conclusions

The staff has reviewed the information in Section 3.2.~~1~~2, "Core Spray System," of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the CS system will be adequately managed so that there is reasonable assurance that this system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The staff also concludes that the UFSAR Supplement contains an adequate summary description of the program activities for managing the effects of aging for the CS system discussed above as required by 10 CFR 54.21(d).

3.2.3 Primary Containment Isolation System

3.2.3.1 Technical Information in the Application

The applicant described its AMR of the primary containment isolation system (PCIS) for license renewal in Section 3.2.3 and Table 3.2-3 of the LRA. The staff reviewed this section to determine whether the applicant demonstrated that the effects of aging on the primary containment isolation system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3). A complete list of the PCIS components requiring AMRs and the component intended functions is provided in Table 3.2-3 of the application.

are not humid or corrosive enough for aging effects to be of a concern for metallic plant components. The staff's evaluation of the applicant's identification of aging effects for carbon steel, cast iron, copper, or stainless steel PCIS components that are exposed to steam, sheltered air, or wetted gas environments is consistent with the staff's analysis in Section 3.2.1.2.1 for similar HPCI components that are exposed to these environments. On the basis of this evaluation, the staff concludes that the applicant's evaluations of PCIS components in sheltered air, dry air, and wetted gas environments either provides an acceptable technical basis for omitting an aging effect as not applicable to a given PCIS component or conservatively identifies the aging effects that are applicable to the PCIS that are exposed to sheltered air, dry air, or wetted gas environments. The staff therefore finds that the applicant's identification of aging effects for the PCIS components that are exposed to gas environments is acceptable.

3.2.3.2.2 Aging Management Programs

The applicant identified ~~that~~ the following AMPs and activities for managing the aging effects that are applicable to the PCIS components:

- The applicant has credited the closed cooling water chemistry activities (LRA B.1.3) to manage loss of material in carbon steel in piping and valve bodies. The staff evaluates these activities in Section 3.0.3.3 of this SER.
- The applicant has credited the reactor coolant system chemistry program (LRA B.1.2) to manage cracking and loss of material in stainless steel and carbon steel in piping, restricting orifices, flow elements, and valve bodies. The staff evaluates these activities in Section 3.0.3.2 of this SER.
- The applicant has credited the primary containment leakage rate testing program (LRA B.1.10) to manage loss of material in carbon steel piping and valve bodies. The staff evaluates these activities in Section 3.0.3.8 of this SER.
- The applicant has credited the (ISI) program (LRA B.1.8) to manage cracking and loss of material in stainless steel, cast austenitic stainless steel, and carbon steel piping and valve bodies. The staff evaluates these activities in Section 3.0.3.6 of this SER.

The staff has evaluated these AMPs and found them to be acceptable for managing the aging effects identified for the PCIS system. On the basis of this review, the staff concludes that the applicant has provided adequate AMPs to manage the aging effects for these combinations of materials and environments and that these AMPs are consistent with published literature and industry experience.

3.2.3.3 Conclusions

The staff reviewed the information in LRA Section 3.2.3, "Primary Containment Isolation System." On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the primary containment isolation system will be adequately managed so that there is reasonable assurance that this system will perform its intended function in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Demineralized water and

- CST Chemistry Program
- Lubricating and Fuel Oil Quality Testing Activities
- RCS Chemistry Program
- ISI Program
- Torus Water Chemistry Program
- HPCI and RCIC Turbine Inspection Activities
- Torus Piping Inspection Activities
- Heat Exchanger Inspection Activities
- GL 89-13 Activities
- Flow-Assisted Corrosion (FAC) Program

Table 3.2-4 of the application identifies which of these programs will be used to manage the aging effects for the specific RCIC component material/environmental-condition combinations identified in the table.

3.2.4.2 Staff Evaluation

The staff reviewed the component groups, intended functions, environments, materials of construction, aging effects, and aging management activities for the RCIC system in Table 3.2-4 of the LRA to determine whether the applicant has demonstrated that the effects of aging system will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.4.2.1 Effects of Aging

<u>Aging Effects for the Surfaces of RCIC Components Exposed to Liquid Environments</u>

In Table 3.2-~~3~~4 of the LRA, the applicant identified the following liquid environments to which the RCIC components may be exposed: reactor coolant, condensate storage water, torus-grade water (including torus-grade water with gas interface), raw water, and lubricating oil. The applicant defines these environments in Section 3.0 of the application. The applicant identified the following aging effects as applicable to the RCIC components that are exposed to these liquid environments and requiring aging management:

- loss of material and cracking for stainless steel RCIC components in condensate storage water and torus-grade water environments

- loss of material for carbon steel RCIC components exposed to condensate storage water, torus-grade water, reactor coolant, and lubricating oil environments

- cracking and reduction in heat transfer capability as additional aging effects that require management for the carbon steel RCIC turbine lube oil cooler shells and tubesheets that are exposed to a condensate storage water environment

- loss of material, cracking, and reduction in heat transfer capability for admiralty brass tubes in the RCIC turbine lube oil coolers exposed to condensate storage water or lubricating oil environments

- loss of material and cracking of stainless steel RCIC components that are exposed to steam

The staff's evaluation of the applicant's identification of aging effects for the RCIC components that are exposed to steam, wetted gas and sheltered air environments is consistent with the staff's analysis in Section 3.2.1.2.1 for similar HPCI components that are exposed to these environments. Based on the staff's evaluation in Section 3.2.1.2.1 of this SER, the staff concludes that the applicant's identification of aging effects for the RCIC components that are exposed to gaseous environments is conservative and is therefore acceptable.

3.2.4.2.2 Aging Management Programs

The applicant identified the following AMPs and activities to manage the above aging effects for the RCIC components:

- The applicant has credited the demineralized water and condensate storage tank chemistry activities (LRA B.1.4) to manage loss of material, cracking, or reduction in heat transfer in stainless steel, carbon steel, and copper alloys in piping, valves, and heat exchangers. The staff evaluates these activities in Section 3.0.3.4 of this SER.

- The applicant has credited the reactor coolant system chemistry activities (LRA B.1.2) to manage loss of material and cracking in stainless steel, carbon steel, and copper alloys in piping, valves, and heat exchangers. The staff evaluates these activities in Section 3.0.3.2 of this SER.

- The applicant has credited the (ISI) program (LRA B.1.8) to manage loss of material and cracking in stainless steel, carbon steel, and copper in piping, valves, and heat exchangers. The staff evaluates these activities in Section 3.0.3.6 of this SER.

- The applicant has credited the torus water chemistry activities (LRA B.1.5) to manage loss of material and cracking in stainless steel and carbon steel in piping and valves. The staff evaluates these activities in Section 3.0.3.5 of this SER.

- The applicant has credited the torus piping inspection activities (LRA B.3.1) to manage loss of material in carbon steel in piping, pipe steam traps, and valves. The staff evaluates these activities in Section 3.0.3.21 of this SER.

- The applicant has credited the heat exchanger inspection activities (LRA B.2.12) to manage cracking, loss of material, and reduction in heat transfer in copper alloys and carbon steel in heat exchangers. The staff evaluates these activities in Section 3.0.3.17 of this SER.

- The applicant has credited the HPCI and RCIC turbine inspection activities (LRA B.2.10) to manage loss of material in ~~carbon~~ low-alloy steel turbine casing~~, and lubricating oil tanks and change in properties of neoprene and rubber in flex hoses~~. The staff evaluates these activities in Section 3.2.1.2.2.1 of this SER.

- The applicant has credited the lubricating and fuel oil quality testing activities (LRA B.2.1) to manage loss of material, cracking, and heat transfer reduction in carbon steel, cast iron, copper alloys, stainless steel, brass alloys, or brass in valves, pump casings, heat exchangers, and lubricating oil tanks. The staff evaluates these activities in Section 3.0.3.18 of this SER.

RCIC

- The applicant has credited the Generic Letter 89-13 activities (LRA B.2.8) to manage flow blockage in the copper cooling coils in the ~~HPCI~~ pump rooms. The staff evaluates these activities in Section 3.0.3.15 of this SER.

- The applicant has credited the flow-accelerated corrosion program (LRA B.1.1) to manage loss of material in carbon steel piping. The staff evaluates these activities in Section 3.0.3.1 of this SER.

RCIC

The staff has evaluated these AMPs and found them to be acceptable for managing the aging effects identified for the ~~high pressure coolant injection~~ system. On the basis of this review, the staff concludes that the applicant has provided adequate AMPs to manage the aging effects for these combinations of materials and environments that are consistent with published literature and industry experience.

3.2.4.3 Conclusions

The staff reviewed the information in LRA Section 3.2.4, "Reactor Core Isolation Cooling System." On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the RCIC system will be adequately managed so that there is reasonable assurance that this system will perform its intended function in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.5 Residual Heat Removal

3.2.5.1 Technical Information in the Application

The applicant described its AMR for the residual heat removal (RHR) system in Section 3.2, "Aging Management of Engineered Safety Features," and Table 3.2-5, "Residual Heat Removal System," of the application. The staff reviewed these sections of the applications to determine whether the applicant has demonstrated that the effects of aging on the RHR system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3). A complete list of the RHR components requiring AMRs and the component intended functions is provided in Table 3.2-5 of the application.

3.2.5.1.1 Aging Effects

In Table 3.2-5 of the application, the applicant identifies the major flowpaths of RHR as including piping, piping specialties (i.e., thermowells, cyclone separators, restricting orifices, flow elements, and suction strainers), valve bodies, pump casings, and heat exchangers and their subcomponents (i.e., coils, tubes, tubesheets, channels, baffles, nozzles, fins, shells, and internals) that are fabricated from stainless steel ~~(including galvanized stainless steel),~~ carbon/low-alloy steel materials, copper alloys (copper, bronze, or brass), or aluminum.

(including galvanized carbon steel)

The applicant identifies that the RHR components are subject to any of the following environments:

- torus-grade water
- torus-grade water with a gas interface
- raw water
- reactor coolant
- dry gas
- sheltered air
- wetted gas

The applicant describes the environmental conditions for these environments in Section 3.0 of the application.

The applicant identifies the following aging effects as applicable to the RHR components:

- loss of material
- cracking
- heat transfer reduction
- flow blockage

3.2.5.1.2 Aging Management Programs

The applicant credits the following programs and activities for managing the aging effects attributed to the RHR components:

- RCS Chemistry Program
- ISI Program
- Torus Water Chemistry Program
- Primary Containment Leakage Rate Testing Program
- High-Pressure Service Water (HPSW) Radioactive Monitoring Activities
- Torus Piping Inspection Activities
- IST Program
- GL 89-13 Activities

3.2.5.2 Staff Evaluation

The staff reviewed the component groups, intended functions, environments, materials of construction, aging effects, and aging management activities for the RHR system in Table 3.2-5 of the LRA to determine whether the applicant has demonstrated that the effects of aging will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.5.2.1 Aging Effects

<u>Aging Effects for the Surfaces of RHR Components Exposed to Liquid Environments</u>

RHR includes piping, piping specialties (i.e., thermowells, cyclone separators, restricting orifices, flow elements, and suction strainers), valve bodies, pump casings, and heat exchangers and their subcomponents (i.e., coils, tubes, tubesheets, channels, baffles, nozzles, fins, shells, and/or internals). These components are fabricated from stainless steel ~~(including galvanized stainless steel)~~, carbon/low-alloy steel (including galvanized carbon steel), copper alloys (copper, bronze, or brass), or aluminum and are exposed to either condensate storage water, reactor coolant, or torus-grade water, ~~or lubricating oil~~ environments. The applicant identified the following aging effects as applicable to the RHR components that are exposed to these environments:

- loss of material and cracking for stainless steel RHR pump, valve, and piping components in reactor coolant and torus-grade water

- loss of material for carbon steel RHR pump, valve, and piping components exposed to reactor coolant and torus-grade water

- loss of material, cracking, flow blockage, and reduction in heat transfer capability for surfaces of copper and stainless steel RHR heat exchanger tubes exposed to raw water

- loss of material, cracking, and reduction in heat transfer capability for surfaces of stainless steel and carbon steel RHR heat exchanger components exposed to torus-grade water

The staff's evaluation of the applicant's identification of aging effects for stainless steel RHR pressure boundary components that are exposed to reactor coolant, torus-grade water, or raw water environments is consistent with the staff's analysis in Section 3.2.1.2.1 for similar stainless steel HPCI components that are exposed to these environments. Based on the staff's evaluation in Section 3.2.1.2.1 of this SER, the staff concludes that the applicant's identification of aging effects for the stainless steel RHR components that are exposed to reactor coolant or torus-grade water environments is conservative and is therefore acceptable.

The staff's evaluation of the applicant's identification of aging effects for carbon steel/low-alloy steel RHR pump, valve, and piping components that are exposed to the reactor coolant or torus-grade water is consistent with the staff's analysis in Section 3.2.1.2.1 for similar carbon steel/low-alloy HPCI piping, pump, and valve components that are exposed to these environments. Based on the staff's evaluation of valve components in liquid environments in Section 3.2.1.2.1 of this SER, the staff concludes that the applicant's identification of aging effects for the carbon steel/low-alloy steel RHR piping, pump, and valve components that are exposed to reactor coolant or torus-grade water environments is conservative and is therefore acceptable.

The RHR components within the scope of license renewal also include the RHR heat exchangers and the RHR pump room cooling coils. These heat exchangers serve safety-related heat transfer functions in addition to pressure boundary functions. The RHR heat exchangers include stainless steel tubes and tubesheets and carbon steel channels that are exposed to raw water internally and torus-grade water externally, as well as carbon steel shells, baffles, and nozzles that are exposed to torus-grade water internally and sheltered air externally. Heat exchanger components that are highly stressed may be subject to a number of mechanisms, including loss of material by pitting or erosion and stress-induced cracking, which in turn may reduce the heat transfer capability of the heat exchanger components. Heat exchanger tubes and tubesheets that are exposed to raw water sources may also be exposed to biological organisms or crud (i.e., sediment or oxidation products), which, if not attended to, may restrict coolant flow through the tubes and inhibit the heat transfer capability of the heat to the RHR pump, valve, and piping components in dry gas, sheltered air, or wetted gas environments. Based on these considerations that staff finds acceptable the applicant's identification of aging effects for the RHR pump, valve, and piping components and the RHR heat exchanger casing that are exposed to gaseous environments.

The staff's evaluations of the applicant's identification of aging effects for the RHR pump room cooling coil frames, tubesheets, tubes, and fins that are exposed to sheltered air is consistent with the staff's evaluation in Section 3.2.2.2.1 of this SER for similar CS pump room cooler components under this environment. Based on the staff's evaluation in Section 3.2.2.2.1 of this SER, the staff concludes that the applicant's identification of aging effects for the RHR pump, room cooling coil components that are exposed to shelter air is conservative and is therefore acceptable.

3.2.5.2.2 Aging Management Programs

The applicant will use the following programs and activities for managing the aging effects that are applicable to the RHR components:

- The applicant has credited the reactor coolant system chemistry activities (LRA B.1.2) to manage loss of material and cracking in stainless steel, carbon steel, and copper alloys in piping, valves, and heat exchangers. The staff evaluates these activities in Section 3.0.3.2 of this SER.

- The applicant has credited the (ISI) program (LRA B.1.8) to manage loss of material and cracking in stainless steel, carbon steel, and copper in piping, valves, and heat exchangers. The staff evaluates these activities in Section 3.0.3.6 of this SER.
- The applicant has credited the torus water chemistry activities (LRA B.1.5) to manage loss of material and cracking in stainless steel and carbon steel in piping and valves. The staff evaluates these activities in Section 3.0.3.5 of this SER.

- The applicant has credited the torus piping inspection activities (LRA B.3.1) to manage loss of material in carbon steel in piping, pipe steam traps, and valves. The staff evaluates these activities in Section 3.0.3.21 of this SER.

- The applicant has credited the primary containment leakage rate testing program (LRA B.1.10) to manage loss of material in carbon steel piping and valve bodies. The staff evaluates these activities in Section 3.0.3.8 of this SER.

- The applicant has credited the inservice testing (IST) program (LRA B.1.11) ~~is~~ which provides for inservice testing of Class 1, 2, and 3 pumps and valves in compliance with the ASME O&M Code, 1990 Edition, and 10 CFR 50.55a, to manage flow blockage in the emergency service water (ESW) and emergency cooling water (ECW) components, and to manage heat transfer reduction for the torus water that flows through the RHR heat exchangers. The staff evaluates this program in Section 3.0.3.10 of this SER.

- The applicant has credited the Generic Letter 89-13 activities (LRA B.2.8) to manage flow blockage in the copper cooling coils in the ~~HPCI~~ RHR pump rooms. The staff evaluates these activities in Section 3.0.3.15 of this SER.

High Pressure Service Water Radioactivity Monitoring Activities

The applicant has credited the high-pressure service water (HPSW) radioactivity monitoring activities (LRA B.1.7) to manage loss of material and cracking in the RHR heat exchangers. The staff evaluates this activity as follows:

The applicant described the high pressure service water (HPSW) radioactivity monitoring activities AMP in Section B.1.7 of Appendix B of the LRA. The staff reviewed the applicant's description of the AMP in the LRA to determine whether the applicant has demonstrated that the HPSW radioactivity monitoring activities AMP will adequately manage the applicable effects of aging of the RHR heat exchanger tubes and tube sheets exposed to raw water during the period of extended operation, as required by 10 CFR 54.21(a)(3).

In Section B.1.7 of the LRA, the applicant identified the HPSW radioactivity monitoring activities as an existing aging management program that will be used by the applicant to manage loss of material and cracking in the tubes and tube sheets of the RHR heat exchangers together with the Generic Letter 89-13 activities AMP. The tubes and tube sheets are exposed to raw water. The HPSW radioactivity monitoring activities AMP consists of weekly sampling and analysis of the HPSW system water (raw water) to confirm the absence of radioactive contaminants. The Generic Letter 89-13 activities AMP also manages flow blockage and reduction of heat transfer in the RHR heat exchangers, including tubes and tube sheets. The staff's evaluation of the GL 89-13 activities AMP is provided in Section 3.0.3.15 of this SER.

The staff's evaluation of the high pressure service water radioactivity 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 the quality assurance program is provided separately in Section 3.0.4 of this SER. The remaining seven elements are discussed below.

Program Scope: The HPSW radioactivity monitoring activities AMP consists of routine sampling and analysis of the HPSW system water (i.e., raw water) contained in the RHR heat exchangers to verify the absence of radioactive contaminants. The staff found the scope of the program to be acceptable because the applicant adequately addressed the component whose aging effect(s) could be managed by the application of this activity.

Preventive or Mitigative Action: The applicant indicated that this AMP is a monitoring AMP. The applicant did not provide any preventive or mitigative actions for this activity, nor did the staff identify a need for such. The monitoring activities are a means of detecting, not preventing aging and, therefore, the staff agrees that no preventive actions are applicable to the HPSW radioactivity monitoring activities.

Parameters Monitored or Inspected: The HPSW radioactivity monitoring activities AMP monitors the radioactive isotopes that do not occur naturally. Samples taken from selected system test points and the bottom head drains of the heat exchangers are analyzed. The staff found the parameters monitored acceptable because loss of material and cracking can be identified by the presence of radioactive contaminants contained in raw water of the RHR heat exchangers.

Detection of Aging Effects: Sampling and analysis are performed weekly to confirm the absence of radioactive contaminants. Sampling taken from selected system test points and the bottom head drains of the heat exchangers are analyzed. The staff found that the applicant's extent of inspection scope and inspection schedule are adequate to detect the aging degradation in a timely manner prior to loss of component intended function.

Monitoring and Trending: The applicant stated that sampling and analysis are performed weekly to provide timely detection of aging degradation due to loss of material and cracking. The staff found the weekly sampling monitoring and analysis acceptable because it would provide timely detection of aging degradation and sufficient data for trending.

Acceptance Criteria: The acceptance criteria for the HPSW radioactivity monitoring activities AMP requires the absence of the radioactive contaminants in the system water. The staff found the acceptance criteria acceptable because loss of material and cracking in the tubes and tube sheets of the RHR heat exchangers can be identified by the presence of radioactive contaminants in the system water.

Operating Experience: The applicant identified the HPSW radioactivity monitoring activities AMP as an existing program. The applicant stated in Section B.1.7 of the LRA that leakage and minor degradation have been found in the RHR heat exchangers on the HPSW system water (raw water) side. The degradation involved leakage of floating head gaskets, and degradation of internal baffle welds. Evaluations and adequate corrective actions, including gasket modifications were implemented prior to loss of intended function. The staff agreed that these activities are effective at maintaining the intended function of the structures and components that may be served by the HPSW radioactivity monitoring activities, and can reasonably be expected to do so for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff reviewed Section A.1.7 of the UFSAR Supplement and found that the description of the applicant's HPSW radioactivity monitoring activities program is consistent with Section B.1.7 of the LRA and is equivalent to the information in NUREG-1800 and therefore provides an adequate summary of program activities as required by 10 CFR 54.21(d).

The staff has reviewed the information provided in Section B.1.7 of the LRA and the summary description of the high pressure service water radioactivity monitoring activities in Section A.1.7 of the UFSAR Supplement. On the basis of this review and the system and components discussed above, the staff found there is reasonable assurance the applicant has demonstrated that the system and components discussed above will be adequately managed so that there is reasonable assurance that this system will perform its intended function in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff has evaluated these AMPs and found them to be acceptable for managing the aging effects identified for the RHR system. On the basis of this review, the staff concludes that the applicant has provided adequate AMPs to manage the aging effects for these combinations of materials and environments and that the AMPs are consistent with published literature and industry experience.

3.2.5.3 Conclusions

The staff reviewed the information in LRA Section 3.2.5, "Residual Heat Removal System." On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the RHR System will be adequately managed so that there is reasonable assurance that this system will perform its intended function in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.6 Containment Atmosphere Control and Dilution System

3.2.6.1 Technical Information in the Application

The applicant described its AMR of the containment atmosphere control and dilution system (CACDS) for license renewal in Section 3.2.6 and Table 3.2-6 of the LRA. The staff reviewed this section and table of the LRA to determine whether the applicant demonstrated that the effects of aging associated with the containment atmosphere control and dilution system will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3). A complete list of the CACDS components requiring AMRs and the component intended functions is provided in Table 3.2-6 of the application.

3.2.6.1.1 Aging Effects

In Table 3.2-6 of the application, the applicant identifies the CACDS components subject to AMRs as pumps, valves, piping, ~~and~~ fittings, and vessels. These components are fabricated from the following materials:

- carbon steel
- stainless steel
- brass
- aluminum

The applicant identifies these components as subject to any of the following environments:

- sheltered air
- dry gas
- wetted gas

The applicant describes the environmental conditions for these environments in Section 3.0 of the application.

The applicant identifies the following aging effects as applicable to the CACDS components:

- loss of material

3.2.6.1.2 Aging Management Programs

The applicant credits the following program for managing the aging effects attributed to the CACDS components within the scope of license renewal:

- primary containment leakage rate testing program

3.2.6.2 Staff Evaluation

The staff reviewed the component group, intended function, environments, materials of construction, aging effects, and aging management activity for the containment atmosphere control and dilution system in Table 3.2-6 of the LRA to determine whether the applicant has demonstrated that the effects of aging for this system will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.6.2.1 Effects of Aging

Aging Effects for the Surfaces of CACDS Components Exposed to Gas Environments

The CACDS components include carbon steel valves and piping that are exposed to a wetted gas environment. In Table 3.2-6 of the LRA, the applicant identified loss of material as the applicable effect for the carbon steel CACDS components that are exposed to wetted gas. The applicant did not identify any applicable aging effects for the aluminum, brass, carbon steel, and stainless steel pumps, valves, piping, ~~and~~ fittings and vessels that are exposed to either dry gas or sheltered air environments.

The staff's evaluation of the applicant's omission of aging effects for the carbon steel CACDS components that are exposed to dry gas, sheltered air, or wetted gas environments is consistent with the staff's analysis in Section 3.2.1.2.1 for similar materials in the HPCI system. Based on the staff's evaluation in Section 3.2.1.2.1, the staff concludes the applicant has provided an acceptable basis for concluding no aging effects are applicable to the metallic CACDS piping components that are exposed to either sheltered air or ventilation atmosphere environments. The applicant's omission of aging effects for the metallic CACDS components in sheltered air or ventilation atmosphere environments is therefore acceptable to the staff.

3.2.6.2.2 Aging Management Programs

The applicant has credited the primary containment leakage rate testing program (LRA B.1.10) to manage loss of material in the CACDS components that are exposed to wetted gas. The staff evaluates this program in Section 3.0.3.8 of this SER. The staff has evaluated this AMP and has found it to be acceptable for managing the aging effects identified for CACDS. On the basis of this review, the staff concludes that the applicant has provided adequate AMPs to manage the aging effects for these combinations of materials and environments and that the AMPs are consistent with published literature and industry experience.

3.2.6.3 Conclusions

The staff has reviewed the information in Section 3.2.6, "Containment Atmosphere Control and Dilution System," of the LRA. On the basis of this review the staff concludes that the applicant has demonstrated that the aging effects associated with CACDS will be adequately managed so that there is reasonable assurance that this system will perform its intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.7 Standby Gas Treatment System

3.2.7.1 Technical Information in the Application

The applicant described its AMR for the standby gas treatment system (SGTS) in Section 3.2, "Aging Management of Engineered Safety Features," and Table 3.2-7, "Standby Gas Treatment System," of the application. The staff reviewed these sections of the applications to determine whether the applicant has demonstrated that the effects of aging on the standby gas treatment system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3). A complete list of the SGTS components requiring AMRs and the component intended functions is provided in Table 3.2-7 of the application.

3.2.7.1.1 Aging Effects

In Table 3.2-7 of the application, the applicant identifies the major flowpaths of the SGTS as including the following components subject to AMRs: valve bodies, elastomer material flex connections and seals, piping (pipe, tubing, and fittings), pipe specialties (flow elements, pressure elements, and temperature element couplings), and sheet metal (plenums, fan enclosures, louvers, ductwork and damper enclosures). In this table, specific ~~N~~SGTS components are identified as fabricated from the following materials:

- carbon steel
- stainless steel
- neoprene
- bronze, brass, or copper
- anodized aluminum
- galvanized steel
- dielectric union materials

The applicant identifies the SGTS components as subject to any of the following environments:

- sheltered air
- ventilation atmosphere
- buried

The applicant describes these environments in Section 3.0 of the application.

The applicant identifies the following aging effects as applicable to the SGTS components:

- loss of material
- change in material properties

3.2.7.1.2 Aging Management Programs

The applicant credits the following programs and activities for managing the aging effects attributed to the SGTS components:

- Ventilation System Inspection and Testing Activities
- Outdoor, Buried, and Submerged Component Inspection Activities

Table 3.2-7 of the application identifies which of these programs will be used to manage the aging effects for the specific SGTS component materials and environmental condition combinations.

3.2.7.2 Staff Evaluation

The staff reviewed the component group, intended function, environments, materials of construction, aging effects, and aging management activities for the SGTS in Table 3.2-7 of the LRA to determine whether the applicant has demonstrated that the effects of aging for this system will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.7.2.1 Effects of Aging

<u>Aging Effects for the Surfaces of SGTS Components Exposed to Gas Environments</u>

SGTS includes valve bodies, elastomer material flex connections and seals, piping (pipe, tubing, and fittings), pipe specialties (flow elements, pressure elements, and temperature element couplings), and sheet metal (plenums, fan enclosures, louvers, ductwork, and damper enclosures) that are fabricated from carbon steel, stainless steel, galvanized steel, copper alloy (including brass and bronze), galvanized aluminum, or neoprene materials. These components are exposed to either sheltered air or ventilation air conditions. In LRA Table 3.2-7, the applicant identified the following aging effect as applicable to the SGTS components that are exposed to gas environments:

- change in material properties for neoprene materials in sheltered air or ventilation atmosphere

The staff's evaluation of the applicant's omission of applicable aging effects for the metallic SGTS components that are exposed to sheltered air or ventilation atmosphere environments is similar to the staff's evaluation in Section 3.2.1.2.1 for metallic HPCI and other ESF components in these environments. Based on the staff's evaluation in Section 3.2.1.2.1, the staff concludes the applicant has provided an acceptable basis for concluding that aging effects are not applicable to the metallic SGTS piping, piping specialty, and sheet metal components that are exposed to either sheltered air or ventilation atmosphere environments. The applicant's omission of aging effects for the metallic SGTS components in sheltered air or ventilation atmosphere environments is therefore acceptable to the staff.

The staff's evaluation of the applicant's identification of applicable aging effects for the neoprene SGTS components that are exposed to sheltered air or ventilation atmosphere environments is consistent with the staff's evaluation in Section 3.2.1.2.1 for similar neoprene flex hose in the HPCI system in these environments. Based on the staff's evaluation in Section 3.2.1.2.1, the staff concludes that the applicant's identification of aging effects for the neoprene SGTS components that are exposed to either sheltered air or ventilation atmosphere environments is conservative and is therefore acceptable to the staff.

Deletion of the HPCI neoprene flex hose would require the staff assessment to be written here.

cycles estimated to occur up to the end of the extended period of operation. The staff's evaluation of this TLAA is provided in Section 4.1.3 of this SER.

3.3.0.3 Ventilation Systems Flexible Connectors

Numerous ventilation systems discussed in Section 3.3 of the LRA include elastomer components. Ventilation systems contain elastomer materials in duct seals, flexible collars between ducts and fans, rubber boots, etc. For some plant designs, elastomer components are used as vibration isolators to prevent transmission of vibration and dynamic loading to the rest of the system. In Section 3.3 of the LRA, the applicant identified the component and aging effect of change in material properties for the elastomer components. To manage that aging effect, the applicant relies on the periodic visual inspection and testing activities included in the ventilation system inspection and testing activities AMP. The applicant stated that the inspection interval is dependent on the component and the system in which it resides. The applicant also indicated that previous inspection and testing activities have detected damaged components and leakage in certain ventilation systems. However, the aging effects of concern for those elastomer components are loss of material due to wear and changes in material properties such as hardening and loss of strength.

By letter dated February 6, 2002, per RAI 3.3-2, the staff requested that the applicant clarify whether it had considered the aging effect of loss of material due to wear for the applicable elastomer components. In addition, the applicant was requested to provide the frequency of the subject visual inspection and testing activities and to demonstrate the adequacy of the frequency of these inspection and testing activities to ensure that aging degradation will be detected before there is a loss of intended function.

The applicant responded to this RAI in a letter dated May 6, 2002. The applicant stated that based on plant operating experience and operating conditions, it determined that the applicable aging effect for elastomer components in the ventilation systems was change in material properties (loss of strength, resiliency, and elasticity). Loss of material due to wear was not identified as an applicable aging effect. The applicant also stated that components in the control room emergency ventilation system and the standby gas treatment system are inspected and tested annually. The inspection and testing for the battery room and emergency switchgear ventilation, control room fresh air supply, ESW booster pump room and diesel generator room are performed every 2 years. The inspection and testing for the pump structure ventilation fans are performed every 4 years. The applicant further stated that the deficiencies noted in LRA Appendix B.2.3, "Ventilation System Inspection and Testing Activities", attribute number 10, had occurred before adequate preventive maintenance activities were instituted. No failures have been identified since the current inspection and testing activities have been instituted. Therefore, the applicant concluded that the existing inspection and testing activities and their associated frequencies are adequate to detect any aging effects prior to loss of intended function.

Based on the above discussion, the staff finds that the applicant's inspection and testing activities are based on the plants-specific operating experience and the associated frequencies are adequate to detect any aging effects prior to loss of intended function. Therefore, the AMP provides reasonable assurance that the plausible aging effect associated with the elastomer components, as it applies to the ventilation systems, will be adequately managed and is acceptable.

expanded and additional systems that were added as a result of the staff's RAIs. The applicant identified the following systems that were affected by the change to the scope of license renewal:

- reactor coolant system
- engineered safety feature systems
- auxiliary systems

demineralized water and

In its response to the staff's RAIs, the applicant also provided information regarding management of aging effects associated with those additional non-safety-related piping segments brought into the scope of license renewal. The applicant is using the reactor coolant system chemistry program, closed cooling chemistry program, condensate storage tank chemistry activities program, torus water chemistry activities program, fuel pool chemistry activities program, and the one-time piping inspection activities program to manage the aging effects identified for these additional components. The staff verified that the added scope did not include new and unique materials and aging effects, and that the applicant is using the above-listed aging management programs to manage the identified aging effects. The staff's review of the above-mentioned aging management programs is included in Section 3.0 of this SER. On the basis of its review of the additional information provided by the applicant, the staff concludes that the aging management of NSR piping in the spatial proximity to SR piping will be adequately monitored and managed so that the safety release function of the SR piping will be ensured during the period of extended operation.

3.3.1 Fuel Handling System

3.3.1.1 Technical Information in the Application

The technical information is presented in Section 2.3.3.1 and Table 3.3-1 of the LRA. The component groups for the fuel handling systems include fuel preparation machines, the refueling platform, the refueling rails, and the refueling mast.

The fuel handling system consists of the refueling platform equipment assembly and the fuel preparation machines. The Unit 2 and 3 refueling floors are physically separated. Each unit has its own fuel handling system and fuel pool. The refueling platform includes a bridge structure that spans the spent fuel pool and the reactor well. The platform travels on rails that extend the length of the fuel storage pool and the reactor well. A working platform extends the width of the bridge structure, providing working access to the entire width of the pools and the reactor well area.

Two fuel preparation machines located in each fuel storage pool are used to strip the channels from spent fuel assemblies and to install the used channels on new fuel assemblies.

The refueling platform assembly and fuel preparation machines are constructed from stainless steel, aluminum, and carbon steel and the rails are constructed from carbon steel.

3.3.1.1.1 Aging Effects

The components of the fuel handling system are described in Section 2.3.3.1 of the submittal. These components are within the scope of license renewal and are subject to an aging management review. Table 3.3-1 of the LRA lists individual components of the system, including fuel preparation machines, refueling platform assembly, rails, and mast. Stainless steel and aluminum components are identified as being subject to loss of material from exposure to the fuel pool water. Stainless steel and carbon steel exposed to sheltered environments have no associated aging effects.

3.3.1.1.2 Aging Management Programs

The following AMP is utilized to manage aging effects for the fuel handling system:

- fuel pool chemistry activities

A description of the aging management program activities is provided in Appendix B of the LRA. The applicant concludes that the effect of aging associated with the components of the fuel handling system will be adequately managed by the aging management program such that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.3.1.2 Staff Evaluation

The staff reviewed the application to determine whether the applicant has demonstrated that the effects of aging on these component groups will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.1.2.1 Aging Effects

The fuel preparation machines are fabricated from stainless steel and aluminum and are exposed to fuel pool water.

The refueling platform assembly is constructed from stainless steel and carbon steel and the rails are constructed from carbon steel. They are exposed to a sheltered environment. There were no aging effects identified and, as a result, no aging management activity is required. The staff agrees with the applicant's conclusion that there are no credible aging effects for stainless steel and carbon steel in a sheltered environment.

The refueling platform mast is constructed from stainless steel and chrom~~ium~~e plated stainless steel exposed to fuel pool water. The applicant identified loss of material as the aging effect. The aging effect of the SSCs in the fuel handling system exposed to the environments identified in the LRA are consistent with industry experience. The staff finds that the aging effects identified are appropriate.

3.3.1.2.2 Aging Management Programs

Section 2.3.3.1 and Table 3.3-1 of the LRA state that the following aging management program is credited for managing the aging effects in the fuel handling system:

- fuel pool chemistry activities

The staff finds that the fuel pool chemistry activities are effective in controlling loss of material for these component groups. The staff review of the fuel pool chemistry activities ~~follows~~ is in Section 3.5.2.2.2.

3.3.1.3 Conclusions

The staff has reviewed the information on aging effects and aging management activities for the materials and environments of the fuel handling equipment, and the staff concludes that the applicant has demonstrated that aging effects associated with the subject components will be adequately managed so there is reasonable assurance that the subject system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.2 Fuel Pool Cooling and Cleanup System

3.3.2.1 Technical Information in the Application

The aging management review results for the fuel pool cooling and cleanup system are presented in Table 3.3-2 of the LRA.

Section 2.3.3.2 of the LRA states that the fuel pool cooling and cleanup system provides fuel pool water temperature control and is used to maintain fuel pool water clarity, purity, and level. The fuel pool cooling and cleanup system cools the fuel storage pool by transferring decay heat through the heat exchangers to the service water system. Water purity and clarity in the fuel storage pool, reactor well, and steam dryer-separator storage pit are maintained by filtering and demineralizing the pool water.

The system consists of three fuel pool cooling pumps, three heat exchangers, a filter demineralizer, two skimmer surge tanks, and associated piping and valves. The three fuel pool cooling pumps are connected in parallel, as are the three heat exchangers. The pumps and heat exchangers are located in the reactor building. An interconnection with the RHR system provides backup cooling and makeup water to the fuel storage pool.

Piping and components required to support fuel pool makeup from the RHR system are the only part of the system in scope for this application.

3.3.2.1.1 Aging Effects

In Table 3.3-2 of the LRA, the applicant identifies the following components that will require aging management: valve bodies, piping, tubing, vacuum breakers, and restricting orifices. The applicant identified stainless steel and carbon steel as the materials of construction for the fuel pool cooling and cleanup system. Loss of material and cracking were identified as applicable aging effects for stainless steel exposed to the fuel pool water. Loss of material was identified as an applicable aging effect for carbon steel components exposed to the fuel pool water.

3.3.2.1.2 Aging Management Programs

The LRA identifies the fuel pool chemistry activities as the aging management program that will manage the aging effects of the fuel pool cooling and cleanup system. A description of the fuel pool chemistry activities is provided in Appendix B of the LRA. The applicant concludes that the effects of aging associated with components of the fuel pool cooling and cleanup system will be adequately managed by this aging management program such that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.3.2.2 Staff Evaluation

The staff reviewed Section 2.3.3.2 and Table 3.3-2 of the LRA to determine whether the applicant has demonstrated that the effects of aging on these component groups will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.2.2.1 Aging Effects

breakers

The fuel pool cooling and cleanup system contains castings and forgings (valve bodies), piping and piping specialities (vacuum ~~bivalve~~ and restricting orifices) constructed from carbon steel and stainless steel which are exposed to fuel pool water. The carbon steel components and stainless steel components are susceptible to the aging effect loss of material. The stainless steel components are also susceptible to cracking.

The aging effects of the SSCs in the fuel pool cooling and cleanup system exposed to the environments the applicant identified in the LRA are consistent with industry experience. The staff finds that the aging effects identified are appropriate.

3.3.2.2.2 Aging Management Programs

The loss of material and the cracking aging effects are managed by the fuel pool chemistry activities. The staff agrees that the fuel pool chemistry activities are adequate to manage the aging effects, loss of material and cracking of stainless steel and carbon steel exposed to fuel pool water. The staff review of the fuel pool chemistry activities is documented ~~above~~ in Section ~~3.3.1.2.2.~~ 35.2.2.2.

Based on industry experience, there are no aging effects for stainless steel and carbon steel pipe exposed to a sheltered environment, and no aging management programs are required.

3.3.2.3 Conclusions

The staff has reviewed the information on aging effects and aging management activities for the materials and environments of the fuel pool cooling and cleanup components. The staff concludes that the applicant has demonstrated that aging effects associated with the subject components will be adequately managed so there is reasonable assurance that the subject system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.3 Control Rod Drive System

3.3.3.1 Technical Information in the Application

The aging management review results for the control rod drive system are presented in Table 3.3-3 of the LRA.

Section 2.3.3.3 of the LRA states that the control rod drive (CRD) system is a reactivity control system that utilizes pressurized demineralized water to rapidly insert control rods in the core upon receipt of a scram signal. The system also provides control rod manipulation and positioning for power adjustments, and serves as a source of cooling water for the graphitar seals of the CRD mechanisms.

The CRD system serves as a source of purge water for the reactor water cleanup pumps and reactor recirculation pump seals. The system also serves as a source of injection water to reactor vessel level instrumentation reference legs to mitigate the accumulation of gases.

The alternate rod insertion (ARI) system is a subsystem of the CRD system and serves as a backup means to provide a reactor scram, independent of the reactor protection system, by venting off the scram air header. The ARI function serves to reduce the probability of an ATWS event and may be initiated automatically or manually.

The components in this system are fabricated from carbon steel and stainless steel.

3.3.3.1.1 Aging Effects

Table 3.3-3 of the LRA identifies the following components that will require aging management: valve bodies, piping, tubing, filter bodies, ~~rupture discs,~~ and accumulators. The applicant identified stainless steel and carbon steel ~~as the~~ materials of construction for the CRD system. Loss of material was identified as an applicable aging effect for carbon steel components exposed to condensate storage water. Loss of material and cracking were identified as applicable aging effects for stainless steel materials exposed to condensate storage water.

3.3.3.1.2 Aging Management Programs

The LRA identifies the following two aging management programs that will manage the aging effects of the CRD system:

- demineralized water and condensate storage tank chemistry activities
- ISI program

Appendix B of the LRA contains a detailed description of the subject aging management programs. The LRA cites these programs for managing aging effects of the CRD system components in applicable environments.

3.3.3.2 Staff Evaluation

The staff reviewed Section 2.3.3.3 and Table 3.3-3 of the LRA to determine whether the applicant has demonstrated that the effects of aging on these component groups will be

The control rod drive system contains accumulators constructed from carbon steel and stainless steel and exposed to dry gas and a sheltered environment. The applicant identified no aging effects requiring management. The staff agrees that for this material and environment combination, there are no aging effects requiring management.

The aging effects of the SSCs in the control rod drive system exposed to the environments the applicant identified in the LRA are consistent with industry experience. The staff finds that the aging effects identified are appropriate.

3.3.3.2.2 Aging Management Programs

The applicant identified the following two aging management programs that will manage the aging effects for the control rod drive system:

demineralized water and
- condensate storage tank chemistry activities
- ISI activities

demineralized water and   demineralized water and
The CST chemistry activities are reviewed in Section 3.0.3.4 of this SER. The staff agrees with the effects of aging identified by the applicant and agrees that the CST chemistry activities are the adequate aging management activities.

The ISI program is reviewed in Section 3.0.3.6 of this SER. The staff agrees that loss of material is the appropriate aging effect for these material and environment combinations and that the ISI program will adequately manage this aging effect for the period of extended operation.

3.3.3.3 Conclusions

The staff has reviewed the information on aging effects and aging management activities for the material/environment combinations for the control rod drive system. The staff concludes that the applicant has demonstrated that aging effects associated with the subject components will be adequately managed so there is reasonable assurance that the subject system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.4 Standby Liquid Control System

3.3.4.1 Technical Information in the Application

The technical information regarding the standby liquid control system is presented in Section 2.3.3.4 and Table 3.3-4 of the LRA. The purpose of the standby liquid control system is to provide a backup method, which is redundant to, and independent of, the control rod drive system to shut down the reactor and maintain it in a cold, subcritical condition. Maintaining subcriticality as the nuclear system cools assures that the fuel barrier is not threatened by overheating in the event that not enough of the control rods can be inserted to counteract the positive reactivity effects of a decrease in the moderator temperature. A neutron absorber consisting of enriched sodium pentaborate in solution is injected into the vessel and distributed throughout the core in sufficient quantity to achieve and maintain shutdown while allowing for margin due to leakage and imperfect mixing. The system is manually initiated from the control room via a three-position key-locked selector switch.

3.3.4.1.1 Aging Effects

The components of the standby liquid control system are described in Section 2.3.3.4 of the submittal as being within the scope of license renewal and subject to aging management review. Table 3.3-4 of the LRA lists individual components of the system, including a solution storage tank, ~~a test tank,~~ two 100%-capacity positive displacement pumps with their associated relief valves and accumulators, two explosive valves installed in parallel, and associated controls and instrumentation. The components of the standby liquid control system are fabricated from carbon steel and stainless steel.

A description of the environments is provided in ~~Table 3.3-4~~ Section 3.0 of the LRA. The standby liquid control system structures and components are exposed to the following environments:

- borated water
- dry gas
- reactor coolant
- sheltered

The following aging effects associated with the structures and components require aging management:

- cracking of stainless steel components in borated water environments
- cracking of stainless steel components in reactor coolant environments
- loss of material from carbon steel and stainless steel components in borated water environments
- loss of material from ~~carbon steel and~~ stainless steel components in reactor coolant environments

3.3.4.1.2 Aging Management Programs

The following aging management activities manage aging effects for the standby liquid control system structures and components:

- RCS Chemistry
- Deminerlized Water and Condensate Storage Tank Chemistry Activities
- ~~Standby Liquid Control System Surveillance~~
- ISI Program
- One-Time Piping Inspection Activities

Descriptions of these aging management programs are provided in Appendix B of the LRA. The applicant concludes that the effects of aging associated with the components of the standby liquid control system will be adequately managed by these aging management programs such that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.3.4.2 Staff Evaluation

The applicant described its AMR of the standby liquid control system for license renewal in Section 2.3.3.4 and Table 3.3-4 of the LRA. The staff reviewed this section and table of the LRA to determine whether the applicant has demonstrated that the effects of aging on the standby liquid control system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.4.2.1 Aging Effects

The components of the standby liquid control system are fabricated from carbon steel and stainless steel.

Some pump, valve, piping, and tubing components that are made of carbon steel and stainless steel are exposed to a borated water environment. The aging effects associated with exposure to borated water are identified in Table 3.3-4 of the LRA. The applicable aging effects are loss of material and cracking due to chemical attack. Cracking of stainless steel in borated water is an aging effect that needs to be managed by appropriate AMPs. Loss of material of carbon steel in borated water is identified as an aging effect and will be managed by AMPs. Loss of material of stainless steel components in borated water is also identified by the applicant as an aging effect. The staff believes this aging effect is insignificant and unlikely to occur. However, since the applicant's position is more conservative, the staff agrees with the applicant's review for this combination of material and environment.

The components of the standby liquid control system which are exposed to a sheltered environment are fabricated from stainless steel and carbon steel. The sheltered environment consists of a moist, atmospheric air with a temperature ranging from 65°F to 150°F and a relative humidity ranging from 10% to 90%. The aging effect discussion for these materials is provided in Section 3.3.0.6 of this SER.

The aging effects that result from the contact of standby liquid control system structures and components with the environments listed in Table 3.3-4 are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects identified are appropriate for the combinations of materials and environments listed.

3.3.4.2.2 Aging Management Programs

As shown in Section 2.3.3.4 and Table 3.3-4 of the LRA, the following aging management programs are credited for managing the aging effects in the standby liquid control system:

The applicant modified the aging management activities associated with the standby liquid control system. By letter dated May 14, 2002, the applicant stated that the modified managing approach for the standby liquid control system includes water chemistry controls applied to the demineralized water system and a one-time inspection of a representative section of standby liquid control system piping. These AMPS are discussed in Section 3.0.3 of this SER. Therefore, App B.1.13 of the Standby Liquid Control System Service Activities AMP in the LRA was deleted. A detailed discussion is provided in Section 3.0.3.19 of this SER.

- RCS Chemistry
- Demineralized Water and Condensate Storage Tank Chemistry Activities
- ISI Program

refueling and post-accident conditions. The system provides core decay heat removal capability during shutdown periods, and containment cooling during normal operations and during post-accident conditions.

3.3.5.1.1 Aging Effects

The components of the high-pressure service water system are described in Section 2.3.3.5 of the submittal as being within the scope of license renewal and subject to aging management review. Table 3.3-5 of the LRA lists individual components of the system, including heat exchangers, pumps, and the necessary piping, tubing, valves, and controls. The components are made of carbon steel, cast iron, copper, alloy steel and stainless steel.

A description of the environments is provided in ~~Table 3.3-5~~ Section 3.0 of the LRA. The High-pressure service water system structures and components are exposed to the following environments:

- outdoor
- raw water
- buried
- lube oil
- sheltered

The following aging effects associated with the structures and components require aging management:

- cracking of stainless steel and copper components in raw water environments
- loss of material from carbon steel in outdoor environments
- loss of material from carbon steel, cast iron, stainless steel, and alloy steel components in raw water environments
- flow blockage of carbon steel, cast iron, stainless steel, and copper components in raw water environments
- cracking of cast iron and copper components in lube oil environments
- heat transfer reduction of copper in lube oil environments
- heat transfer reduction of cast iron in ~~raw water~~ lube oil environments
- loss of material from carbon steel in buried environments
- heat transfer reduction of copper in raw water environments

3.3.5.1.2 Aging Management Programs

The following aging management activities manage aging effects for the High-pressure service water system structures and components:

- Outdoor, Buried, and Submerged Component Inspection Activities
- Generic Letter 89-13 Activities
- Lubricating and Fuel Oil Quality Testing
- ISI Program

Descriptions of these aging management programs are provided in Appendix B of the LRA. The applicant concludes that the effects of aging associated with the components of the High-Pressure Service Water System will be adequately managed by these aging management programs such that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.3.5.2 Staff Evaluation

The applicant described its AMR of the high-pressure service water system for license renewal in Section 2.3.3.5 and Table 3.3-5 of the LRA. The staff reviewed this section and table of the LRA to determine whether the applicant has demonstrated that the effects of aging on the High-Pressure Service Water System will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.5.2.1 Aging Effects

The components of the high-pressure service water system are heat exchangers, pumps, piping, tubing, valves, and controls, and are made of carbon steel, cast iron, copper, alloy steel, and stainless steel.

Valve, piping, and tubing components made of carbon steel are exposed to a raw water environment. The aging effects associated with exposure to raw water are identified in Table 3.3.5 of the LRA. The applicable aging effects are loss of material and flow blockage due to chemical attack and fouling.

Some components made of stainless steel are exposed to a raw water environment. The applicable aging effects are cracking and flow blockage due to chemical attack and fouling.

Pump casings made of cast iron are exposed to a raw water environment. The aging effects associated with exposure to raw water are loss of material and flow blockage.

Some pump motor oil cooler coils and casings made of cast iron or copper are also exposed to a lubricating oil environment. The aging effects associated with exposure to this environment are cracking and heat transfer reduction.

Heat exchanger tubing made of copper is exposed to a raw water environment. The aging effects associated with exposure to raw water are identified in Table 3.3-5 of the LRA. The applicable aging effects are cracking, heat transfer reduction, and flow blockage.

The aging effects that result from the contact of High-pressure service water system structures and components with the environments shown in Table 3.3-5 are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects identified above are appropriate for the combinations of materials and environments listed.

3.3.5.2.2 Aging Management Programs

As shown in Section 2.3.3.5 and Table 3.3-5 of the LRA, the following aging management programs are credited for managing the aging effects in the High-pressure service water system:

- Outdoor, Buried, and Submerged Component Inspection Activities

3.3.6 Emergency Service Water System

3.3.6.1 Technical Information in the Application

The technical information regarding the emergency service water system is presented in Section 2.3.3.6 and Table 3.3-6 of the LRA. The emergency service water system provides a reliable supply of cooling to diesel generator coolers, emergency core cooling system and reactor core isolation cooling compartment air coolers, core spray pump motor oil coolers, and other equipment during a loss of offsite power or during a loss of normal station service water.

A return header in each unit returns the water to the discharge pond or the emergency cooling water system. During normal operations, all system loads with the exception of the emergency diesel generator heat exchangers are supplied with cooling water from the service water system. The emergency service water system provides the cooling water whenever the pumps are operating and the emergency service water system pressure is greater than service water system pressure or the service water system is manually isolated from the emergency service water system. In the event of extreme high or low Conowingo Pond level, the emergency service water system can be shifted to closed cycle operation through the use of the emergency cooling water system.

3.3.6.1.1 Aging Effects

The components of the emergency service water system are described in Section 2.3.3.6 of the submittal as being within the scope of license renewal and subject to aging management review. Table 3.3-6 of the LRA lists individual components of the system, including two 100%-capacity ESW pumps and the associated discharge and distribution piping, piping components, valves, and instrumentation and controls. These components are made of carbon steel, copper, alloy steel, and stainless steel.

The environments are described in ~~Table 3.3-6~~ Section 3.0 of the LRA. The emergency service water system structures and components are exposed to the following environments:

- outdoor
- raw water
- buried
- sheltered

The following aging effects associated with the structures and components require aging management:

- cracking of stainless steel and copper components in raw water environments
- loss of material from carbon steel in outdoor environments
- loss of material from carbon steel, cast iron, stainless steel, and alloy steel components in raw water environments
- flow blockage of carbon steel, cast iron, stainless steel, and copper in raw water environments
- loss of material from carbon steel in buried environments

3.3.6.1.2 Aging Management Programs

The following aging management activities manage aging effects for the emergency service water system structures and components:

- Outdoor, Buried, and Submerged Component Inspection Activities
- Generic Letter 89-13 Activities
- ISI Program
- Inservice Testing (IST) Program

These aging management programs are described in Appendix B of the LRA. The applicant concludes that the effects of aging associated with the components of the emergency service water system will be adequately managed by these aging management programs such that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.3.6.2 Staff Evaluation

The applicant described its AMR of the emergency service water system for license renewal in Section 2.3.3.6 and Table 3.3-6 of the LRA. The staff reviewed this section and table of the LRA to determine whether the applicant has demonstrated that the effects of aging on the emergency service water system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.6.2.1 Aging Effects

The Emergency Service Water (ESW) System consists of two ESW pumps and associated discharge and distribution piping, piping components, valves, and instrumentation and controls. These components are made of carbon steel, copper, alloy steel, and stainless steel.

Valve, piping, and tubing components made of carbon steel and valve bodies and pump casings made of cast iron are exposed to a raw water environment. The aging effects associated with exposure to raw water are identified in Table 3.3-6 of the LRA. Applicable aging effects include loss of material and flow blockage due to chemical attack and fouling.

Some components made of stainless steel are exposed to a raw water environment. The aging effects associated with exposure to raw water are identified in Table 3.3-6 of the LRA. Applicable aging effects include loss of material, cracking, and flow blockage due to chemical attack and fouling.

Some carbon steel piping is exposed to a buried environment. The aging effect associated with exposure to this environment is loss of material.

The possible aging effects for copper piping exposed to raw water are loss of material, cracking, and flow blockage.

Loss of material and flow blockage are the applicable aging effects for piping made of alloy steel exposed to a raw water environment.

3.3.6.3 Conclusions

The staff reviewed the information in Section 3.3.6 and Table 3.3-6 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the emergency service water system structures and components will be adequately managed so that there is reasonable assurance that this system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.7 Fire Protection System

3.3.7.1 Technical Information in the Application

The fire protection system contains components and equipment for detecting, suppressing, containing, and monitoring fires. This system includes various types of water, foam, and carbon dioxide suppression systems and has active and passive features such as fire doors and fire dampers that prevent a fire from spreading from one area of the plant to another. Two vertical turbine fire pumps — one diesel, one electric — take their suction from independent, isolable intake wells and can provide water from Conowingo Pond.

The components of the fire protection system are described in Section 2.3.3.7 of the LRA as being within the scope of license renewal and subject to aging management review (AMR). The materials of construction of the fire protection system components are cast iron, carbon steel, bronze, aluminum, stainless steel, brass, copper, brass alloys, chrome-plated brass, and malleable iron. Table 3.3-7 of the LRA lists the individual components of the system, including valve bodies, sprinkler heads, strainer screens, pump casings, hydrants, pipe, tubing, fittings, discharge nozzles, strainer bodies, restricting orifices, flow elements, flexible hoses, metal flex connections, Y strainer bodies, Cardox tanks, fuel tanks, and mufflers.

3.3.7.1.1 Aging Effects

The applicant identified no aging effects for cast iron, carbon steel, bronze, aluminum, stainless steel and brass components in the sheltered and dry gas environment and no aging effects for copper, brass alloys, chrome-plated brass, and malleable iron in the sheltered environment or carbon steel, malleable iron, and bronze components in the outdoor environment. The applicant identified aging effects for the following combinations of component materials and internal/external environments:

- loss of material and flow blockage for cast iron in buried, fuel oil, outdoor, and raw water environments
- loss of material and flow blockage for lined cast iron in buried and raw water environments
- cracking, loss of material and flow blockage for bronze in fuel oil and raw water environments
- loss of material and flow blockage for carbon steel in fuel oil, raw water, and wetted gas environments
- loss of material, cracking and flow blockage for stainless steel in raw water and fuel oil environments
- cracking, loss of material, and flow blockage for brass in fuel oil and raw water

environments

- cracking and loss of material for brass alloys in fuel oil environment
- cracking, loss of material and flow blockage for chrome-plated brass in a raw water environment
- changes in material properties for neoprene and rubber in the fuel oil environment
- flow blockage and loss of material for black steel in the raw water environment
- cracking, loss of material and flow blockage for copper in the raw water environment

The applicant also identified fire barrier components such as fire walls, fire penetration seals, fire doors, and fire wraps as within the scope of license renewal and subject to AMR. The applicant considered these components with their respective structures under the Hazard Barriers and Elastomers structural commodity group in LRA Sections 2.4 and 3.5. These components were reviewed by the staff and are addressed in Section 3.5 of this SER.

3.3.7.1.2 Aging Management Programs

The applicant credits the following AMPs to manage aging effects of the fire protection system:

- Fire Protection Activities
- Outdoor, Buried, and Submerged Component Inspection
- Lubricating and Fuel Oil Quality Testing Activities

A description of these aging management programs is provided in Appendix B of the LRA. The applicant concludes that the effects of aging associated with the components in this system will be adequately managed by these aging management programs such that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.3.7.2 Staff Evaluation

The applicant described its AMR of the fire protection system for license renewal in Section 2.3.3.7 and Table 3.3-7. The staff reviewed this section and table to determine whether the applicant has demonstrated that the effects of aging on the fire protection system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.7.2.1 Aging Effects

During a teleconference on July 15, 2002, the staff requested the applicant to explain the exclusion of aging effects for carbon steel in the outdoor environment. The applicant submitted a supplement RAI response to RAI 3.3-4 to address this issue. The applicant states that the exhaust piping for the fire protection diesel-driven pump is routed outdoors to safely emit the exhaust gases outside of the building. The pressure boundary integrity of the exhaust piping is critical for the indoor piping; however, once the exhaust piping penetrates the roof slabs, the pressure boundary integrity of the exhaust piping is no longer critical. Throughwall corrosion of the outdoor exhaust piping will not impact the operability or availability of the fire protection diesel-driven pump since exhaust gas flow through pipe-wall breaches is still safely emitted outside the buildings.

In a letter dated February 6, 2002, the staff issued RAI 3.3-11 to request the applicant to provide information supporting the exclusion of aging effects for bronze in the outdoor environment. The applicant responded to this RAI by a letter dated May 6, 2002. In this letter the applicant stated that the aging management review determined that there are no aging effects for bronze in an outdoor environment because of an evaluation in Electrical Power Research Institute (EPRI) document 1003056, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools", Rev. 3. This evaluation concludes that copper alloys are resistant to general corrosion in a gas environment, even in the presence of oxygen and moisture. The applicant equated the gas environment from the EPRI document to the wetted gas environment and stated that the wetted gas environment is, therefore, similar to the outdoor environment. The applicant further states that the atmospheric conditions at PBAPS do not contain high levels of contaminants that would result in an aggressive corrosive environment. Given that the outdoor environment will contain agents such as sulfates, nitrates, sulfur dioxide, sulfuric acid, and lead that could contribute to the corrosion of bronze, applicant needs to provide a more quantitative response regarding the levels of contamination at the site. PBAPS is located near areas that are in "nonattainment status" with respect to air quality, which means that the air quality does not meet minimum national air quality standards. In addition, the applicant alludes to the fact that the outdoor environment is corrosive by stating that the atmospheric conditions are not an "aggressive corrosive environment." That wording suggests that the environment is, although not aggressively corrosive, corrosive nonetheless, and therefore capable of inducing aging effects. During a meeting on July 18, 2002, the staff communicated these concerns to the applicant. The applicant noted the staff's concerns and committed to providing a response to facilitate the staff's completion of this SER. By letter dated July 29, 2002, the applicant supplemented RAI 3.3-11, informing the staff that the bronze valves in question are 2.5-inch angle valves used for fire hose connections. The valves are normally closed and capped. Although the outer material of these valves is exposed to the outdoor environment, the bronze material inside the valves is exposed to raw water and subject to aging management. Fire protection activities include visual inspection of valves to detect loss of material, cracking and flow blockage. Therefore, the component integrity of these valves is provided via these fire protection activities.

The staff finds that the applicant's responses adequately address RAI 3.3-4 and RAI 3.3-11.

The aging effects of the SSCs in the fire protection system exposed to the environments that the applicant identified in the LRA are consistent with industry experience. The staff finds that the aging effects identified are appropriate.

3.3.7.2.2 Aging Management Programs

Section 2.3.3.7 and Table 3.3-7 of the LRA state that the following aging management programs are credited for managing the aging effects in the fire protection system:

- Fire Protection Activities
- Outdoor, Buried, and Submerged Component Inspection
- Lubricating and Fuel Oil Quality Testing Activities

The Fire Protection Activities, Outdoor, the Buried, and Submerged Component Inspection, and

Lubricating and Fuel
the Oil Quality Inspection are credited with managing the aging effects of several components in various different structures and systems and are, therefore, considered common aging management programs. The staff review of the common aging management programs is in Section 3.0 of this SER.

The staff evaluated the aging management programs identified in Section 3.0.3.16 and found them to be acceptable for managing the aging effects identified for the fire protection system.

3.3.7.2.3 Conclusions

The staff has reviewed the information in Sections 2.3.3.7 and 3.3.7 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the fire protection system will be adequately managed so that there is reasonable assurance that this system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.8 Control Room Ventilation System

3.3.8.1 Technical Information in the Application

The aging management review results for the control room ventilation system are presented in Table 3.3-8 of the LRA.

Section 2.3.3.8 of the LRA states that the control room ventilation system is a safety-related system that is common to Units 2 and 3. The system consists of several subsystems: the control room fresh air supply, control room emergency ventilation filter, control room air conditioning ventilation supply, and control room return air systems.

The system ensures the habitability of the control room even under design basis events. The fresh air portion of the system is operable during the loss of offsite power. The fresh air intake is filtered when control room emergency ventilation is initiated to prevent iodine and particulate contamination of the control room air.

The system consists of normal and emergency ventilation supply fans, air conditioning supply and return fans, filters, heating coils and cooling coils, refrigerant water chillers, chilled water pumps, dampers, ductwork, instrumentation, and controls.

The control room fresh air supply system consists of two 100%-capacity, redundant supply fans, a roll filter, and a preheat coil. The system is supplied with outside air from the outside air intake plenum.

The control room emergency ventilation filter system is a safety-related system which consists of two 100%-capacity filter units and redundant supply fans. Each filter unit consists of a charcoal filter and two banks of high-efficiency particulate air (HEPA) filters, one upstream and the other downstream of the charcoal filter.

3.3.8.1.1 Aging Effects

The control room ventilation system contains castings and forgings (valve bodies), piping (pipe and tubing), pipe specialities (flow elements), and sheet metal (ducting, damper enclosures, plenums, and fan enclosures) constructed from stainless steel, brass, carbon steel, galvanized steel and copper. These components are exposed to a sheltered environment. The applicant found no aging effects requiring management for these components.

The control room ventilation system contains elastomers (fan flex connections and filter plenum access door seals) constructed from fiberglass-impregnated neoprene, sponge, neoprene, and rubber and exposed to sheltered and ventilation environment. The applicant identified change in material properties as the aging effect.

The control room ventilation system contains castings and forgings (valve bodies), piping (pipe and tubing), piping specialities (flow elements), sheet metal (plenums, fan enclosures, louvers, ducting, and damper enclosures) constructed from stainless steel, brass, copper, carbon steel and galvanized steel and exposed to a ventilation atmosphere. The applicant identified no aging effects requiring management for this combination of materials and environment.

3.3.8.1.2 Aging Management Programs

The following AMP is utilized to manage aging effects on the control room ventilation system:

- the ventilation inspection and testing activities

A description of the aging management program (activities) is provided in Appendix B of the LRA. The applicant concludes that the effects of aging associated with the components of the control room ventilation system will be adequately managed by the aging management program such that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.3.8.2 Staff Evaluation

The staff reviewed Section 2.3.3.8 and Table 3.3.8 of the application to determine whether the applicant has demonstrated that the effects of aging on these component groups will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.8.2.1 Aging Effects

The control room ventilation system contains castings and forgings (valve bodies), piping (pipe and tubing), pipe specialities (flow elements), and sheet metal (ducting, damper enclosures, plenums, and fan enclosures) constructed from stainless steel, brass, carbon steel, galvanized steel and copper. These components are exposed to a sheltered environment. The applicant found no aging effects requiring management for these components. The staff agrees that for this materials/environment combination, there are no aging effects requiring management, as demonstrated by industry experience.

The control room ventilation system contains elastomers (fan flex connections and filter plenum access door seals) constructed from fiberglass-impregnated neoprene, sponge, neoprene, and rubber and exposed to sheltered and ventilation environments. The applicant identified change in material properties as the aging effect. The staff agrees that based on industry experience the applicant has identified the appropriate aging effects for these combinations of materials and environments.

The control room ventilation system contains castings and forgings (valve bodies), piping (pipe and tubing), piping specialities (flow elements), sheet metal (plenums, fan enclosures, louvers, ducting, and damper enclosures) constructed from stainless steel, brass, copper, and carbon steel galvanized steel. These components are exposed to a ventilation atmosphere. The applicant identified no aging effects requiring management for this combination of materials and environment. The staff agrees that for is materials/environment combination, there are no aging effects requiring management, as demonstrated by industry experience.

The aging effects of the SSCs in the control room ventilation system exposed to the environments the applicant identified in the LRA are consistent with industry experience. The staff finds that the aging effects identified are appropriate.

3.3.8.2.2 Aging Management Programs

The applicant identified the following aging management program that will manage the aging effects of the control room ventilation system:

- the ventilation system inspection and testing activities

The ventilation system inspection and testing activities are reviewed in Section 3.0.3.12 of this SER. The staff agrees that the applicant has identified the appropriate aging effects for these combinations of materials and environments and that the ventilation inspection and testing activities will adequately manage the effects of aging for the extended period of operation.

3.3.8.3 Conclusions

The staff has reviewed the information on aging effects and aging management activities for the materials and environments of the control room ventilation system, and the staff concludes that the applicant has demonstrated that aging effects associated with the subject components will be adequately managed so there is reasonable assurance that the subject system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.9 Battery and Emergency Switchgear Ventilation System

3.3.9.1 Technical Information in the Application

The aging management review results for the battery and emergency switchgear ventilation system is in Table 3.3-9 of the LRA.

Section 2.3.3.9 of the LRA states that the battery and emergency switchgear ventilation system consists of a common air supply system and separate exhaust systems. Outdoor air is filtered, conditioned by heating coils when required, and discharged by one of the two supply fans to the emergency switchgear and battery rooms of Units 2 and 3. One of the two emergency switchgear room return air fans is controlled by an air-operated damper and exhausts air to atmosphere at the radwaste building roof or back to the suction of the supply fan. One of the two battery room exhaust fans discharges exhaust air from the battery rooms to atmosphere at the radwaste building roof. Loss of duct pressure automatically starts standby fans and sounds an alarm in the main control room.

The ventilation system is normally in operation and continues to operate during accident conditions, including the loss of offsite power. All system controls are from a local panel. Redundant fans are provided for reliable system operation.

3.3.9.1.1 Aging Effects

In Table 3.3-9 of the LRA, the applicant identifies the components of the battery and emergency switchgear ventilation system. The system contains castings and forgings (valve bodies), piping (tubing), sheet metal (ducting, plenums, damper enclosures, and fan enclosures), constructed from stainless steel, galvanized steel ~~mesh~~, and carbon steel and exposed to a sheltered environment. The applicant found no aging effects requiring management for these components in a sheltered environment.

The battery and emergency switchgear ventilation system also contains castings and forgings (valve bodies), piping (tubing), sheet metal (exhaust hoods, fan enclosures, ducting, plenums, bird screens damper enclosures, and louvers), constructed from stainless steel, galvanized steel mesh, galvanized steel with galvanized casing, and carbon steel. These components are exposed to a ventilation atmosphere. The applicant found no aging effects requiring management for these components in a ventilation atmosphere.

The battery and emergency switchgear ventilation system contains elastomers (fan flex connections) constructed from fiberglass-impregnated neoprene and exposed to both a sheltered and a ventilation atmosphere. The applicant identified change in material properties as an aging effect requiring management.

The components of this system are fabricated from carbon steel, stainless steel, and galvanized steel.

3.3.9.1.2 Aging Management Programs

The LRA identifies the following aging management program that will manage the aging effects of the battery and emergency switchgear ventilation system:

- ventilation system inspection and testing activities

Appendix B of the LRA contains a detailed description of the aging management program. The LRA cites this program for managing aging effects for the fan flex connections of the battery and emergency switchgear ventilation system.

3.3.9.2 Staff Evaluation

The staff reviewed Section 2.3.3.9 and Table 3.3-9 of the application to determine whether the applicant has demonstrated that the effects of aging on these component groups will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.9.2.1 Aging Effects

The battery and emergency switchgear ventilation system contains castings bird screens and forgings (valve bodies), piping (tubing), sheet metal (ducting, plenums, damper enclosures, and fan enclosures) constructed from stainless steel, galvanized steel mesh, and carbon steel. These components are exposed to a sheltered environment. The applicant found no aging effects requiring management for these components. The staff agrees that, based on industry experience, there are no aging effects requiring management for these materials and environment combinations (see Section 3.3.0.6 of this SER).

The battery and emergency switchgear ventilation system contains castings and forgings (valve bodies), piping (tubing), sheet metal (exhaust hoods, bird screens fan enclosures, ducting, plenums, damper enclosures, and louvers), which are constructed from stainless steel, galvanized steel mesh, galvanized steel with galvanized casing, and carbon steel. These components are exposed to a ventilation atmosphere. The applicant found no aging effects requiring management for these components. The staff agrees that, based on industry experience, there are no aging effects requiring management for these materials and environment combinations.

The battery and emergency switchgear ventilation system contains elastomers (fan flex connections) constructed from fiberglass-impregnated neoprene and exposed to both a sheltered and a ventilation atmosphere. The applicant identified change in material properties as the aging effect.

The aging effects of the SSCs in the battery and emergency switchgear ventilation system exposed to the environments the applicant identified in the LRA are consistent with industry experience. The staff finds that the aging effects identified are appropriate.

3.3.9.2.2 Aging Management Programs

The battery and emergency switchgear ventilation system contains elastomers (fan flex connections) constructed from fiberglass-impregnated neoprene and exposed to both a sheltered and a ventilation atmosphere. The applicant identified change in material properties as the aging effect and credits the following activities for managing this aging effect during the period of extended operation:

- ventilation system inspection and testing activities

The ventilation system inspection and testing activities are reviewed in Section 3.0.3.12 of this SER. The staff agrees that the applicant has identified the appropriate aging effects for these combinations of materials and environments and that the ventilation inspection and testing activities will adequately manage the effects of aging for the extended period of operation.

3.3.9.3 Conclusions

The staff has reviewed the information on aging effects and aging management activities for the materials and environments of the battery and emergency switchgear ventilation system, and the staff concludes that the applicant has demonstrated that aging effects associated with the subject components will be adequately managed so there is reasonable assurance that the subject system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.10 Diesel Generator Building Ventilation System

3.3.10.1 Technical Information in the Application

The aging management review results for the diesel generator building ventilation system are given in Table 3.3-10 of the LRA.

Section 2.3.3.10 of the LRA states that the diesel generator building ventilation system provides heating, cooling, and ventilation for personnel comfort, for the diesel generators and associated equipment, and for the ESW booster pumps. The system provides ventilation and cooling to the emergency diesel generator rooms during normal plant operation and following design basis events. It supplies heating as required during normal operating conditions. The system also provides ventilation, cooling, and heating as required to the Cardox and ESW booster pump room during normal plant operating conditions.

Each emergency diesel generator room is provided with ventilation air supply fans and an exhaust relief damper. Combustion air for the diesel engine is taken from the room. The ventilation systems are supplied with power from the diesels during the loss of offsite power.

The components in this system are fabricated from carbon steel, ~~stainless steel,~~ and galvanized steel. The ventilation system contains elastomers (fan flex connectors) made from fiberglass-impregnated neoprene.

3.3.10.1.1 Aging Effects

The diesel generator building ventilation system contains elastomers (fan flex connectors) made from fiberglass-impregnated neoprene and exposed to a sheltered and a ventilation atmosphere. The applicant identified change in mechanical properties as the applicable aging effect.

The diesel generator building ventilation system contains sheet metal (ducting, damper enclosures, and fan enclosures) constructed from carbon steel and galvanized steel and exposed to a sheltered environment. The applicant found no aging effects requiring management for these components.

3.3.10.2 Staff Evaluation

The staff reviewed Section 2.3.3.10 and Table 3.3-10 of the application to determine whether the applicant has demonstrated that the effects of aging on these component groups will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

concludes that the applicant has demonstrated that aging effects associated with the subject components will be adequately managed so there is reasonable assurance that the subject system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.11 Pump Structure Ventilation System

3.3.11.1 Technical Information in the Application

The aging management review results for the pump structure ventilation system are given in Table 3.3-11 of the LRA.

Section 2.3.3.11 of the LRA states that each of the two seismic Class 1 emergency service water and high-pressure service water compartments housing the high-pressure service water pumps, emergency service water pumps, fire pumps, and service water screen wash pumps is provided with a ventilation supply and exhaust system in each of the two seismic Class 1 compartments. The pump structure ventilation system is supplied with standby power during the loss of offsite power. Redundant ventilation equipment is furnished in each compartment for uninterrupted service. Each pump room contains two safety-related 100%-capacity supply fans, two safety-related 100%-capacity exhaust fans, and one non-safety-related steam unit heater.

Each pump room has a missile-protected concrete air mixing box which contains an outdoor air damper and a return air damper. Air is exhausted to a missile-protected concrete exhaust plenum.

3.3.11.1.1 Aging Effects

The components of the pump structure ventilation system are described in Section 2.3.3.11 of the LRA. Table 3.3-11 of the LRA lists individual components of the system, including valve bodies, fan flex connections, piping, ducting, damper enclosures, louvers, and bird screens. The components are fabricated from brass, fiberglass-impregnated neoprene, copper, carbon steel, galvanized steel, or galvanized steel mesh. The components are exposed to a sheltered and ventilated envirgment, except the bird screens, which are exposed to an outdoor environment. The applicant identified change in material properties for fan flex connections constructed from fiberglass-impregnated neoprene and exposed to both a sheltered and a ventilation atmosphere as the only aging effect requiring management for the pump structure ventilation system.

3.3.11.1.2 Aging Management Programs

The LRA identifies the following aging management program that will manage the aging effects of the pump structure ventilation system:

- ventilation system inspection and testing activities

Appendix B of the LRA contains a detailed description of the aging management program. The LRA cites this program for managing aging effects for the fan flex connections of the pump structure ventilation system.

3.3.11.2 Staff Evaluation

The staff reviewed Section 2.3.3.11 and Table 3.3-11 of the application to determine whether the applicant has demonstrated that the effects of aging on these component groups will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.11.2.1 Aging Effects

The pump structure ventilation system contains castings and forgings (valve bodies), piping (tubing), sheet metal (ducting, louvers, damper enclosures, and fan enclosures) constructed from brass, copper, carbon steel, galvanized steel, or galvanized steel mesh. These components are exposed to a sheltered environment and ventilation atmosphere. The applicant found no aging effects requiring management for these components in the identified environment. The bird screens ~~are~~ made of galvanized screen mesh are exposed to an outdoor environment. No degradation mechanism requiring management has been identified for the bird screens. The staff agrees that, based on industry experience, for these materials and environment combinations, there are no identified aging effects requiring management.

The pump structure ventilation system contains elastomers (fan flex connections) constructed from fiberglass-impregnated neoprene and exposed to both a sheltered and a ventilation atmosphere. The applicant identified the change in material properties as the aging effect.

The aging effects of the pump structure ventilation system SSCs exposed to the environments the applicant identified in the LRA are consistent with industry experience. The staff finds that the aging effects identified are appropriate.

3.3.11.2.2 Aging Management Programs

The pump structure ventilation system contains elastomers (fan flex connections) constructed from fiberglass-impregnated neoprene and exposed to both a sheltered and a ventilation atmosphere. The applicant identified change in material properties as the aging effect and credits the following activities for managing this aging effect during the period of extended operation:

- ventilation system inspection and testing activities

The ventilation system inspection and testing activities are reviewed in Section 3.0.3.12 of this SER. The staff agrees that the applicant has identified the appropriate aging effects for this combination of materials and environment and that the ventilation inspection and testing activities will adequately manage the effects of aging for the extended period of operation.

3.3.11.3 Conclusions

The staff has reviewed the information on aging effects and aging management activities for the material/environments for the pump structure ventilation system, and the staff concludes that the applicant has demonstrated that aging effects associated with the subject components will be adequately managed so there is reasonable assurance that the subject system will perform its intended function in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.12 Safety-Grade Instrument Gas System

3.3.12.1 Technical Information in the Application

The safety-grade instrument gas (SGIG) system supplies pressurized nitrogen gas from the containment atmospheric dilution tank as a backup to normal instrument air. Spring-loaded check valves designed for zero leakage isolate the safety grade air supply from the non-safety-grade air supply. This system also acts as a backup pneumatic source to the containment atmospheric control purge and vent isolation valves, the torus to secondary containment vacuum breakers, and the containment atmospheric dilution vent control valves following a loss of coolant accident (LOCA) coincident with a loss of instrument air.

The materials of construction of the SGIG system components are stainless steel and brass.

3.3.12.1.1 Aging Effects

The components of the SGIG system are described in Section 2.3.3.12 of the LRA as being within the scope of license renewal and subject to aging management review (AMR). Table 3.3-12 of the LRA lists the individual components of the system, including valve bodies, pipe and flexible hoses. The applicant identified no aging effects for stainless steel and brass in the sheltered and dry gas environments.

3.3.12.1.2 Aging Management Programs

Because the applicant did not identify any aging effects for this system, the applicant did not identify any aging management programs.

3.3.12.2 Staff Evaluation

The applicant described its AMR of the SGIG system for license renewal in Section 2.3.3.12 and Table 3.3-12. The staff reviewed this section and table to determine whether the applicant has demonstrated that the effects of aging on the SGIG system, if any, will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.12.2.1 Aging Effects

The applicant did not identify any aging effects for stainless steel and brass in sheltered or dry gas environments. This assessment is consistent with industry experience. Stainless steel and brass are resistant to age-related degradation such as loss of material and cracking under the dry, atmospherically controlled conditions that are of dry gas and sheltered environments.

The staff has reviewed the information in Sections 2.3.3.12 and 3.3.12 of the LRA. On the basis of this review, the staff finds that the applicant has demonstrated that no aging effects associated with the SGIG system require aging management. Therefore, there is reasonable assurance that aging effects will not inhibit this system from performing its intended functions in accordance with the CLB during the period of extended operation.

effects for stainless steel in the sheltered and dry gas environments.

3.3.13.1.2 Aging Management Programs

Because the applicant did not identify any aging effects for this system, the applicant did not identify any aging management programs.

3.3.13.2 Staff Evaluation

The applicant described its AMR of the backup instrument nitrogen to ADS for license renewal in Section 2.3.3.13 and Table 3.3-13. The staff reviewed this section and table to determine whether the applicant has demonstrated that the effects of aging on the backup instrument nitrogen to ADS will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.13.2.1 Aging Effects

The applicant did not identify any aging effects for stainless steel in sheltered or dry gas environments. This assessment is consistent with industry experience. Stainless steel is resistant to age-related degradation such as loss of material and cracking under the dry, atmospherically controlled conditions of dry gas and sheltered environments.

The staff has reviewed the information in Sections 2.3.3.13 and 3.3.13 of the LRA. On the basis of this review, the staff finds that the applicant has demonstrated that no aging effects associated with the backup instrument nitrogen to ADS require aging management. Therefore, there is reasonable assurance that aging effects will not inhibit this system from performing its intended functions in accordance with the CLB during the period of extended operation.

3.3.13.2.2 Aging Management Programs

The applicant did not credit any AMPs towards managing the aging effects of this system because no aging effects were identified. This assessment is consistent with industry practice. An aging management program is not required for passive SSCs that do not experience aging effects. The staff finds it acceptable for the applicant not to apply an aging management program to this system.

3.3.13.2.3 Conclusions

The staff has reviewed the information in Sections 2.3.3.13 and 3.3.13 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated are no aging effects associated with the backup instrument nitrogen to ADS and that there is reasonable assurance that this system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.14 Emergency Cooling Water System

3.3.14.1 Technical Information in the Application

The technical information in the application is presented in Section 2.3.3.14 and Table 3.3-14 of the LRA. The emergency cooling water system provides a reliable backup source of cooling water to the emergency service water and high-pressure service water systems when the circulating water pump structure is isolated from the normal heat sink, Conowingo Pond. The source of water for the emergency cooling water system is the emergency cooling tower, which includes the reservoir.

The emergency cooling water system is designed to remove sensible and decay heat from the reactor primary and auxiliary systems so that the reactor can be shut down in the event of the unavailability of the normal heat sink. When the normal heat sink is lost, or when flooding occurs, sluice gates in the circulating water pump structure are closed. Water is provided through two gravity-fed lines from the emergency cooling tower basin into the circulating water pump structure. The emergency cooling water system pump in conjunction with the emergency cooling water system booster pump and high-pressure service water system pumps, supply heat exchangers with cooling water required to bring Units 2 and 3 to safe shutdown. Return water from the high-pressure service water system flows to the emergency cooling tower. Return water from the emergency cooling water system flows through one of the two emergency cooling water booster pumps and is pumped into the emergency cooling tower.

3.3.14.1.1 Aging Effects

casting and forging (valve bodies, pump casings), piping (pipe, tubing), and piping specialties (flow elements).

The components of the emergency cooling water system are described in Section 2.3.3.14 of the submittal as being within the scope of license renewal and subject to aging management review. Table 3.3-14 of the LRA lists individual components of the system, including one ECW pump, two ESW booster pumps, three emergency cooling tower fans in an induced-draft three-cell cooling tower with an integral storage reservoir, and associated discharge and distribution piping. These components are made of carbon steel, cast iron, alloy steel, and stainless steel.

A description of the environments is provided in Section 3.0 ~~Table 3.3-14~~ of the LRA. The emergency cooling water system structures and components are exposed to the following environments:

- outdoor
- raw water
- buried
- sheltered

The following aging effects associated with the structures and components require aging management:

- cracking of stainless steel components in raw water environments
- cracking of stainless steel components in outdoor environments
- loss of material from carbon steel and stainless steel components in outdoor environments
- loss of material from carbon steel, lined carbon steel, cast iron, stainless steel, and alloy steel components in raw water environments
- flow blockage of carbon steel, lined carbon steel, cast iron, alloy steel, and stainless steel components in raw water environments
- loss of material from carbon steel in buried environments

3.3.14.1.2 Aging Management Programs

The following aging management activities manage aging effects for the emergency cooling water system structures and components:

- Outdoor, Buried, and Submerged Component Inspection Activities
- Generic Letter 89-13 Activities
- ISI Program
- Inservice Testing (IST) Program

A description of these aging management programs is provided in Appendix B of the LRA. The applicant concludes that the effects of aging associated with the components of the emergency cooling water system will be adequately managed by these aging management programs so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.3.14.2 Staff Evaluation

The applicant described its AMR of the emergency cooling water system for license renewal in Section 2.3.3.14 and Table 3.3-14 of the LRA. The staff reviewed this section and table of the LRA to determine whether the applicant has demonstrated that the effects of aging on the emergency cooling water system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.14.2.1 Aging Effects

The emergency cooling water (ECW) system consists of one ECW pump, two ESW booster pumps, three emergency cooling tower fans, and associated discharge and distribution piping. These components are made of carbon steel, cast iron, alloy steel, and stainless steel.

Some valve bodies and piping made of stainless steel are exposed to an outdoor environment. The associated aging effects are identified in Table 3.3-14 of the LRA as loss of material and cracking. The staff believes that, under normal circumstances, stainless steel components exposed to an outdoor environment are not subject to loss of material. The applicant chose to be more conservative and identified loss of material as an aging effect and will manage it with appropriate aging management programs. The staff finds the aging effects identified acceptable.

Some components made of stainless steel are exposed to a raw water environment. The applicable aging effects are loss of material, cracking, and flow blockage.

Some carbon steel piping and cast iron pump casings are exposed to a raw water environment. The aging effects associated with exposure to this environment are loss of material and flow blockage.

Loss of material and flow blockage were identified as possible aging effects for alloy steel piping exposed to raw water.

The aging effects that result from the contact of emergency cooling water system structures and components with the environments identified in Table 3.3-14 are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects identified above are appropriate for these combinations of materials and environments.

3.3.14.2.2 Aging Management Programs

Section 2.3.3.14 and Table 3.3-14 of the LRA credits the following aging management programs for managing the aging effects in the emergency cooling water system:

- Outdoor, Buried, and Submerged Component Inspection Activities
- Generic Letter 89-13 Activities
- ISI Program
- Inservice Testing (IST) Program

The Outdoor, Buried, and Submerged Component Inspection activities detect degradation due to loss of material or cracking of external surfaces for outdoor, buried, and submerged components. The program is implemented in accordance with PBAPS maintenance procedures and routine test procedures that provide instructions for visual inspections.

The GL 89-13 activities include both condition monitoring and mitigating activities for managing aging effects in the HPSW, ESW, and ECW systems and in other components using raw water as a cooling medium. System and component testing, visual inspections, UT, and biocide treatments are conducted to ensure that aging effects are managed such that system and component intended functions are maintained. The program manages loss of material, cracking, flow blockage, and heat transfer reduction aging effects in cooling water piping and components that are tested and inspected in accordance with the guidelines of NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-related Equipment."

The ISI program provides for visual inspection of selected surfaces of specific components and structural components, or alternatively their replacement/refurbishment during the performance of periodic surveillance and preventive maintenance activities. The program provides for condition monitoring of pressure-retaining piping and components in the scope of license renewal except for those components covered by the reactor pressure vessel and internals ISI program.

The IST program is implemented by a PBAPS specification and provides for inservice testing of Class 1, 2, and 3 pumps and valves in compliance with the ASME O&M Code. The program manages the aging effects of flow blockage in the ESW and ECW components exposed to raw water and heat transfer reduction for the torus water path through the RHR heat exchangers.

ISI Program
The Outdoor, Buried, and Submerged Component Inspection Activities Program, Generic Letter 89-13 Activities Program, and Inservice Testing (IST) Program are credited with managing the aging effects for several components in various different structures and systems and are, therefore, considered common aging management programs. A description of these programs is provided in Appendix B of the LRA. The staff review of the common aging management programs is in Section 3.0 of this SER.

3.3.14.3 Conclusions

The staff reviewed the information in Section 3.3.14 and Table 3.3-14 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the emergency cooling water system structures and components will be adequately managed so that there is reasonable assurance that this system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.15 Condensate Storage System

3.3.15.1 Technical Information in the Application

The technical information regarding the condensate storage system is presented in Section 2.3.3.15 and Table 3.3-15 of the LRA. The condensate storage system is the preferred water supply for the high-pressure coolant injection system and the reactor core isolation cooling system. The system also provides plant system makeup, receives flow, and provides condensate for any continuous service needs. The condensate storage system is common to both units at Peach Bottom. Although the condensate storage system is non-safety-related, it supplies the high-pressure coolant injection and reactor core isolation cooling systems during fire safe shutdown and station blackout scenarios.

3.3.15.1.1 Aging Effects

casting and forging (valve bodies), piping (pipe, tubing), and vessels (condensate storage tanks, tank nozzles).

The components of the condensate storage system are described in Section 2.3.3.15 of the LRA as being within the scope of license renewal and subject to aging management review. Table 3.3-15 of the LRA lists individual components of the system, including two 200,000-gallon-capacity carbon steel condensate storage tanks (one for each unit), two condensate transfer pumps, a condensate transfer system pump, and associated piping and valves necessary to complete required system functions. These components are made of carbon steel and stainless steel.

A description of the environments is provided in ~~Table 3.3-15~~ Section 3.0 of the LRA. The condensate storage system structures and components are exposed to the following environments:

- outdoor
- condensate storage water
- sheltered

The following aging effects associated with the structures and components require aging management:

- cracking of stainless steel components in condensate storage water
- cracking of stainless steel components in outdoor environments
- loss of material from carbon steel and stainless steel components in outdoor environments
- loss of material from carbon steel and stainless steel components in condensate storage water environments

3.3.15.1.2 Aging Management Programs

The following aging management activities manage aging effects for the condensate storage system structures and components:

Demineralized Water and

- Outdoor, Buried, and Submerged Component Inspection Activities
- Condensate Storage Tank Chemistry

A description of these aging management programs is provided in Appendix B of the LRA. The applicant concludes that the effect of aging associated with the components of the condensate storage system will be adequately managed by these aging management programs such that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.3.15.2 Staff Evaluation

The applicant described its AMR of the condensate storage system for license renewal in Section 2.3.3.15 and Table 3.3-15 of the LRA. The staff reviewed this section and table of the LRA to determine whether the applicant has demonstrated that the effects of aging on the condensate storage system will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.15.2.1 Aging Effects

The condensate storage system consists of condensate storage tanks, condensate transfer pumps, and associated piping and valves. These components are made of carbon steel and stainless steel.

The condensate storage tanks are made of carbon steel. The internal surfaces of the tanks are exposed to a condensate storage water environment, while the exteriors are exposed to an outdoor environment. Loss of material is identified as the aging effect.

Some valve bodies, tank nozzles, and piping are made of stainless steel and are exposed to an outdoor environment. The associated aging effects are identified in Table 3.3-15 of the LRA as loss of material and cracking.

Some valve bodies and piping made of stainless steel are exposed to a condensate storage water environment. The aging effects associated with exposure to this environment are identified in Table 3.3-15 of the LRA as loss of material and cracking.

The aging effects that result from the exposure of condensate storage system structures and components to the environments listed in Table 3.3-15 are consistent with industry experience for these combinations of materials and environments. The staff finds that the aging effects listed are appropriate for these combinations of materials and environments.

3.3.15.2.2 Aging Management Programs

Section 2.3.3.15 and Table 3.3-15 of the LRA states that the following aging management programs are credited for managing the aging effects in the condensate storage system:

Demineralized Water and

- Outdoor, Buried, and Submerged Component Inspection Activities
- Condensate Storage Tank Chemistry

The Outdoor, Buried, and Submerged Component Inspection activities detect degradation due to loss of material or cracking of external surfaces for outdoor, buried, and submerged components. The program is implemented in accordance with PBAPS maintenance procedures and routine test procedures that provide instructions for visual inspections.

Demineralized Water and

The Outdoor, Buried, and Submerged Component Inspection program and Condensate Storage Tank Chemistry Program are credited with managing the aging effects of several components in various different structures and systems and are, therefore, considered common aging management programs. The staff review of the common aging management programs is in Section 3.0 of this SER.

3.3.15.3 Conclusions

The staff reviewed the information in Section 3.3.15 and Table 3.3-15 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the condensate storage system structures and components will be adequately managed so that there is reasonable assurance that this system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.16 Emergency Diesel Generator

3.3.16.1 Technical Information in the Application

The four emergency diesel generators (EDGs) provide Class 1E electrical power to the emergency buses during a loss of offsite power (LOOP) or a LOCA coincident with a LOOP. The EDGs also support offsite power transfer from one offsite safeguard source to another by providing a parallel source of AC power to emergency buses during the transfer operation. Each EDG set consists of a diesel engine, a generator, and auxiliary systems (starting air, fuel oil, jacket cooling, air cooling, and lubricating oil). Each EDG is connected to one 4kV Class 1E emergency bus per unit and is automatically started on LOOP, low reactor water level, or high drywell pressure signals.

The components of the emergency diesel generators are described in Section 2.3.3.16 of the LRA as being within the scope of license renewal and subject to aging management review (AMR). The materials of construction within the EDGs are cast iron, carbon steel, bronze, copper, copper alloys, muntz metal, admiralty, aluminum, aluminum alloys, stainless steel, neoprene and rubber, brass, and brass alloys. Table 3.3-16 of the LRA lists the individual components of the system, including valve bodies, strainer screens, pump casings, pipe, tubing, fittings, strainer bodies, restricting orifices, flexible hoses, fuel oil day tanks, fuel oil storage tanks, lubricating oil tanks, EDG jacket coolant coolers, EDG air coolant coolers, EDG lube oil coolers, expansion joints, thermowells, thermowell caps, drain traps, the expansion tank, air receivers, and silencers.

3.3.16.1.1 Aging Effects

The applicant identified no aging effects for cast iron, carbon steel, bronze, copper alloys, aluminum, aluminum lube oil tank in the alloys, stainless steel, neoprene and rubber, brass and brass alloys ~~in the~~ sheltered environment environment and no aging effects for carbon steel Pipe ~~components~~ in the outdoor environment, carbon steel strainer screens in the ~~wetted~~ gas, and lubricating oil environment and stainless steel components in the outdoor environment. The applicant identified the following aging effects for various combinations of component materials and internal and external environments.

- cracking, loss of material, reduction in heat transfer, and flow blockage for cast iron in closed cooling water, lubricating and fuel oil, wetted gas, raw water environments
- cracking and loss of material for aluminum in closed cooling water and lubricating and fuel oil environments
- cracking and loss of material for aluminum alloys in the lubricating and fuel oil environment
- loss of material for bronze in closed cooling water and lubricating and fuel oil environments
- cracking, loss of material, and heat transfer reduction for carbon steel in closed cooling water, lubricating and fuel oil, buried, and wetted gas environments
- cracking and loss of material for stainless steel in closed cooling water, lubricating and fuel oil, and wetted gas environments
- cracking and loss of material for brass in closed cooling water and lubricating and fuel oil environments
- cracking and loss of material for brass alloys in the lubricating and fuel oil environment
- changes in material properties for neoprene and rubber in closed cooling water and lubricating and fuel oil environments
- change in material properties for neoprene in the wetted gas environment
- cracking and loss of material for copper and copper alloys in the lubricating and fuel oil environment
- cracking, loss of material, heat transfer reduction and flow blockage for admiralty in closed cooling water, lubricating oil, and raw water environments
- cracking, loss of material, heat transfer reduction, and flow blockage for muntz metal in closed cooling water, lubricating oil, and raw water

3.3.16.1.2 Aging Management Programs

The applicant credits the following AMPs to manage aging effects of the emergency diesel generators:

- Closed Cooling Water (CCW) Chemistry
- Outdoor, Buried, and Submerged Component Inspection
- Lubricating and Fuel Oil Quality Testing
- Emergency Diesel Generator Inspection
- GL 89-13 Activities

A description of these aging management programs is provided in Appendix B of the LRA. The applicant concludes that the effects of aging associated with the components in this system will be adequately managed by these aging management programs so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

the staff finds the applicant's response adequately addresses RAI 3.3-4..

3.3.16.2.2 Aging Management Programs

Section 2.3.3.16 and Table 3.3-16 of the LRA credit the following aging management programs for managing the aging effects in the emergency diesel generators:

Lubricating and Fuel

- Closed Cooling Water (CCW) Chemistry
- Outdoor, Buried, and Submerged Component Inspection
- Oil Quality Testing
- Emergency Diesel Generator Inspection
- GL 89-13 Activities

Lubricating and Fuel

CCW Chemistry, Outdoor, Buried, and Submerged Component Inspection, Oil Quality Inspection, and GL 89-13 Activities are credited with managing the aging effects of several components in various different structures and systems and are, therefore, considered common aging management programs. The staff review of the common aging management programs is in Section 3.0 of this SER. The staff evaluation of the EDG inspection AMP follows.

<u>Emergency Diesel Generator Inspection AMP</u>

The applicant described the emergency diesel generator (EDG) inspection AMP in Section B.2.4 of Appendix B to the LRA. The applicant credits this program with managing the effects of aging of EDG equipment that is within the scope of license renewal. The staff has reviewed Section B.2.4 of the LRA to determine whether the applicant has demonstrated that the effects of aging will be adequately managed by the program during the extended period of operation as required by 10 CFR 54.21(a)(3).

The EDG inspection activities provide for condition monitoring of in-scope EDG equipment that is exposed to a gaseous, closed cooling water or lubricating oil or fuel oil environment. Loss of material in the starting air system air receivers is mitigated by daily removal of any accumulation of condensate. Loss of material and cracking in lubricating oil and fuel oil systems is mitigated by periodic oil quality inspections. Visual inspections for change in material properties of flexible hoses in the starting air system and the cooling water system are performed in accordance with a plant procedure for periodic EDG maintenance. This procedure will be enhanced to require inspections of the lubricating oil and fuel oil system flexible hoses for change in material properties. The aging management of the loss of material in the EDG exhaust silencer will be enhanced by periodic disassembly, cleaning, and inspection of an automatic drain trap to ensure its functionality in preventing condensation buildup.

The staff's evaluation of the EDG inspection program focused on how the program manages the aging effect through the effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The corrective actions, confirmation process, and administrative controls for license renewal are in accordance with the site-controlled quality assurance program pursuant to 10 CFR Part 50, Appendix B, and cover all structures and components that are subject to an aging management review. The applicant's quality assurance program is evaluated separately in Section 3.0.4 of this SER. This program

3.3.17.2.2 Aging Management Programs

Section 2.3.3.17 and Table 3.3-17 of the LRA state that the Primary Containment ISI program is credited for managing aging effects of the SPOTMOS. The Primary Containment ISI program is credited with managing the aging effects of several components in several different structures and systems and is, therefore, considered a common aging management program. The staff review of the common aging management programs is in Section 3.0 of this SER.

The staff evaluated the aging management program identified in Sections 2.3.3.17 and 3.3.17 and found it to be acceptable for managing the aging effects identified for the SPOTMOS.

3.3.17.2.3 Conclusions

The staff has reviewed the information in Sections 2.3.3.17 and 3.3.17 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the SPOTMOS will be adequately managed so that there is reasonable assurance that this system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.18 Cranes and Hoists

3.3.18.1 Technical Information in the Application

The reactor building cranes and cranes such as the four emergency diesel generator building cranes and hoists are designed and analyzed to maintain their structural integrity and perform tasks without preventing the SSCs from performing their intended safety functions. The reactor building crane is designed to lift and transport spent fuel casks such that no credible postulated failure of any crane component will result in the dropping of a cask. The reactor building cranes also support single-failure-proof criteria for lifting heavy loads over fuel in the reactor pressure vessel or over the spent fuel pool.

The components of the cranes and hoists are described in Section 2.3.3.18 of the LRA as being within the scope of license renewal and subject to aging management review (AMR). The materials of construction of the cranes and hoists are ~~stainless steel,~~ carbon steel, and low-alloy steel. Table 3.3-18 of the LRA lists the individual components of the equipment, including structural members, rails, rail clips, rail bolts, and monorail flanges.

3.3.18.1.1 Aging Effects

~~The applicant identified no aging effects for stainless steel in the sheltered environment.~~ The applicant identified carbon and low-alloy steel in outdoor and sheltered environments as susceptible to loss of material.

3.3.18.1.2 Aging Management Programs

The applicant credits Crane Inspection Activities to manage aging effects of the cranes and hoists. This aging management program is described in Appendix B of the LRA. The applicant concludes that the effects of aging associated with the components of this system will be adequately managed by these aging management programs so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.3.18.2 Staff Evaluation

The applicant described its AMR of cranes and hoists for license renewal in Section 2.3.3.18 and Table 3.3-18. The staff reviewed this section and table to determine whether the applicant has demonstrated that the effects of aging on the cranes and hoists will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.18.2.1 Aging Effects

By letter dated February 6, 2002, the staff requested additional information per RAI 3.3-3 to justify the exclusion of fatigue and a corresponding TLAA evaluation relating to crane load cycles. By letter dated May 6, 2002, the applicant informed the staff that the LRA was amended to include load cycles for the reactor building overhead bridge cranes, turbine hall cranes, emergency diesel generator bridge cranes, and the circulating water pump structure gentry crane as a TLAA in Section 4.7.4

The staff finds that the applicant's response adequately addresses RAI 3.3-3.

The aging effect of the SSCs in cranes and hoists exposed to the environments the applicant identified in the LRA is consistent with industry experience. The staff finds that the aging effect identified is appropriate.

3.3.18.2.2 Aging Management Programs

Section 2.3.3.18 and Table 3.3-18 of the LRA credit the Crane Inspection Activities with managing aging effects of the cranes and hoists.

The applicant's crane inspection activities are described in Section B.1.14 of the LRA. This program is credited with managing the ~~potential~~ aging effect of loss of material for the passive components of the cranes and hoists. The staff has reviewed Section B.1.14 of the LRA to determine whether the applicant has demonstrated that the effects of aging will be adequately managed by the crane inspection activities during the extended period of operation as required by 10 CFR 54.21(a)(3).

The crane inspection activities at PBAPS consist of inspections that are relied upon to manage loss of material for passive components of cranes and hoists. These components are identified in Table 3.3-18 of the LRA. They include carbon steel and low-alloy steel structural support components in both outdoor and sheltered environments. The crane inspection activities comply with the requirements of ASME B30.2, B30.11, B30.16, and B30.17, and are implemented through a plant procedure.

The staff's evaluation of the crane inspection activities focused on how the program manages the aging effect through the effective incorporation of the following 10 elements: program scope, preventive or mitigative actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, corrective actions, confirmation process, administrative controls, and operating experience. The corrective actions, confirmation aging have occurred at PBAPS. Loss of material in crane rails and monorails has been detected and managed by the crane inspection activities. Therefore, the staff finds that there is reasonable assurance that the intended functions of crane and hoist passive components will be maintained during the period of extended operation.

The staff reviewed Section A.1.14 of the UFSAR Supplement (Appendix A of the LRA) to verify that the information provided in the UFSAR Supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1800 and 54. therefore provides an adequate summary of program activities as required by 10 CFR 21(d).

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated that the crane and inspection activities will adequately manage the aging effects associated with the crane and hoist components for the period of extended operation as required by 10 CFR 54.21 (a)(3). The staff also concludes that the UFSAR Supplement contains an adequate summary description of the program activities for managing the effects of aging for the systems and components discussed above as required by 10 CFR 54.21(d).

3.3.18.2.3 Conclusions

The staff has reviewed the information in Sections 2.3.3.18 and 3.3.18 of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effect associated with cranes and hoists will be adequately managed so that there is reasonable assurance that this system will perform its intended functions in accordance with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.4 Aging Management of Steam and Power Conversion Systems

The applicant described its AMR of the steam and power conversion systems for license renewal in LRA Sections 2.3.4, "Steam and Power Conversion Systems," and 3.4, "Aging Management of Steam and Power Conversion Systems." The staff has reviewed this section and tables 3.4-1 thru 3.4-3 of the application to determine whether the applicant has provided adequate information to meet the requirements of 10 CFR 54.21(a)(3) for managing the aging effects of the steam and power conversion systems for license renewal.

The LRA identified three systems that will require aging management to meet the requirements of 10 CFR 54.21(a)(3) for management of aging effects. The three systems are the main steam system, main condenser, and feedwater system. The LRA included a summary of the results of the aging management review for these three systems. The results are listed in Tables 3.4-1 through 3.4-3 of the LRA. The tables provide the following information: (1) component groups, (2) component intended functions, (3) environments , (4) materials of construction, (5) aging effects, and (6) aging management activities that manage the identified aging effects.

Section 3.0 of the LRA identified seven environments that are applicable to the steam and power conversion systems:

- Reactor coolant: Reactor coolant system water is demineralized and maintained in accordance with stringent chemistry parameters to mitigate corrosion.

- Steam: Steam is produced in the reactor vessel from reactor-grade water and has extremely low levels of impurities. The systems that are pertinent to this evaluation are the reactor pressure vessel and internals, main steam, HPCI, and RCIC systems. The steam exists as a two-phase vapor, ranging from high-quality steam in the main steam system to low-quality steam in the HPCI and RCIC systems. The HPCI and RCIC steam lines normally see little to no steam flow because these systems operate infrequently.

- Torus-Grade Water: The torus-grade water quality is monitored periodically and maintained in accordance with station procedures that include recommendations from EPRI TR-103515, "BWR Water Chemistry Guidelines." Purity of the torus water is maintained by pumping the torus water through filters and demineralizers and by bleed and feed operations with the hotwell. Some carbon steel pipes in the torus pass through the surface of the torus water and are exposed to a water-gas interface. For lines equipped with vacuum breaker valves, the water-gas interface occurs at both the inside and outside diameter of the pipe. For other lines, a water-gas interface occurs only at the outside diameter because the inside of the pipe remains full of water.

- Raw Water: Raw water is untreated fresh water taken from Conowingo Pond, which is formed by the Susquehanna River. Raw water typically contains a dilute solution of mineral salt impurities, dissolved gases, and biological organisms. These dissolved gases (oxygen and carbon dioxide) are the prime corrosion-initiating agents. Water samples show pH variation from 7.00 to 7.55, chloride content of 9 to 18 ppm, and sulfate content from 1 to 46 ppm.

- Sheltered: The sheltered environment consists of indoor ambient conditions where components are protected from outdoor moisture. Conditions outside the drywell consist of normal room air temperatures ranging from 65 $^{\circ}$F to 150 $^{\circ}$F and a relative humidity ranging from 10% to 90%. The warmest room outside the drywell is the steam tunnel, with an average temperature of 150 $^{\circ}$F (based on measured temperatures) and a maximum normal fluctuation to 165 $^{\circ}$F. The drywell is inerted with nitrogen to render the containment atmosphere nonflammable by maintaining the oxygen content less than 4% oxygen. The drywell normal operating temperature ranges from 65 $^{\circ}$F to 150 $^{\circ}$F with a relative humidity from 10% to 90%. The sheltered environment atmosphere is an air or nitrogen environment with humidity. Components in systems with external surface temperatures the same or higher than ambient conditions are expected to be dry. Lack of a liquid moisture source in direct contact with a given component precludes external surface corrosion of metallic components as an effect requiring aging management.

- Wetted Gas: Wetted gas environments include air, containment atmosphere, and diesel exhaust gas. Air is either ambient or compressed air without air dryers in the system. Containment atmosphere in the drywell and torus is inerted with nitrogen with only 4% oxygen but is assumed to have the same corrosive effects as ambient air. Diesel exhaust can contain sulfur residues so exhaust system components can be exposed to moisture and sulfuric acid.

- Dry Gas: The dry gas environments include dried air, nitrogen, carbon dioxide, hydrogen, oxygen, and freon. These gases are considered inert with respect to corrosion because they have no significant moisture content.

- stainless steel, carbon steel, brass and copper in dry gas and sheltered environments—no aging effects
- carbon steel in a steam environment— loss of material
- stainless steel in a steam environment—loss of material and cracking
- carbon steal in a wetted gas environment—loss of materials
- stainless steel in a wetted gas environment—cracking
- carbon steel in a torus-grade water environment—loss of material

No aging effects were identified in the AMR of piping, piping specialties, accumulators, tubing, and valve bodies made of stainless steel, carbon steel, brass or copper in a dry gas or sheltered environment. These materials are resistant to corrosion in both dry gas and sheltered environments. The applicant, therefore, has not identified any applicable aging effects for the surfaces of stainless steel, carbon steel, brass, or copper main steam system components exposed to these environments.

Loss of material was identified for carbon steel piping, piping specialties, and valve bodies in steam environments. Loss of material of carbon steel materials by corrosion may occur in steam environment, and therefore may be an applicable aging effect for carbon steel surfaces exposed to steam. The applicant will use the RCS chemistry program, ISI program, and FAC program to manage loss of material for carbon steel piping, piping specialties, and valve bodies in a steam environment.

Loss of material and cracking were identified for the stainless steel piping, piping specialties, and tubing in steam environments. Loss of material and cracking of stainless steel materials may occur in steam environment, and therefore may be an applicable aging effect for stainless steel surfaces exposed to steam. The applicant will use the RCS chemistry program and ISI program to manage loss of material for stainless steel piping, piping specialties, and tubing in a steam environment.

Loss of material was identified for the carbon steel piping, and valve bodies in wetted gas environments. Loss of material of carbon steel materials by corrosion may occur in a wetted gas environment, and therefore may be an applicable aging effect for carbon steel surfaces exposed to wet gas. The applicant will use the ISI program and Torus Piping Inspection program to manage loss of material for carbon steel piping and valve bodies in a wetted gas environment.

Cracking of material was identified for the stainless steel piping, piping specialties, and valve bodies in wetted gas environments. Cracking of stainless steel materials may occur in a wetted gas environment, and therefore may be an applicable aging effect for stainless steel surfaces exposed to wet gas. The applicant will use the ISI program to manage cracking associated with stainless steel piping, piping specialties, and valve bodies in wetted gas environment.

Loss of material was identified for carbon steel piping and piping specialties in a torus-grade water environment. Loss of material of carbon steel materials by corrosion may occur in torus-grade water environment, and therefore may be an applicable aging effect for carbon steel surfaces exposed to torus water. The applicant will use the Torus Water Chemistry program and Torus Piping Inspection program to manage loss of material for carbon steel piping and piping specialties in a torus-grade water environment.

3.4.1.2.2 Aging Management Programs

The applicant stated that the RCS chemistry program, ISI program, and FAC program will be used to manage the loss of material associated with carbon steel piping, piping specialties, and valve bodies in a steam environment. The RCS chemistry program and ISI program will be used to manage the loss of material associated with stainless steel piping, piping specialties, and tubing in a steam environment. The ISI program and Torus Piping Inspection program will be used to manage the loss of material associated with carbon steel pipe, and valve bodies in a wetted gas environment. The ISI program will be used to manage cracking associated with stainless steel pipe, pipe specialties, and valve bodies in a wetted gas environment. The Torus Water Chemistry program and Torus Piping Inspection program will be used to manage the loss of material associated with carbon steel piping and piping specialties in a torus-grade water environment. Detailed description concerning each of the programs identified above is included in Appendix B to the LRA, along with a demonstration that the identified aging effects will be effectively managed for the period of extended operation. The staff's detailed review of the different aging management activities and their ability to adequately manage the applicable aging effects is provided in Section 3.0.3~~.5 and 3.0.3.21~~ of this SER. As a result of this review, the staff did not identify any concerns or omissions in the aging management activities used to manage the main steam system.

3.4.1.3 Conclusions

The staff has reviewed the information in Section 3.4, "Aging Management of Steam and Power Conversion Systems," of the LRA. On the basis of its review, the staff concludes that the applicant's identification of the aging effects associated with the main steam system is consistent with published literature and industry experience. The staff further concludes that the applicant has adequate aging management programs to effectively manage the aging effects of the main steam system and that there is reasonable assurance that the intended functions of the system will remain consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.4.2 Main Condenser

3.4.2.1 Technical Information in the Application

The Peach Bottom main condenser provides a heat sink for the turbine exhaust steam and turbine bypass steam. It also deaerates and stores the condensate for reuse after a period of radioactive decay. Additionally, the main condenser provides for post-accident containment, holdup, and plateout of main steam isolation valve (MSIV) bypass leakage.

The main condenser is a single-pass, single-pressure, deaerating type with a reheating deaerating hotwell and divided waterboxes. The condenser consists of three sections, each located below the low-pressure elements of the turbine, with the tubes oriented transverse to the turbine-generator axis. The steam exhausts directly down into the condenser shells through exhaust openings in the bottom of each low-pressure turbine casing. The condensers also receive steam from the reactor feed pump turbines.